NOTE: This impact assessment is based on the Service Strategies as presented in the Draft RWSP. See Part I of this FEIS for revised strategy descriptions and analysis.

CHAPTER 11
CONSTRUCTION IMPACTS AND MITIGATION MEASURES

INTRODUCTION

This chapter describes impacts associated with the construction of facilities proposed in the RWSP. These are typically temporary, short-term impacts. They can include such impacts as temporary traffic congestion, reduced access to properties, noise, dust, and erosion and sedimentation. These impacts are discussed in this chapter along with mitigation measures that could be used to minimize them.

The chapter begins with a discussion of the methods typically used in the construction of wastewater facilities. This discussion provides background for the following analysis of environmental considerations, which are organized by elements of the environment. Each element begins with a discussion of impacts common to all service strategies and then describes the impacts of specific facilities.

The facilities proposed in the RWSP would be constructed in phases over relatively long periods of time. This means that construction would occur incrementally. Where possible, the impacts of construction are described in terms of each development phase by facility. However, in cases where overall environmental impacts are small or are not easily quantified, the discussion is focused on the effects of constructing the entire facility, regardless of phasing. As with operational impacts, construction impacts will be analyzed in greater detail during project-level SEPA analysis when specific alignments or sites are under consideration and design details are better developed.

GENERAL CONSTRUCTION METHODS

Treatment Plants, Pumping and Regulator Stations, Storage Tanks

Most of the proposed facilities are underground, requiring large-scale excavation. Because existing treatment plants and potential new treatment and conveyance facilities are located at relatively low elevations, it is likely that excavation will extend below the groundwater table, requiring dewatering to achieve and maintain dry foundation excavations. The excavation depth (up to 50 feet for some types of facilities) requires shoring to support the sides.

Pipelines

The quantities of earth excavated for conveyance systems depend on pipe size, depth, and type of flow (i.e., force main vs. gravity main). Pipelines are usually constructed using the “cut-and-cover” method, where a length of trench is excavated, the pipe is placed and

connected to the previous section, and the trench is backfilled with material excavated from the trench, if suitable, or with clean imported materials. Cut-and-cover construction typically involves deep excavations requiring a support system (e.g., sheeting and shoring or use of a trench box) to prevent soils from slumping into the trench and to maintain a narrow construction corridor. After excavation, the area would be restored to its previous condition (e.g., paved areas would be repaved and landscaped areas would be replanted).

So-called trenchless technologies are alternatives to cut-and-cover pipe installation. These include several methods, such as boring, jacking, tunneling, and microtunneling to install a portion or all sections of underground pipe, while minimizing surface disruption.

Jacking and tunneling provide a continuous lining as the tunnel advances, reducing or avoiding above-ground disturbance. Pipes can be installed under highways and railways without interrupting services and can be placed under environmentally sensitive areas without disturbing the site. All underground construction methods reduce disruption by confining surface work to a few shafts or portals.

The tunnel boring machine (TBM) is practical only with larger-diameter pipes (10 feet or more). To use this method, a large working portal area is prepared at one end of the tunnel for staging of equipment and removal of spoils. A retaining wall is constructed to support the soils above the tunnel at the portal and soils are excavated down to the design elevation of the tunnel. A digging apparatus at the front of the tunnel shield deposits the spoils onto a conveyor belt, which moves them to the rear of the machine where a rail cart collects and transports them back to the portal. From the working portal, trucks haul the spoils away to an approved disposal site. As the machine moves forward, supports are placed behind to support the excavation. When the boring machine has completed digging the tunnel length, a hole (the receiving portal) is dug at the end, and the machine is removed. Long tunnels may required access/air shafts to the surface located at specific distances along the routes.

The shields and TBMs used at the leading end of the tunnel are virtually the same for jacking; the only difference is in the way the tunnel is lined. Jacking is often used for installing short, straight lengths of pipe (for example to cross under a road or railroad tracks). A pit is dug at either end of the section and a hydraulic jack is placed in the drive pit at one end. The jack forces sections of pipe casing into the hole formed by the cutting shield and an auger is used to remove soil within the casing. Spoils are moved from the jacking end. When the casing is placed, the sewer pipe is placed inside it and the annular space is filled with light concrete mix.

Microtunneling is pipejacking of smaller-diameter pipes that are too small for workers to enter, and is used to install pipes by remote control.

Directional drilling can be used for smaller-pressure pipe diameters where the segment is not straight. For example, it is often used for placing a siphon under a water body. Directional drilling uses a drilling head or auger rather than a tunneling machine or cutting shield to drill a hole and remove the spoils. Once the drill is removed, the pipe is inserted into the hole.

WATER RESOURCES

Impacts Common to All Service Strategies

Treatment, Conveyance, and CSO Projects. Construction impacts on water resources from all four of the service strategies would occur during implementation of the following: expansion of the treatment plants and installation of major conveyance lines including pump stations, CSO conveyance lines, CSO storage tanks, deep tunnels, and associated facilities. Short-term construction impacts would occur periodically over the life of the project, as facilities are developed in various locations. For this analysis, cumulative water quality impacts are considered for each facility, regardless of whether phased construction is planned.

Construction of treatment plants, pump stations, pipelines, and other wastewater facilities on land could affect the quality of those receiving waters at or near construction sites. Construction activities could include clearing vegetation, removing soil, importing fill, and the physical, chemical, and biochemical changes associated with bulldozing, grading, and soil compaction. These activities can alter a site's ability to absorb and retain water, which can cause erosion and sediment loading to surface waters. Increased sediment loading could increase nutrient concentrations, harm benthic biota, reduce fish habitat, and, depending on the organic content of suspended sediment, decrease dissolved oxygen levels in receiving waters. In addition, construction runoff may include debris from demolition such as lime and cement, petroleum fuels, and construction chemicals. Accidental spills of petrochemicals and construction chemicals could also occur, although there is little likelihood of such spills because of normal precautions taken to prevent them. (See Mitigation Measures section for information on construction best management practices.)

Construction activities within riparian and wetland zones may cause the destruction or alteration of the site's hydrology, vegetation, and hydric soils. Impacts to wetlands and riparian corridors may impair water quality by influencing varying degrees of one or more of their hydrologic, edaphic **(**physical and chemical characteristics of soil**)**, and biotic **(**living organisms**)** functions. Loss of and/or reduction of wetlands and riparian corridors would cause erosion, decreased ability to store storm and flood waters, decreased ability to recharge groundwater, and reduced ability to filter and purify surface water.

The placement of pipelines across rivers and streams could have similar impacts to riparian corridors and fisheries (although open "cut-and-cover" crossing of streams would be avoided wherever possible). These impacts include increasing the amount of sediment suspended in the water during construction through erosion and the discharge of pumped groundwater. Contamination of surface water and groundwater by construction-related chemicals is another potential impact. Erosion of stream banks and subsequent sedimentation in stream channels can also harm both rearing and spawning habitat of fish. Clearing riparian vegetation from stream banks can increase water temperatures, alter the recruitment of large woody debris into the channel for use as fish cover, and change substrate composition.

In-water construction activities such as trench excavation and placement of bedding material for outfalls or conveyance pipelines would have short-term impacts on water quality. Installation of outfall pipes in Puget Sound and conveyance lines along the shorelines of Lake Washington would require in-water construction. Excavation of pipe trenches and sidecasting dredge spoils would release sediments into the water column. These sediments would temporarily increase turbidity and would decrease light transmission in the water near excavation sites. Substances in the excavated sediment could also be resuspended in the water. These could include nutrients, organic materials, pollutants, and sulfides (which would exert an oxygen demand in the water column).

The relative magnitude of water quality impacts on both freshwater and marine water bodies would vary, depending on the extent or area of construction and proximity to receiving water bodies. Other construction activities, such as installation of regulators and pumps, and tunnel access roads, are considered to have minor water quality impacts and are not addressed further here.

I/I Reduction Projects. Direct impacts of I/I reduction activities could include temporary increases in traffic congestion in some locations because of construction work in streets. The extent and duration of activities in streets would be kept to a minimum to keep these impacts as small as possible. Trenchless technologies (e.g., lining, grouting) for I/I control would be used wherever feasible. These approaches typically involve construction equipment mainly at manholes, which would minimize congestion between manholes.

Construction equipment, particularly pumps used to route sewage flows around construction areas, would produce noise. In most cases, any resulting noise impacts would be of short duration for particular noise receptors, given the short duration of most I/I control activities along individual sections of sewer pipe. Where necessary, noise mitigation measures would be implemented. These could include placing pumps in boxes or behind noise barriers. For small pipes, another approach might be to place pumps in manholes. Use of electric rather than gasoline-powered pumps would also help reduce noise levels.

Temporary minor erosion and sedimentation could occur if trenches are dug or other excavation is carried out. Best management practices would be used to minimize these impacts (e.g., silt fencing, street sweeping, straw bales, etc.). The trenchless technologies mentioned above would also reduce these impacts.

Service Strategy 1

Treatment Facilities

SS1 involves completion of the West Plant to a capacity of 159 mgd and expansion of the East Plant to a capacity of 235 mgd. Based on preliminary calculations about 1.4 acres would be affected by construction at the West Plant. Expansion at the East Plant would affect about 46 acres. The West Plant is located near Puget Sound. Part of the East Plant's eastern boundary adjoins Springbrook Creek and the Green/Duwamish River is located a few hundred feet west of the plant. Water quality impacts from stormwater runoff at the construction sites during expansion of the plants would vary. Although there

is a potential for runoff to occur, best management practices will be used during construction to avoid or minimze runoff. Localized sedimentation impacts to intertidal and subtidal habitat could occur in the West Point area if stormwater runoff was not sufficiently treated prior to discharge. Similarly, localized sedimentation impacts could occur in waters near the East Plant if best management practices were not followed.

Conveyance Facilities

Major conveyance line installation would result in stormwater runoff, discharge of turbid water from dewatering trench excavations, crossing of stream channels and wetlands, and accidental spills of hydrocarbons and construction chemicals. Individual conveyance lines would generally disturb between 5 and 9 acres. The exception would be the parallel Eastside interceptor, which could affect water quality in a number if creeks, (Lake Washington, Juanita Creek, Forbes Creek, Yarrow Bay tributaries, Kelsey Creek, Coal Creek, May Creek, the Cedar River, and Springbrook Creek) disturbing an estimated 31 acres.

CSO Facilities

CSO conveyance lines would be installed in a variety of locations in West Service Area. Excavation of contaminated sediments could occur in several areas, and there is the potential for stormwater runoff from this material to reach receiving waters. CSO conveyance line impacts are based on calculations of acreage for a 20-foot-wide disturbed area along the length of the pipeline. Given the relatively short length of these CSO conveyances, the overall acreage disturbed is a minor amount (0.5 to 3.0 acres).

CSO storage tanks and, in some cases, primary treatment facilities would be installed at a variety of sites in conjunction with CSO conveyance improvements. Each of these facilities would disturb about an acre

Service Strategy 2

Treatment Facilities

At the West Plant, impacts of SS2 would be similar to those of SS1. Impacts at the East Plant would be somewhat less than in SS1, based on an estimated 15 acres of disturbance. Construction of a new 65-mgd North Plant would disturb a total of 16 to 21 acres. Potential receiving waters for construction-related stormwater runoff would vary, depending on the location of the plant, but could include Puget Sound, Swamp Creek, the Sammamish River, and Lake Washington, or other waterbodies in Snohomish County.

Conveyance Facilities

Major conveyance facility impacts would generally be similar to those of SS1. Construction of the parallel Eastside Interceptor would not be required under this service strategy. The new outfall for the North Plant could result in water quality impacts to receiving waters depending on the plant location and outfall alignment.

CSO Facilities

CSO facility impacts would be similar to those described under SS1.

Service Strategy 3

Treatment Facilities

SS3 would not involve expanding the West Plant. Impacts to water resources resulting from the East Plant expansion would be the same as for SS2. Construction of a new 89-mgd North Plant would disturb approximately 28 acres. Similar to SS2, potential impacts on receiving waters would vary, based on the site chosen.

Conveyance Facilities

Impacts of conveyance facilities would be similar to those identified for SS2.

CSO Facilities

Impacts of CSO facilities would be similar to those identified for SS1 and SS2.

Service Strategy 4

Treatment Facilities

Impacts of SS4 on the West and East Plants would be the same as for SS1.

Conveyance Facilities

Impacts would be similar to those of SS1. In general, construction of the deep tunnel would occur primarily underground, with surface disturbance limited to areas around tunnel portals and access shafts.

CSO Facilities

Construction impacts of CSO storage tank and conveyance facilities would be similar to those of SS1. One of the functions of the deep tunnel proposed under this service strategy is to store, convey and treat CSOs. The construction impacts of the tunnel are described in the preceding section.

Mitigation Measures

Potential adverse impacts to water quality resulting from construction of all the wastewater facilities and conveyances proposed under the RWSP can be avoided or minimized through careful design, proper construction practices, and maintenance of the stormwater facilities. Based on the identification of environmentally sensitive areas in the King County service area, efforts have been focused on avoidance of impacts. Where avoidance is not possible, impacts will be minimized to the greatest extent possible. Whenever unavoidable adverse impacts occur, the use of compensatory mitigation is

appropriate. The following mitigating measures are proposed to avoid, minimize, and compensate for these impacts. Impact avoidance strategies include:

- Construction activities would comply with the most recent *King County Surface Water Design Manual* (King County, 1996) guidelines for erosion and sediment control features and procedures. This construction work should also be conducted in accordance with the Ecology guidelines.

- Best management practices would be followed to avoid accidental spills of fuel oils, chemicals, concrete leachate, and sediments into aquatic habitats. These practices include proper storage, use, and cleanup of all construction-related chemicals. Erosion and sediment control features may include silt fences, straw bales, hydroseeding of exposed soils, and mulching.

- Routes would be carefully selected to avoid sensitive riparian and wetland areas.

Impact minimization strategies include:

- Minimize construction impacts on receiving water bodies by implementing an erosion and sediment control plan and following best management practices.

- Limit vegetation clearing to what is necessary to construct the wastewater facilities. Only trees and shrubs within the limits of construction and tree limbs extending into the clearance area should be removed. Using and maintaining vegetative cover appropriately during construction will minimize erosion of excavated soil and sediment loading to surface waters.

- Limit grading, excavation, and filling activities to what is necessary to construct the wastewater facilities. Limit the size of all excavations within the 100-year floodway of streams, lakes, and marine waters, and perform this work during summer low flows.

- Construct stream and river crossings during low-flow periods in accordance with recommendations from the Washington Department of Fish and Wildlife (WDFW) and other agencies to minimize impacts on salmonids and other fish and invertebrate species.

- Limit impacts from in-water construction by depositing excavated sediments in barges for on-land disposal or in near-shore diked areas rather than sidecasting them. Such measures could be required if the excavated sediments were contaminated. If they were contaminated and had to be hauled offsite, clean fill material would be used to refill the trench around the pipe.

- Avoid using open, “cut-and-cover” construction in crossing water bodies wherever possible; use tunneling or other “trenchless technology” construction methods (especially in areas with contaminated sediments) to minimize sediment disturbance.

- Use sedimentation basins to reduce discharge of water high in suspended solids.

- Use appropriate "housekeeping" procedures for handling chemicals and petroleum products during construction.

- For outfalls, minimize water quality impacts by selecting an outfall site with strong currents, favorable circulation, gentle slopes and suitable foundation material. The first two factors would reduce long-term operational impacts, while the last two would reduce short-term construction impacts.

Compensatory mitigation for unavoidable adverse construction impacts includes:

- Revegetation of disturbed areas with native trees, shrubs, and herbaceous plants. This would compensate for impacts and minimize colonization by invasive species. A diverse mixture of vegetation in three canopy layers would stabilize soils, minimize erosion, and eventually shade aquatic habitats. Sediment control features would be retained until the plants cover the site.

Unavoidable Adverse Impacts

Construction of proposed treatment, conveyance, and CSO facilities for the selected service strategy would result in some level of erosion and sedimentation into nearby receiving waters. If construction best management practices are employed, impacts are not expected to result in long-term impairment of water resources or significant adverse impacts to water quality.

BIOLOGICAL RESOURCES

Impacts Common to All Facilities and Service Strategies

Because of the urbanized condition of much of the service area, construction of most facilities would have no large-scale impacts to biological resources. Most pipelines and tunnels would be constructed in existing road rights-of-way. The East and West treatment plant expansions and CSO storage facilities would be constructed in areas that are already developed or have been cleared of native vegetation. Impacts to vegetation, fish, or wildlife are most likely to be isolated to where facilities disturb patches of vegetation in public parks or greenbelts, or where facilities are located in or across shorelines, streams, and wetlands. A possible exception would be construction of a new North Plant. Impacts to biological resources would depend on plant locations, which could include, for example, undeveloped and/or wooded areas for an inland site.

Constructing facilities along marine shorelines could potentially result in adverse impacts to both marine habitat and biota (plants and animals), depending on the specific locations. Adverse impacts could result from direct or indirect disruption of habitat. Direct impacts to marine habitat and biota could result from trenching through the intertidal zone, which can displace benthic plants and animals, or noise from construction equipment, which can temporarily disturb or displace wildlife. Indirect short-term construction impacts could result from increased erosion and sedimentation in shoreline

areas, as well as increased turbidity during in-water construction. The degree of impact is related primarily to the location of the facility, the construction method used, and whether pipeline is laid on the bottom or trenched below the surface of the substrate. The impacts of sidecasting excavated material could be avoided by storage on barges for later use as backfill or land disposal. Benthic populations are usually able to recolonize an impacted area after construction and return to pre-construction levels in a short period of time.

Construction in the marine environment could disrupt eelgrass beds in the nearshore area if they are located in the outfall alignment. If this aquatic habitat cannot be avoided, mitigation measures such as replanting the area after construction would be implemented, as required by jurisdictional regulatory agencies.

As described in the Water Resource section above, impacts to fresh water resources could also occur where pipelines cross streams or disturb wetlands (although open, "cut-and-cover" construction would be avoided wherever possible). Increased sedimentation could disrupt or destroy spawning habitat and adversely impact freshwater fisheries resources without appropriate mitigation. Erosion and sedimentation control measures include planning construction activities during less sensitive times (i.e. summer low flows, typically July 15 to September 30) and providing physical structures such as silt fences and retention basins to control sedimentation and runoff. Such measures would be consistent with statutory requirements and guidelines for WDFW Hydraulic Project Approvals (HPAs). Riparian corridors would be preserved to provide streamside cover and maintain the integrity of stream banks. Corridor widths would be maintained in accordance with HPA requirements and pertinent zoning ordinances.

Construction activities have the potential to disturb bald eagles and great blue heron if these species are located in proximity to construction projects. These species may alter perching and foraging habitats during the construction period. However, experience at the West and East plants indicates that these species have developed some tolerance of human activity including construction. While some alteration of behavior may occur, significant adverse impacts on these species are unlikely.

Conveyance pipelines that flow by gravity or a gravity-and-pumping system are often located in lowland areas and may result in disturbance to wetlands. Disturbance of wetlands is regulated though both local ordinances and federal permits. Disturbance of wetlands or wetland buffers in many cases can be avoided through modification of facility design and location. Where disturbance is unavoidable, compensatory mitigation through wetland enhancement or creation is often required.

West Service Area

West Plant (SS1, SS2, SS4)

Expansion of the West Plant would occur within the existing DCLU permitted footprint of the plant. The total area required for expansion of the West Plant is estimated to be about 1.4 acres; no significant impacts on plant and animal resources during plant expansion are expected. Because the West Plant site has been altered and designed for potential future expansion, the areas where construction of additional facilities would

take place do not provide important habitat for wildlife. Construction activities may, however, disrupt mitigation areas developed as part of the most recent plant upgrade. Depending on construction methods, beach and bluff plantings could be disturbed. Elimination of an onsite wetland, created as part of the prior mitigation plan, would occur. Additional mitigation, such as onsite or offsite wetland creation, would be required. Potential impacts are more likely to occur during construction of the new aeration tanks at the northeast corner of the site where access is more limited.

Impacts on sensitive species during construction are not anticipated. During the recent construction activities at the plant, the eagles that nest in Discovery Park above the treatment plant have continued to breed and rear their young and do not appear to have been displaced by construction noise. Because of the relatively small scale of the proposed expansion, no impacts on nesting eagles are expected.

Parallel Kenmore Interceptor (SS1, SS2)

If the parallel interceptor were constructed within Lake Washington, in-water dredging activities would result in direct disturbance to or displacement of a number of macrophytic plant species, including milfoil, present to depths of about 20 feet. Turbidity also could result in short-term impacts to macrophytic vegetation and may result in a decrease of light and a temporary decrease in photosynthesis and plant growth. Release of nutrients in sediments may temporarily result in increased growth of nuisance macrophytes such as milfoil after construction is completed. The connection of the new parallel Kenmore Interceptor to the Matthews Park Pump Station would be made offshore; therefore, no impacts to the riparian habitat along Thornton Creek are expected.

Dredging for the pipeline would result in the direct loss of macrophytes and benthic invertebrates along the trenching corridor. This situation would result in a temporary reduction in prey organisms for finfish. Turbidity could also affect migrating salmonids and siltation could adversely affect spawning and rearing areas. The magnitude of impacts would depend on the timing of construction. Adherence to WDFW closure periods would substantially reduce potential impacts to fisheries in the lake.

Other than the shoreline of Lake Washington, which is a lacustrine wetland, in-water construction of the Kenmore Interceptor would not disturb any other major wetlands along the pipeline route. A small, seasonally flooded wetland is located just west of Tracy Owen Park in Kenmore, but this wetland is not likely to be affected.

There would be fewer impacts to biological resources if the pipeline were routed along an inland corridor. Two potential routes include the Lake Sammamish/Burke-Gilman Trail or a route along Bothell Way N.E. An inland route would most likely be located in an existing road or trail right-of-way, minimizing disturbance to any wetlands, vegetation, or wildlife habitat. Microtunneling would minimize open-cut excavation and reduce the potential for erosion. Minor increases in turbidity and sedimentation could occur where the pipeline crossed streams, but these impacts would be temporary and highly localized.

Deep Tunnel, Kenmore To Duwamish (SS4)

Impacts on biological resources from construction of the deep tunnel would be primarily related to activities at the tunnel portals and intermediate construction portals. The tunnel would typically be about 100 feet below grade and, consequently, would not result in the types of impacts associated with conventional cut-and-cover construction techniques. Although specific locations have yet to be determined, portals and drop shafts would likely be located in fully developed, urbanized locations where habitat is limited and the wildlife species present have developed a high tolerance for human activity (e.g., University Regulator, Kingdome area, Duwamish Pump Station). In some locations, construction may occur in the vicinity of shoreline areas, undeveloped greenbelts, small wetland areas, and/or parks. Depending on specific construction sites, portions of these habitats may be temporarily lost. Noise, dust, lighting, and activity from construction could temporarily disrupt wildlife using these areas.

East Service Area

East Plant (SS1, SS2, SS3, SS4)

The most recent construction activities at the East Plant will increase plant capacity to 115 mgd. The proposed expansion of this plant would occur on 46 acres of the 85-acre site located within the existing boundary (38 acres for the initial expansion to 172 mgd and 8 acres for the subsequent expansion to 235 mgd). Some of the new facilities would be constructed on a portion of the plant site that is already developed; no impacts would occur on this portion of the project. Undeveloped areas consist of open, grassy, and landscaped areas with plantings of trees, shrubs, and groundcover. These areas are used by waterfowl (including Canada goose and American widgeon) typically during non-breeding seasons, because flightless offspring cannot easily access the site. With the exception of an enhanced wetland area in the extreme northern portion of the site, wildlife habitat at the treatment plant site is very limited. These wetlands were enhanced during the most recent plant expansion.

The Black River great blue heron rookery is located approximately 1,350 north of the plant boundary, several hundred feet beyond the buffer areas recommended by state and federal agencies. Although occupied in the past, it is unknown if herons are present this season. The herons have developed a tolerance for human activity in the area, including rail traffic, quarry activity, local vehicular traffic, I-405, and air traffic. While construction at the plant would temporarily increase the level of human activity in the area, it is not expected to be at a scale above existing activity, so that significant impacts on herons would not occur.

Eastside Interceptor (SS1)

The proposed Eastside Interceptor (ESI) would generally parallel the existing Eastside Interceptor and would be constructed using a combination of open-cut and tunneling methods. Impacts on biological resources are most likely to occur at stream crossings and in wetland areas. The route of the new, parallel Eastside Interceptor would cross about 12 streams that provide some level of support for migratory salmonids and resident fish. Temporary increases in sedimentation and some disturbance to riparian vegetation could

occur where the pipeline crossed these streams. Several large riparian/wetland complexes are also located in the vicinity of the proposed pipeline corridor. The nature and magnitude of impacts in these locations would depend on construction methods, duration, timing, and adherence to best management practices. In some locations, it is likely that stream and wetland mitigation would be required to compensate for temporary disruption and/or loss of resources along the pipeline corridor.

Eastside Interceptor (SS2, SS3, SS4)

Smaller portions of the Eastside Interceptor would be paralleled under these service strategies, resulting in substantially less construction (approximately 1 mile versus approximately 15 miles under SS1). Construction would occur in the vicinity of the Mercer Slough in Bellevue, and the Cedar River in Renton. Depending on the construction methods used, temporary increases in sedimentation and some disturbance to riparian vegetation could occur where the pipeline crosses these streams.

Effluent Transfer System (SS1, SS2, SS3, SS4)

Impacts associated with the 20-mg storage facility that would be built under SS1, SS2, SS3, and SS4 would be similar to those associated with East Plant expansion because the storage facility would likely be located on the East Plant site.

Construction of a third outfall (SS1, SS2 and SS3) would result in temporary impacts to marine habitat and biota in the Duwamish Head area. The shoreline consists of riprap or bulkhead in the backshore and upper intertidal zones, extensive sand beach, and eelgrass in the lower intertidal and subtidal zones. Eelgrass occurs in a band from Duwamish Head to near Alki Point, generally between 0 and -15 MLLW (mean lower low water). Many small invertebrates inhabit eelgrass habitat and provide a food source for larger invertebrates and finfish. Eelgrass and associated invertebrates would be lost along the outfall corridor, but could recolonize the area after construction is completed. With avoidance of construction during outmigration periods, impacts to juvenile salmonids are not expected to occur. Mitigation could also be required for the loss of eelgrass and geoducks *(*see the Inter-Agency Permit Streamlining Document, *Shellfish and Domestic Wastewater Discharge Outfall Projects)*. Potentially affected upland areas are highly developed and provide limited wildlife habitat.

North Service Area

North Plant (SS2, SS3)

Although specific sites for a North Plant have not been identified, some possible areas include lowlands near the north end of Lake Washington and lowland or Puget Sound shoreline areas in north King or south Snohomish Counties. Approximately 25 to 45 acres would be needed for a site that would accommodate a 65- to 89-mgd wastewater treatment facility and a landscape buffer. The major lowland areas near the county boundary are the valleys of the Sammamish River, Little Bear Creek, North Creek, and Swamp Creek. There are large, diverse wetland areas in these valleys, which are located within floodplains or have otherwise been difficult to develop. If the North Plant site included wetlands, some wetlands could be lost through site development and would

require permitting and mitigation in accordance with local, state, and federal requirements.

The Sammamish River, North Creek, and Swamp Creek support important migratory and resident fish populations, including chinook, coho, and sockeye salmon, steelhead trout, and cutthroat trout. Depending on location of a North Plant, there is some risk that construction activities would introduce contaminants to major streams or tributaries, which could, in turn, affect resident and migratory fish species and critical spawning habitats. The degree of adverse impact to biological resources would depend on location and timing of construction activities, and the degree to which contractors followed best management practices.

Each of the streams and associated natural areas provide support for a wide variety of wildlife species including the bald eagle (state and federal threatened species) and great blue heron. Potential impacts on these species would be assessed as part of subsequent site selection and environmental investigations.

Depending on the specific location, there may be impacts on eelgrass from construction of the North Plant outfall. These impacts would occur primarily in the +1 foot to -15 foot MLLW elevation. Intertidal and shallow subtidal areas are primarily sandy flats with scattered concentrations of eelgrass and lesser amounts of kelp where substrate is suitable. Detailed surveys of the benthic community along the north King/south Snohomish County shoreline have not been conducted. However this community is thought to be similar to that found at Richmond Beach. Generally, the benthic community in the Richmond Beach area is dominated by polychaetes and mollusks, with relatively fewer species of crustacea. Intertidal and subtidal areas support a number of species of clams, including geoduck and Dungeness crab, which could be directly displaced or disturbed by outfall construction. Shoreline areas include a variety of shorebirds, waterfowl, raptors, and seabirds that would likely be temporarily displaced by construction.

During outfall construction, turbidity and siltation associated with pipe installation have the potential to adversely affect fisheries resources. However, the proposed outfall would not be located near important salmonid streams. Construction is likely to be restricted during the salmon outmigration period, roughly March 15 to June 15. Geoducks along the outfall corridor are likely to be lost, although surveys have shown that concentrations in this general area of Puget Sound are low. Additional geoduck surveys would be required in order to comply with Ecology's Interagency Streamlining Agreement.

Conveyance Facilities

There are a number of important aquatic resources and wetlands along the corridor of proposed routes of the Woodinville-to-Bothell pipeline. Subsurface tunneling as a construction method would minimize adverse impacts to these resources. Impacts from North Plant conveyance facilities would depend on its location; potential affected resources for an inland site could include Swamp Creek, North Creek, Bear Creek, the Sammamish River, and associated wetlands. See the Biological Resources and Impacts Common to All Facilities sections for a discussion of impacts associated with stream crossings.

CSO Facilities

In general, areas proposed for CSO facilities are developed, and construction activities would probably not result in significant disruption of biological resources. A possible exception would be the cormorants that roost on the large poplars that line the Ship Canal near Seattle Pacific University. These birds may be temporarily disturbed during construction at sites along the canal; however, there are no nests in the area and the birds appear to have a high level of tolerance for waterfront activities such as boat traffic, ship repair, and ship building. Some open excavation would also likely be required, but construction would largely occur in existing road rights-of-way and would not result in any significant disturbance to biological resources.

Mitigation Measures

- Pipeline alignments would be designed to minimize destruction of existing vegetation along conveyance routes and at facility sites. When disturbance could not be avoided, sites would be revegetated as soon as possible after construction.

- Wherever possible, pipelines would be located to avoid sensitive marine vegetation such as eelgrass and kelp. Trenchless technology and/or sheetpiling methods can be employed to minimize the amount of eelgrass lost. King County would coordinate with the WDFW regarding construction methods and the best measures for site restoration. Site restoration would include backfill of sediments, similar to those removed, and possible replanting of the disturbed area.

- As far as possible, excavation and other site work at facilities and along conveyance routes would be scheduled during the dry season to avoid potential erosion and sedimentation of natural areas. When wet season construction could not be avoided, sedimentation control measures, including hay bales, sedimentation basins, silt fences, sprinkling, and street cleaning would be employed at particular sites.

- Construction in streams and nearshore areas would not take place during designated fishery closure periods to protect migratory and resident fishery resources. Closure periods would be established by the WDFW.

- Open, “cut-and-cover” construction in crossing water bodies would be avoided wherever possible through use of tunneling or other “trenchless technology” construction methods, especially in areas with contaminated sediments. This would minimize sediment disturbance.

- During construction, King County staff and contractors would coordinate with appropriate Point Elliott Treaty Tribes to reduce the potential for disruption of tribal commercial fisheries in Lake Washington, the Lake Washington Ship Canal, the Duwamish River, and Elliott Bay.

- Where possible, construction site drainage would be routed through grass-lined swales or treated through other mechanisms to reduce silt loading to nearby wetlands and streams.

- Wetland mitigation plans would be developed for those wetland areas that cannot be avoided during construction. Mitigation would be provided at suitable sites and ratios to comply with local jurisdictional requirements. Mitigation plans would be negotiated with and permitted by the U.S. Army Corps of Engineers, Ecology, WDFW, and local jurisdictions.

- King County would work with resource agencies to develop specific site restoration methods for affected sensitive areas. The County would also develop appropriate mitigation measures for potential loss of wildlife or habitat during construction. These measures could include replacing lost habitat onsite, providing or restoring habitat offsite, or contributing to the restoration or enhancement of other species habitat.

- Use of heavy equipment on shorelines or in other sensitive areas would be minimized.

- Material excavated from streams, lake bottoms, and nearshore marine areas as part of pipeline trenching operations would not be sidecast. The material would be stored and used for backfill of the trench as appropriate. Contaminated material would be disposed of at approved upland or confined sites.

- Vegetated areas disturbed during construction would be replanted, if possible, to restore habitat and provide noise and visual buffers for wildlife.

- Construction would be timed to avoid and/or minimize impacts to sensitive species during breeding seasons.

- Refer to the Water Resources section for additional mitigation measures.

Unavoidable Adverse Impacts

Temporary displacement or disturbance to vegetation, wildlife, or fish in the direct path or vicinity of construction activities is largely unavoidable; however, these would be short-term impacts and would be appropriately mitigated.

LAND AND SHORELINE USE

Impacts Common to All Facilities and Service Strategies

Construction-related impacts would be temporary and primarily would affect areas on and immediately adjacent to construction sites. Duration of construction would vary from 5 to 7 years for a new treatment plant to only a few weeks for pipeline placement in a specific local area. Pumping and regulator stations would take about one and one-half years to construct. Tunnel construction portals would operate for several months, depending on the size and length of the tunneled section.

Temporary construction activity for any of these proposed facilities may be somewhat incompatible with surrounding land uses because of noise, dust, and traffic. These impacts are discussed in the Environmental Health (Noise) and Other Elements of the Environment (Air Quality and Transportation) sections. In addition, the Recreation section discusses impacts on recreational facilities.

Construction easements from property owners would be required for many of the proposed conveyances and CSO facilities. Utilities easements are required for pipeline construction. Pipelines are, most often, buried under streets where they are clearly allowed in virtually all cases.

If construction occurs in shoreline environments, staging areas would be located away from the shoreline, when feasible, to minimize disruption to beach access. If public access to beaches is disrupted, staging of construction may allow for beach access in other locations. Refer to the Other Elements of the Environment (Recreation) section for a discussion of recreational impacts associated with bicycle paths, pedestrian trails, etc.

Mitigation Measures

Mitigation measures would be selected during the design phase of the proposed facilities to reduce odor and noise impacts to the neighboring properties. Measures to lessen any disruption of recreational activities near construction areas include standard best management practices and timing of construction. For construction in shoreline districts, such as for an outfall, King County would apply for project-specific shoreline permits, when necessary, and would comply with specific permit provisions. King County would restore disturbed areas after construction in compliance with local jurisdictional requirements. Additional measures to minimize construction impacts are discussed in the Environmental Health (Noise) and Other Elements of the Environment (Air Quality, Aesthetics, Recreation and Transportation) sections.

Unavoidable Adverse Impacts

Temporary construction-related impacts (noise, dust, and traffic) would affect land uses adjacent to proposed facilities.

ENVIRONMENTAL HEALTH

Public Health

No public health impacts are expected to result from construction of projects under the RWSP.

Noise

Impacts Common to All Facilities and Service Strategies

Construction of all wastewater facilities (treatment plants, pipe systems, etc.) would involve the use of heavy equipment. Such equipment can create a high level of noise, which can be disruptive to people nearby. Table 11-1 lists many types of equipment commonly used in wastewater system construction, and shows the expected range of noise levels and average noise levels at a distance of 50 feet.

Table 11-1. Typical Construction Equipment Noise (dBA)

Task	Type of Equipment	Range of Noise Levels at 50 ft.[a]	Average Noise Level at 50 ft.
Earth Moving	Compactors (rollers)	73-75	na[b]
	Front Loaders	73-84	na
	Backhoes	73-93	85
	Tractors	76-96	na
	Scrapers, Graders	80-94	na
	Dump Trucks	82-94	88
Materials Handling	Concrete Mixers	75-87	85
	Concrete Pumps	81-83	na
	Cranes (movable)	76-87	83
	Cranes (derrick)	86-88	88
Stationary Equipment	Pumps	69-71	76
	Generators	71-82	78
	Compressors	74-87	81
Impact Equipment	Pneumatic Wrenches	83-88	85
	Jackhammers and Rock Drills	81-98	88
	Impact Pile Drivers (peaks)	95-106	101(peak)
Clearing	Bulldozer	77-96	87
	Dump Truck	82-94	88
Grading	Scraper	80-93	87
	Bulldozer	77-96	87
Paving	Paver	86-88	na
	Dump Truck	82-94	88

Source: U.S. Environmental Protection Agency, 1971

[a]The upper ends of these ranges are higher than typically observed for equipment today.

[b]na = data not available.

Mitigation Measures

- Construction vehicles and equipment noise would be reduced using properly sized and maintained mufflers, engine intake silencers, and engine enclosures. Equipment could also be turned off when not in use and activities could be confined to between 7 am and 7 pm.

- Where sheet piles are needed and soil conditions allow, vibratory pile drivers would be used instead of impact pile drivers.

- Stationary construction equipment would be located away from sensitive receptors, such as residences, where possible. Where this is not possible or where noise impacts are still substantial, portable noise barriers could be placed around equipment with the opening directed away from sensitive receptors.

- Construction specifications would provide that noise levels for scrapers, pavers, graders, and trucks should not exceed 90 dBA, and pile drivers should not exceed 95 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, specifications would provide that noise levels should not exceed 85 dBA.

- Substituting hydraulic or electric models for impact tools such as jack hammers and pavement breakers would further reduce construction noise.

Unavoidable Adverse Impacts

Construction would unavoidably require short-term increases in noise levels associated with construction equipment.

Hazardous Materials

Impacts Common to All Facilities and Service Strategies

If siting and construction of new or expanded wastewater treatment facilities requires the demolition of an existing building, materials or products may be encountered containing asbestos, PCBs, or other hazardous materials. These materials would be handled, transported, and disposed of in accordance with applicable regulations and permits. Any hazardous materials encountered during excavation would also be handled, transported and disposed of in this manner.

Mitigation Measures

No mitigation would be required for hazardous materials handled in accordance with regulations.

Unavoidable Adverse Impacts

No unavoidable adverse impacts are anticipated.

OTHER ELEMENTS OF THE ENVIRONMENT

Earth Resources

Impacts Common to All Facilities and Service Strategies

Treatment Plants, Pumping and Regulator Stations, Storage Tanks. Most of the components of these facilities are located underground, and often in low areas. For these reasons, construction would likely require large-scale excavation and dewatering to achieve and maintain dry foundation excavations. The excavation depth (up to 50 feet for some types of facilities) would typically require shoring to support the sides. Reuse of excavated soils as backfill depends on the quality of the material. Unusable soils would be hauled away for disposal at a permitted facility. Contaminated soils would be tested and handled appropriately, depending on the levels and types of contaminants present. Table 11-2 provides estimates of areas disturbed and volumes of material excavated for treatment plant projects.

Conveyances. Cut-and-cover and trenchless technology are the two main categories of pipeline construction. These methods are described in the General Construction Methods section above. Tunneling would reduce the volume of soils excavated for any given pipe size because the soils between the pipe and ground level would not be removed. Subsidence of surrounding ground surfaces could occur during tunneling, and geologic conditions would be studied before and during tunneling. Soil stabilization measures such as soil grouting would be employed to prevent ground subsidence.

Construction of conveyances under the four service strategies would result in the general construction impacts described above. Table 11-2 provides estimates of areas disturbed and volumes of material excavated during construction of major conveyances. Minor areas of contaminated soils may also be encountered during construction of these facilities.

CSO Facilities. Construction of CSO facilities for the four service strategies (e.g., conveyance lines, storage tanks, and storage tunnels) would result in the general construction impacts described above. Table 11-2 shows estimates of areas disturbed and volumes of material excavated for major CSO facilities. There would be a higher likelihood of encountering contaminated soils during site preparation for facilities located in industrial areas.

Impacts Specific to Service Strategies. SS2 and SS3 are similar in the volume of material that would be excavated over the planning period as a whole. SS4 would result in substantially more excavation; SS1, somewhat more excavation than SS2 or SS3. Differences in earth impacts among the four service strategies primarily reflect differences in the timing of construction and location of facilities. No significant change in topography is expected to result from construction of any of the proposed facilities.

NOTE: Table EP2-5, Chapter EP-2, provides approximate areas disturbed and volumes of excavated material for the revised service strategies.

Table 11-2
Approximate Areas Disturbed and Volumes of Excavated Material

Type of Facility	**Service Strategy 1**		**Service Strategy 2**		**Service Strategy 3**		**Service Strategy 4**	
	Area Disturbed (acres	Volume Excavated (cubic yards)*	Area Disturbed (acres	Volume Excavated (cubic yards)*	Area Disturbed (acres)	Volume Excavated (cubic yards)*	Area Disturbed (acres)	Volume Excavated (cubic yards)*
Treatment Plants	47	1,680,000	47	1,380,000	55	1,580,000	47	1,680,000
Conveyance Lines	47	1,000,000	43	855,000	35	670,000	12	2,681,000
CSO Projects	5	1,280,000	12	720,000	9	830,000	1	1,200,000
Total	**99**	**3,960,000**	**102**	**2,955,000**	**99**	**3,080,000**	**60**	**5,561,000**

*Volumes excavated includes estimated volumes of preload material

Mitigation Measures

During construction, erosion and sedimentation control measures would be implemented as required by Ecology's *Stormwater Management Manual for the Puget Sound Basin* and applicable local stormwater regulations.

In areas of suspected contaminated soils, testing would be conducted to determine the extent of contamination before construction. Any excavated contaminated soils would be disposed of in accordance with the Washington State Dangerous Waste Regulation, WAC 173-303, and the Washington State Model Toxics Control Act, WAC 173-340.

Where contaminated soils and groundwater are found together, dewatering systems would be implemented to avoid discharging contaminated groundwater or soils to receiving surface waters.

Unavoidable Adverse Impacts

No unavoidable adverse impacts on earth resources are expected to result from construction of RWSP facilities.

Aesthetics

Impacts to All Facilities and Service Strategies

Treatment Plants. The West Plant is located within Discovery Park. Construction activity associated with plant expansion (SS1, SS2, SS4) would most likely be evident from the beaches and bluff bordering the treatment plant site.

The East Plant is located within an existing industrial and business park area. Construction associated with plant expansions (SS1, SS2, SS3, SS4) would be evident from the upper floors of nearby office buildings, portions of I-405, and some residences located on valley sides about one-half mile from the site.

Construction of a North Plant would occur on either an inland site or a shoreline site in north King or south Snohomish County. Impacts to aesthetics would depend on plant location. Construction of the North Plant would take place in up to three stages.

Conveyance Facilities. Construction of major wastewater conveyance lines, including the deep tunnel and new pump stations, would result in temporary aesthetic impacts because of the presence of construction equipment and excavation activity. These changes to visual character would be localized and would not be evident for more than several hundred yards of the conveyance route or shaft openings. Duration of impact from construction of deep-tunnel segments and pump stations would be longer than for other pipeline conveyances, on the scale of several months compared to several weeks.

CSO Facilities. Construction of CSO facilities (conveyance lines, storage tanks, and storage tunnels) would result in temporary aesthetic impacts similar to those described above for conveyances. Proposed CSO facilities would be located in highly urbanized

areas, and aesthetic impacts during construction of these facilities are not expected to be significant.

Mitigation Measures

Where necessary to reduce adverse aesthetic impacts associated with construction of proposed facilities, measures such as screening and buffering could be implemented during early stages of construction. However, construction requirements may constrain the use of screening and buffering during later construction stages.

Unavoidable Adverse Impacts

There are no known unavoidable adverse impacts to aesthetics resulting from construction of wastewater facilities.

Recreation

Impacts to All Facilities and Service Strategies

Treatment Facilities. Construction of the West Plant expansion (SS1,SS2, SS4) would disrupt use of the adjacent shoreline portions of Discovery Park for up to one year. The specific nature of the impacts would, in part, depend on whether construction transportation used the park roadway or water access. Water access would disrupt use of the North Beach, whereas road access would disrupt pedestrian traffic between the upland portion of the park and the North and South beaches. A temporary construction easement would probably be required along the property line with the Seattle Parks Department. Construction of the East Plant expansions would not result in any impact to recreation as the perimeter trail along Springbrook Creek can remain open during all construction activities at the treatment plant site. Impacts to recreation resulting from construction of a North Plant would depend on its location. Siting could likely avoid major recreational areas.

Conveyance Facilities. Construction of the deep tunnel (SS 4) may require an access shaft or portal in the vicinity of Logboom Park and/or the Burke-Gilman trail in Kenmore. Use of these facilities may be disrupted for a period of one to several years.

Construction of the parallel Kenmore Interceptor (SS1,SS2) could result in recreation impacts. If the parallel interceptor is located along the Burke-Gilman trail, the use of microtunneling would likely minimize recreation impacts, except at the tunnel exit and entry locations. If the parallel interceptor were located underwater, adjacent and parallel to the Lake Washington shoreline, boat access from individual properties along the lake shore would be interrupted.

Expansion of the existing Kenmore and Matthews Beach pump stations would cause disruption to Logboom and Matthews Beach parks for up to several months. Depending on the specific route, the parallel Eastside Interceptor could temporarily disrupt access to and use of the Gene Coulon Park in Renton for a period of up to several weeks. Depending on its location, construction of the North Creek to North Plant conveyance could also temporarily impact existing recreational facilities. Vehicular access to other

recreational facilities could be impacted during construction of these conveyances, but these impacts would be brief and minor.

CSO Facilities. Construction of storage tanks at Lowman Beach Park, both in Seattle, could affect recreational use in the park for a period of up to several months.

Mitigation Measures

Where short periods of temporary construction impacts are expected at recreational facilities, construction could be scheduled to avoid the periods of highest recreational use.

Unavoidable Adverse Impacts

Construction of the proposed facilities would temporarily restrict the use of certain recreational areas for varying periods of time.

Cultural Resources

Impacts Common to All Facilities and Service Strategies

As described in Chapter 4, Affected Environment, the King County wastewater service area contains a number of documented cultural and historic resource sites, and the potential for unidentified sites to exist in the vicinity of RWSP facilities is generally high. Although specific alignments, sites and/or layouts for proposed facilities have not yet been developed, it is assumed that known sites would be avoided. Thus, the primary potential for impacts under any of the service strategies would be the discovery of a previously unidentified site during project construction. The discussion of impacts below describes the relative magnitude of this potential, as well as the known sites in the project vicinity. Methods for addressing the discovery of unidentified resources during construction are described under Mitigation Measures. For all proposed facilities, a cultural resources assessment would be conducted after project designs have been developed and prior to any subsurface disturbance, including geotechnical testing.

West Service Area

West Plant (SS1, SS2, SS4). Excavation could adversely affect cultural resources. Cultural deposits were identified across the West Point landform in 17 areas exposed during construction of the West Plant secondary sewage facilities and were classified as the West Point sites 45KI428 and 45KI429 (Larson and Lewarch, 1994).

The locations of known cultural deposits, areas with probable cultural deposits, and areas with a potential for cultural deposits within the existing footprint of the plant have been identified and mapped. Because the West Point site is an NRHP (National Register of Historic Places) property, a professional archaeologist must be contacted in the planning stages if any proposed construction excavation is in an area with known or potential cultural deposits to determine whether an adverse effect would occur. King County would consult with the Office of Archaeology and Historic Preservation (OAHP) and affected federally recognized Tribes regarding any impacts to the archaeological property.

The West Point Light Station (45KI175H) is also listed on the NRHP and is adjacent to the existing West Plant footprint. Any modifications to the historic structure and/or the grounds of the historic property would be assessed for their impacts by a historical architect through consultation with the OAHP.

Kenmore Interceptor (SS1, SS2). Construction of the Kenmore interceptor may directly affect unidentified archaeological resources associated with Lake Washington. The level of probability for encountering archaeological resources during construction is variable, depending on the location of the conveyance facility relative to the historical Lake Washington shoreline. The probability for archaeological resources along the historical, or pre-1916, shoreline and the ancient shoreline is high. Also, a pipeline route that approaches the former mouths of McAleer and Lyon Creeks—salmon-bearing tributaries with ethnographically associated use—suggests a probability for encountering archaeological resources. The proposed route for the interceptor would include an archeological assessment in areas where subsurface disturbance, including geotechnical testing and dredging, will be undertaken.

Deep Tunnel, Kenmore Duwamish (SS4). The potential for cultural and historic resource impacts from the deep tunnel depends on the depth of the tunnel, the subsurface geology, and the numbers and location of surface access points. In general, impact potential would be highest under the following conditions:

- Relatively shallow pipeline depths (i.e., less than 20 feet below ground surface)
- Alluvial (river-deposited) soils
- Areas of open surface excavation for tunnel portals, access shafts, and adits

Because no design yet exists for the tunnel, the extent to which these conditions would be experienced is difficult to predict. On the whole, however, the tunnel would likely have a lower potential for resource impacts than other conveyance facilities because of its relatively greater depth and lack of open-cut construction. The general portal areas in Kenmore and near the Duwamish River, as well as some of the access shaft locations, have known cultural resource sites nearby and a high potential for undocumented sites. However, it is assumed that known sites would be avoided. As with other proposed facilities, a cultural resource assessment would be prepared before starting construction.

East Service Area

East Plant (SS1, SS2, SS3, SS4). Construction that requires penetration of fill to native soils for proposed expansions of the East Plant might affect unidentified archaeological resources. The existing plant is adjacent to a recorded archaeological site (45KI267) and is within 1 mile of four other sites (45KI51, 45KI438, 45K159, and 45KI438). The East Plant is in an area of high probability for cultural resources because of its proximity to the former Black, White, and Duwamish River confluence. No identified historic structures or traditional cultural resources potentially eligible for listing on the NRHP are on or near the East Plant (Larson, 1994).

Plant expansion plans would include an assessment for potential impacts on archaeological resources through consultation with the OAHP, King County, and affected federally-recognized Tribes.

Effluent Transfer System (SS1, SS2, SS3, SS4). Construction of the third leg of the ETS outfall into Elliott Bay has the potential to encounter undocumented cultural or historic resources, particularly the remains of shipwrecks in Elliott Bay. As with other proposed facilities, a cultural resource assessment would be prepared before starting construction.

Eastside Interceptor. Construction of new storage facilities and placement of new pipe for the Eastside Interceptor may directly affect unidentified archaeological resources, particularly under SS1. The character of the landforms, previous aboriginal occupation, and the abundance of salmon resources suggest this route is very likely to encounter such resources. The conveyance currently traverses the eastern shoreline of Lake Washington and twice approaches the southeast shore of the lake. Before the 1916 lowering of Lake Washington, its shoreline was higher than the current shoreline, increasing the probability of disturbance to archaeological resources along the historic shoreline. A fishing place and village site have been ethnographically documented near the proposed route, and an NRHP archaeological site (45KI9) was excavated near Lake Sammamish. The Eastside Interceptor route also crosses several salmon-bearing streams entering Lake Washington that were used for salmon fishing by aboriginal people. Proposed locations for storage facilities and any conveyance facilities that require subsurface disturbance, including geotechnical testing, would include an assessment prior to project construction.

The proposed Eastside Interceptor improvements may affect structures with potential historical significance. The Kennydale Methodist Church has not been evaluated for its significance and may be eligible for listing as a King County Landmark. If plans that include modifications to this property are proposed, it would be evaluated for its significance. One property, the Wilburton Trestle, is listed on the State Register of Historic Places; any modifications to the structure would be assessed for their impacts by a qualified historical architect in consultation with the OAHP.

North Service Area

North Plant (SS2, SS3). Construction of the proposed North Plant could directly affect unidentified archaeological or traditional cultural resources. With respect to a potential inland site, Swamp Creek is a salmon stream that has supported runs of chinook, coho, and sockeye salmon, and is near an ethnographic village at the mouth of the Sammamish River, strongly suggesting that it was an aboriginal fishing place. Any construction activities that involve subsurface ground disturbance, including geotechnical testing, would include a cultural resources assessment of the project area conducted to determine the effects of construction on cultural resources.

CSO Facilities (SS1, SS2, SS3, SS4). The construction of CSO facilities is proposed primarily within urban Seattle and in several incorporated suburban cities and unincorporated neighborhoods. Several of these areas contain hunter-fisher-gatherer and historic archaeological sites, traditional cultural resources, historic districts, historic buildings, roads, and/or other historic features that have local, state or national

recognition or significance. Unidentified hunter-fisher-gatherer and/or historic archaeological resources may lie in undisturbed soils beneath fill or other landform alterations such as roads or buildings. All proposed CSO facility locations would receive a cultural resources assessment prior to any subsurface disturbance, including geotechnical testing. Areas that contain standing structures may also require assessment for impacts by a qualified historical architect.

Mitigation Measures

Mitigation measures for archaeological resources cannot be determined until a resource has been identified and its eligibility for listing on the NRHP has been determined. If a site is determined eligible for listing on the NRHP through evaluation by a professional archaeologist and consultation with the lead agency, the State OAHP, King County , and the affected federally-recognized Tribes, and if the site cannot be avoided, mitigation measures would be required. Mitigation for impacts to hunter-fisher-gatherer and historic archaeological sites is nearly always accomplished through data recovery or pipeline realignment to minimize site disturbance.

Standing structures that are eligible for listing on the NRHP, and that may be adversely affected by any of the proposed actions may be mitigated by research and/or photographic documentation developed by a qualified historical architect, the lead agency, the State Office of Archaeology and Historic Preservation, and King County.

Unavoidable Adverse Impacts

If a facility proposed under one of the service strategies encroaches on an archaeological or historic site and cannot be rerouted, the site could be demolished or otherwise removed in accordance with applicable guidelines and regulations.

Air Quality

Impacts Common to All Facilities and Service Strategies

Construction of facilities proposed under the RWSP would result in the disturbance of varying amounts of soil on construction sites, as described in the Earth section. Areas of exposed soil can generate fugitive dust emissions, which can cause air quality impacts in the immediate vicinity of the site. These impacts would be temporary and would be kept to a minimum through use of the best management practices described below.

Mitigation Measures

Construction best management practices used to minimize fugitive dust impacts include:

- Water-exposed soil areas
- Cover soil stockpiles and haul truck loads
- Minimize areas of earth disturbed at any one time; revegetate as soon as possible after construction is complete

Unavoidable Adverse Impacts

Temporary, localized dust emissions would likely occur occasionally during construction of larger treatment, conveyance, and storage facilities.

Transportation

Impacts Common to All Facilities and Service Strategies

Short-term construction transportation impacts are substantially greater than long-term operational transportation impacts because of the excavation required to prepare a site for installation of facilities. Dump trucks with capacities ranging from 10 to 18 cubic yards would be used to remove soil from pipeline trenches, treatment plant sites, and pump station excavations. For the purposes of this analysis, a capacity of 16 cubic yards was assumed. The excavated material that is not suitable to be reused at the construction site (e.g. to backfill a pipeline trench) would be hauled away, using major streets in the vicinity and regional highways. The excavation phase would occur early in construction.

Nearly all structures associated with wastewater facilities are constructed of reinforced concrete, which requires concrete trucks for intermittent and sometimes extended "pours." These pours occur as a succession of facility elements are prepared for the concrete (e.g. floors, walls, separate buildings, paving, etc.).

Besides these periods of heavy truck traffic, other trips are generated over the duration of construction. These trips include workers traveling to and from work, delivery of equipment and supplies, and miscellaneous inspector trips.

Table 11-3 provides a summary of transportation impacts for treatment plants. Included are estimates of excavation volumes, total one-way-haul truck trips, average-daily-haul truck trips, and total daily construction-related trips. Principal roadways these trips could affect are also listed. Impacts associated with individual system components are discussed below.

Pipelines are constructed in segments, so traffic impacts in any one area (for instance, a city block) would be most intense during construction in that area. Pipelines are most often constructed in public rights-of-way, so it is common for one or more traffic lanes to be temporarily blocked in the stretch of road immediate to the open trench segment. In those cases, traffic management plans would be developed to ensure the movement of goods and people through the area, usually by employing flaggers to maintain traffic flow in at least one direction at all times. Access to properties adjoining the blocked-off portion of the roadway would be maintained to the maximum extent possible.

NOTE: Table EP2-7, Chapter EP-2, provides a treatment plant construction transportation impact summary for the revised service strategies.

Table 11-3. Treatment Plants
Construction Transportation Impact Summary

Facility	Potentially Affected (1) Roadways	Excavation Volumes (2) (cubic yards)	Total One-Way (3) Haul Truck Trips (16 cy/load)	Maximum Daily Haul Truck Trips (16 cy /load)	Total Construction (4) Related Trips (average/maximum per day)
West Plant to 159 mgd (26 mgd expansion)	• 15th Ave W • W Dravus St • 20 Ave W • Gilman Ave W • W Government Wy • Discovery Pk/Fort Lawton roadways	100,000	12,500	150-200	150-200/300-350
East Plant to 154 mgd (39 mgd expansion)	• SW 7th St • Longacres Drive SW • Monster Rd SW • Oaksdale Ave SW • SW Grady Wy	530,000	33,125	250-300	220-320/450-500
East Plant to 172 mgd (18 mgd expansion)	Same as East Plant (154 mgd)	300,000	18,750	100-150	100-150/200-250
East Plant to 235 mgd (from 154 mgd) (81 mgd expansion)	Same as East Plant (154 mgd)	1,050,000	65,625	NA [5]	NA
North Plant, 35 mgd	Dependent on location	200,000-300,000	25,000-37,500	200-250	200-300/400-450
North Plant to 55 mgd (20 mgd expansion)	Dependent on location	100,000-200,000	12,500-25,000	100-150	100-150/200-250
North Plant to 65 mgd (30 mgd expansion)	Dependent on location	100,000-200,000	12,500-25,000	100-150	100-150/200-250

Facility	Potentially Affected (1) Roadways	Excavation Volumes (2) (cubic yards)	Total One-Way (3) Haul Truck Trips (16 cy/load)	Maximum Daily Haul Truck Trips (16 cy /load)	Total Construction (4) Related Trips (average/maximum per day)
North Plant to 89 mgd (from 55 mgd) (34 mgd expansion)	Dependent on location	200,000-300,000	25,000-37,000	200-250	200-300/400-450

Notes: (1) Roadways listed are principal affected roadways.
(2) Excavation volumes include a 30% swell factor.
(3) A one-way truck trip is defined as a single direction trip to a single destination.
(4) Construction related trips include haul truck, delivery, inspection, and worker trips.
(5) Expansion would be phased; information on magnitude of phases is currently undetermined.

After the trench has been backfilled and the road pavement replaced, the construction "train" moves on to the next segment. The most intensive traffic impact moves along with the construction. Spoils and equipment hauling trucks and workers would use major roadways to access and egress the construction site, so impacts would occur distant from the actual construction as well. For pipeline construction, these impacts are usually minor.

Table 11-4 provides a summary of impacts for major conveyance facilities.

CSO Facilities. Although the size, type, and configuration of CSO control facilities would vary under each service strategy, construction would occur in similar locations under all service strategies and is likely to add construction traffic to major area roadways. Disruptions would most likely not be widespread, as most facilities are small in area, and in most cases construction of each project would be separated from the others by one to several years.

Infiltration/Inflow. No significant adverse transportation impacts would be expected from I/I control projects. These projects would include some minor, highly localized in-road work that could cause temporary, minor disruptions in neighborhood traffic. Advancements in "trenchless" technologies allow relining and replacing of pipes with only minor excavation. The locations requiring excavation would be determined by future studies.

West Service Area

West Plant (SS1, SS2, SS4). Expansion of the West Plant would require comparatively minimal excavation and site work. An estimated 100,000 cubic yards of excavated material would require an average of between 150 and 200 one-way truck trips per day (Table 11-3) over a period of several months. Roadways through the Interbay area, Magnolia neighborhood, Discovery Park, and Fort Lawton would experience temporary increases in construction-related truck traffic.

Kenmore Interceptor (SS1, SS2). The Lake Sammamish/Burke-Gilman Trail system is a major bicycle and pedestrian trail that parallels the Lake Washington shoreline along the entire length of the proposed Kenmore Interceptor. The trail runs directly adjacent to Tracy Owen Station Park and Matthews Beach Park. If a land route were selected along this trail system, alternative routing around construction would likely be required for trail users. This option may be difficult in some areas because of residential development on the lakeside and steep slopes on the upland side of the trail.

Possible in-water construction of the Kenmore Interceptor (SS1, SS2) would likely be accomplished primarily with floating equipment (i.e., barge-mounted crane, equipment and material barges, tugs, skiffs). This equipment would probably be mobilized in a temporary staging area at the Kenmore Navigation Channel. An estimated 200,000 cubic yards of material would have to be dredged. Dredged material would be placed on a barge for backfill or disposal at an approved site. An estimated 18 percent of the 200,000 cubic yards to be dredged may be contaminated. This dredged material would have to be hauled by barge to an approved disposal site.

NOTE: Table EP2-8, Chapter EP-2, provides a major conveyance facilities construction transportation impact summary for the revised service strategies.

Table 11-4. Major Conveyance Facilities
Construction Transportation Impact Summary

Conveyance	**Affected Roadways** [1]	**Excavation Volumes** [2] **(cubic yards)**	**Total One-Way** [3] **Haul Truck Trips (16 cy/load)**	**Average Daily** [4] **Haul Truck Trips (16 cy /load)**	**Total Construction** [5] **Related trips (average per day)**
Parallel Kenmore Interceptor	• SR 522 • NE 175th St • 61st Ave NE • Sand Pt Wy NE	Land Route Excavation volumes are undetermined In-water 200,000	------- In-water (majority of material to be hauled by barge)	------- In-water NA[6]	------- In-water NA
Parallel Eastside Interceptor (ESI)	• I-90 • SR 908 • I-405 • SR 900 • SR 522 • SR 169 • SR 520 • SR 167 • SR 202 • SR 181	Service Strategy 1 700,000 Service Strategy 2 45,000 Service Strategy 3 and 4 60,000	Service Strategy 1 87,500 Service Strategy 2 2,800 Service Strategy 3 and 4 3,800	50-100	100-150
Deep Tunnel (Kenmore/Duwamish)	• I-90 • SR 520 • I-5 • SR 99 • SR 522 • SR 167	2,600,000	325,000	50-100	100-150

Notes: (1) Roadways listed are major and/or principal affected roadways.
(2) Excavation volumes include a 30% swell factor.
(3) A one way trip is defined as a single direction trip to a single destination.
(4) Numbers for daily truck trips assume a single construction site.
(5) Construction related truck trips include haul truck, delivery, inspection, and worker trips.

Deep Tunnel—Kenmore to Duwamish (SS4). Construction traffic would increase on some of the major roadways along the proposed deep tunnel route from Kenmore to the East Plant at various times corresponding to construction timing. Transportation facilities most affected would be those in the immediate vicinity of construction portals, access shafts, and drop shafts. Roads near construction portals would be affected for a number of months each. The tunnel would be constructed in segments in several blocks of time over the planning period. One or two construction portals would be open during each of these blocks. Total excavation volumes and one-way truck trips are listed in Table 11-4. Other facilities that could be affected include rail lines, pedestrian/bicycle trails, and boat traffic.

East Service Area

East Plant (SS1, SS2, SS3, SS4). Expansion of the East Plant would occur in several phases over the planning period, as shown in Table 11-3. The initial expansion of the East Plant from 115 mgd to 154 mgd (all Service Strategies) would generate approximately 250-300 maximum daily one-way haul truck trips during an approximate six month excavation period. Further expansion of the East Plant from 154 mgd to 172 mgd (18 mgd) (SS2, SS3) would generate 100-150 maximum daily one-way haul truck trips during an approximate six month excavation period. Subsequent expansions of 37 mgd and 44 mgd (SS1, SS4) to reach an ultimate East Plant capacity of 235 mgd would generate impacts similar in magnitude to the initial 39 mgd expansion. Roadways affected would include SW Grady Way which provides direct access to I-405 in Tukwila.

Eastside Interceptor (SS1, SS2, SS3, SS4). Construction of a parallel Eastside Interceptor under SS1, or paralleling or replacing smaller sections of the Eastside Interceptor under SS2, SS3, and SS4, would generate an average of 50 to 100 one-way-haul truck trips per day. Impacts to traffic would be greater under SS1, where paralleling of consecutive segments of the Eastside Interceptor could affect area traffic patterns for longer periods of time.

North Service Area

Construction of a new North Plant would occur in phases, as shown in Table 11-3. The initial 35-mgd construction phase would generate an estimated maximum of 200-250 daily one-way haul truck trips during an approximate six-month excavation period. Subsequent second-phase expansions of 20 mgd (SS3) or 30 mgd (SS2) would generate an estimated 100-150 daily one-way haul truck trips over a period of approximately 3 to 6 months. A third expansion of 34 mgd to a total plant capacity of 89 mgd (SS3) would generate impacts similar to the initial construction phase. Roadways affected would depend on plant location, as yet undetermined. A transportation impact assessment would be conducted for the selected site.

Mitigation Measures

- Construction activity would be phased, and traffic would be rerouted during construction. Traffic plans would describe traffic operations in detail during the construction period. Construction would be scheduled to minimize disruption of existing traffic patterns to area residents and businesses. Affected neighborhoods would be provided with appropriate information.

- Open trench segments would be temporarily covered to allow residents and service vehicles to access driveways and loading areas. Trench segments would be excavated and closed promptly, minimizing the time that trenches are open in front of residence driveways and businesses. Construction vehicles would not be parked in front of access points and/or business parking areas.

- *For pipelines, trenchless technologies and/or alternative routes could be used where appropriate to minimize or avoid impacts.*

- Temporary measures would be implemented along trails to separate pedestrians and bicyclists from vehicles and to promote safety along the construction routes.

- Materials delivery or removal during peak traffic hours along major arterials would be avoided when possible. Flaggers would be present to direct traffic around the construction site.

- Temporary parking facilities would be provided where possible for businesses that lose parking and access during construction.

- Onsite construction crew parking would be provided wherever possible.

- Excavation material, fill, aggregate, and other bulky items could be transported by barge or rail where feasible.

- Construction of a temporary concrete batch plant at a treatment plant site to avoid concrete truck trips could be possible.

- Truck traffic could be reduced during construction through stockpiling excavated earth onsite for use as backfill.

Unavoidable Adverse Impacts

Construction activities would unavoidably require short-term increases in truck traffic along major arterials, highways, and other primary roads in the vicinity of construction sites. Treatment plant construction could affect traffic for up to 5 years, with the highest concentrations occurring in the beginning phases.

Public Services, Utilities, and Energy

Impacts Common to All Facilities and Service Strategies

In general, construction of wastewater facilities would create minimal demand on fire, emergency, and police services. During construction of some conveyances within public rights-of-way, police services may be required to provide traffic control. However, the overall impact on demand for police services is expected to be insignificant.

Construction of wastewater facilities may require relocation of existing utilities. This is most likely to be the case with conveyances, which are often placed within rights-of-way where other utilities are likely to be located. Utility relocations could require temporary

disruptions of service of several hours to several days. In general, however, conveyance lines would be located to avoid existing utilities.

Construction of treatment facilities, pump stations, and pipelines would involve short-term increases in energy consumption. During construction, fossil fuels (e.g. diesel fuel, gasoline, natural gas) would be used to operate construction equipment and vehicles hauling materials to and from construction sites. Electrical energy may be used to operate construction equipment such as generators and dewatering pumps.

Mitigation Measures

No specific measures to mitigate construction impacts to public services appear to be necessary. Any utility likely to be affected by construction activity would be contacted, as required, prior to work commencing. All equipment used during construction would meet applicable energy-efficiency standards.

Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to public services, utilities, or energy are anticipated.