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**PROPOSED ROUTINE
MONITORING PLAN FOR THE
RECEIVING ENVIRONMENT IN
THE VICINITY OF THE
BRIGHTWATER TREATMENT
SYSTEM MARINE OUTFALL**

**FINAL
ENVIRONMENTAL
IMPACT STATEMENT**

**Brightwater
Regional Wastewater
Treatment System**

APPENDICES

Final

Appendix 3-I
Proposed Routine Monitoring Plan for
the Receiving Environment in the
Vicinity of the Brightwater Treatment
System Marine Outfall

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1.0 INTRODUCTION

King County has prepared a Draft Environmental Impact Statement (Draft EIS) and Final Environmental Impact Statement (Final EIS) on the Brightwater Regional Wastewater Treatment System. The Final EIS is intended to provide decision-makers, regulatory agencies and the public with information regarding the probable significant adverse impacts of the Brightwater proposal and identify alternatives and reasonable mitigation measures.

King County Executive Ron Sims has identified a preferred alternative, which is outlined in the Final EIS. This preferred alternative is for public information only, and is not intended in any way to prejudge the County's final decision, which will be made following the issuance of the Final EIS with accompanying technical appendices, comments on the Draft EIS and responses from King County, and additional supporting information. After issuance of the Final EIS, the King County Executive will select final locations for a treatment plant, marine outfall and associated conveyances.

The County Executive authorized the preparation of a set of Technical Reports, in support of the Final EIS. These reports represent a substantial volume of additional investigation on the identified Brightwater alternatives, as appropriate, to identify probable significant adverse environmental impacts as required by the State Environmental Policy Act (SEPA). The collection of pertinent information and evaluation of impacts and mitigation measures on the Brightwater proposal is an ongoing process. The Final EIS incorporates this updated information and additional analysis of the probable significant adverse environmental impacts of the Brightwater alternatives, along with identification of reasonable mitigation measures. Additional evaluation will continue as part of meeting federal, state and local permitting requirements.

Thus, the readers of this Technical Report should take into account the preliminary nature of the data contained herein, as well as the fact that new information relating to Brightwater may become available as the permit process gets underway. It is released at this time as part of King County's commitment to share information with the public as it is being developed.

This technical memorandum presents a proposed plan for routine monitoring of the receiving environment in the vicinity of the Brightwater Treatment System marine outfall. The following narrative presents the types of monitoring that could be conducted, the various receiving environments that would be sampled, the types of analyses that would be performed, and how monitoring data would be evaluated and reported.

2.0 EXISTING KING COUNTY MARINE MONITORING PROGRAM

The King County Department of Natural Resources and Parks and its predecessor METRO (Municipality of Metropolitan Seattle) have a long history of water quality improvements in the Puget Sound region. The County's Wastewater Treatment Division provides regional sewage collection, treatment, and disposal systems that discharge treated wastewater to the Central Basin of Puget Sound. King County supports a comprehensive, long-term, marine monitoring program that assesses water quality in the Central Basin and associated waterways. The marine monitoring program is also part of a larger, intergovernmental monitoring effort, the Puget Sound Ambient Monitoring Program. The main objective of the County's marine monitoring program is to provide an understanding of Puget Sound water quality and to monitor changes in water quality over time.

King County routinely monitors the marine environment of Puget Sound to confirm that discharges from its wastewater treatment plants and other systems are not degrading water or sediment quality within the vicinity of the outfalls. The marine monitoring program includes two components: outfall monitoring, which focuses on water, sediment, and biota in the immediate vicinity of outfalls; and ambient monitoring, which focuses on areas outside the influence of discharges. Ambient monitoring is necessary to evaluate background conditions in Puget Sound, to which monitoring data from outfall locations can be compared. King County's goals for ambient monitoring are to better understand regional water quality problems, establish priorities for preventative actions, and provide data needed to identify trends that may indicate impacts from long-term, cumulative pollution.

The County's National Pollutant Discharge Elimination System (NPDES) permits for its wastewater treatment plant outfalls require the periodic collection of subtidal marine sediment samples for chemical analysis. The permits state, in part, that "Sediment monitoring shall be conducted to characterize the nature and extent of chemical contamination and biological toxicity in the vicinity of the discharge." The permits do not specify a timeline but require that sediment monitoring be conducted once during each five-year permit cycle. The County, however, has routinely monitored sediments around its outfalls on a more-frequent basis since the early 1990s.

In addition to the sediment monitoring required under its NPDES permits, King County also conducts additional, voluntary outfall monitoring of the benthic community around its outfall diffusers, the water column above its outfall diffusers, and intertidal water, sediment, and biota in the vicinity of its outfalls. The ambient program monitors these same environmental constituents in areas outside the influence of the County's and other outfalls or discharges. The NPDES, voluntary outfall, and ambient monitoring programs receive annual internal review and are periodically updated to incorporate the latest sampling and analytical technologies and any new requirements of the NPDES program, as

well as to consider and potentially incorporate suggestions and recommendations from the Washington State Departments of Ecology, Fish and Wildlife, and Health.

When the Brightwater Treatment System begins operation, King County proposes to add the area in the immediate vicinity of the outfall to its routine marine monitoring program. This technical memorandum describes the types of monitoring that would be performed, with the types of samples collected and analyses conducted. Specific details about various components of the monitoring plan would be made available in project-specific sampling and analysis plans prior to the time monitoring commences. All monitoring would be designed and conducted following regionally-accepted methodologies recommended in various Puget Sound Estuary Program (PSEP) and Washington State Department of Ecology (Ecology) documents (PSEP 1986a, b, 1987, 1991, 1997a, b, c, d, 1998; Ecology 1995, 2003).

3.0 MONITORING THE OFFSHORE WATER COLUMN AT THE OUTFALL DIFFUSER

Monitoring the offshore marine water column at both outfall and ambient locations is an integral component of King County's marine monitoring program. The offshore water column monitoring program is designed to detect natural seasonal changes in various water column constituents as well as identify changes or impacts from anthropogenic inputs. King County proposes to collect water column samples at the Brightwater outfall in a manner and frequency that is comparable to monitoring performed at other King County outfalls.

King County proposes to collect monthly water column samples at the location of the Brightwater outfall diffuser. Typically, water column samples at King County outfalls are collected from seven depths; 1, 15, 25, 35, 55, and 100 meters and a seventh, deepest depth, which, in the case of the Brightwater outfall, would be a few meters above the diffuser and be determined when the final diffuser location has been selected. These seven water column samples would be analyzed for bacteria (fecal coliforms and enterococci), nutrients (ammonia, nitrate/nitrite, phosphorus, and silica), and total suspended solids. Chlorophyll-a and phaeophytin, two pigments present in phytoplankton, would also be analyzed in the samples collected from 1, 15, 25 and 35 meters, which represents the photic zone, that portion of the water column in which phytoplankton growth occurs.

Fecal coliforms and enterococci are considered indicator bacteria and are usually not pathogenic, however, they may occur along with disease-causing bacteria and their presence indicates the potential for pathogens to be present. These indicator bacteria are monitored because they are easier and safer to test in the laboratory.

A continuous water quality profile would also be collected throughout the entire water column, concurrent with the collection of the seven water samples. The water quality profile would be collected with a CTD, an electronic instrument that measures conductivity, temperature, and depth, as well as dissolved oxygen, turbidity, and light intensity. The conductivity, temperature, and depth measurements are also used to calculate salinity and density.

Water column monitoring data from the Brightwater outfall diffuser site would be compared, both spatially and temporally, to water column monitoring sites at other King County outfall locations as well as King County ambient monitoring sites and regional Puget Sound water quality data. Water column data for certain water quality parameters such as temperature, dissolved oxygen, turbidity, ammonia, and indicator bacteria would be compared to Ecology water quality standards for Class AA marine water (Ecology 1997). Data would be evaluated to assess natural seasonal changes in the water column as well as monitor any changes to the water column that might be imparted from wastewater discharges.

4.0 MONITORING SUBTIDAL SEDIMENT CHEMISTRY AT THE OUTFALL DIFFUSER

Sediment monitoring is an important part of King County's outfall monitoring program because many metals and organic chemicals are associated with particulates that settle onto seafloor sediments. At sufficient concentrations, these chemicals may be detrimental to benthic organisms and some may potentially bioaccumulate through the food chain. Ecology promulgated the Sediment Management Standards (SMS) in 1991 as Chapter 173-204 WAC (Ecology 1995, updated). The purpose of the SMS is to reduce and ultimately eliminate adverse effects on biological resources and any significant human health risk from surface sediments.

Three sets of criteria were developed for marine sediment under the SMS: sediment quality standards; sediment cleanup standards; and source control standards. The "no adverse effects level" is the designated Sediment Quality Standard (SQS), the most protective standard for all marine sediments in the state. The SQS corresponds to a sediment quality that will result in no adverse biological effects in the environment (acute or chronic effects to biological resources) and no significant human health risk. To date, no chemical criteria values have been adopted for human health protection, however, 47 chemicals have numeric criteria set to protect against biological harm to the marine environment (Chapter 173-204-320 WAC, Table I). The SMS criteria for marine sediment were developed primarily to protect benthic invertebrates with the assumption that such criteria would also protect fish and other marine animals from exposure.

Sediment monitoring at the outfall will be a likely component of the NPDES permit for the Brightwater Treatment System. King County proposes to collect subtidal sediment samples at the Brightwater outfall in a manner and frequency that is comparable to monitoring performed at other King County outfalls.

King County would monitor sediment quality at the Brightwater outfall by collecting subtidal sediment samples for chemical analysis from multiple stations in the vicinity of the outfall diffuser. The exact number of subtidal sediment monitoring stations would be determined once the final location of the diffuser has been selected and would be based, in part, on the final diffuser configuration and prevailing currents in the vicinity of the outfall. Sediment chemistry samples would be collected once every two to five years, concurrently with samples collected for benthic community analysis (see Section 4). The sediment monitoring program would be designed and performed following Ecology guidelines (Ecology 1995, 2003).

Sediment samples would be analyzed for ammonia, sulfides, organic carbon, oil and grease, metals, semivolatile organic chemicals (polynuclear aromatic

hydrocarbons (PAHs), phthalates, chlorobenzenes, and others), chlorinated pesticides, and polychlorinated biphenyls (PCBs). Sediment quality would be evaluated by comparing sediment chemical concentrations to published sediment quality criteria (Ecology 1995; Army Corps of Engineers [ACOE] 2000) as well as Puget Sound regional values for those chemicals for which published criteria do not exist. Sediment chemical concentrations in the vicinity of the Brightwater outfall would be compared to baseline concentrations found in samples collected prior to construction and operation of the outfall. Sediment quality at the Brightwater outfall would also be compared to sediment quality at other King County outfall locations as well as regional Puget Sound sediment quality.

5.0 MONITORING THE SUBTIDAL BENTHIC COMMUNITY AT THE OUTFALL DIFFUSER

The health of marine benthic communities is another useful indicator of sediment quality. Benthic organisms spend the majority of their lives in direct contact with sediment and can be exposed to potentially harmful metals and organic chemicals that may be present in their environment. Exposure routes might include ingesting contaminated sediment or prey and absorption from overlying water or sediment pore water. Potentially harmful metals and organic chemicals may also be passed up the food chain since benthic organisms are, themselves, prey for fish and other marine animals.

The health of the benthic community may be assessed in several ways. Abundance, which is the total number of organisms present in an area, can be measured along with species richness, which is the total number of different species present in an area. These two measurements provide a tool for assessing the gross population of organisms as an indicator of a healthy benthic community. Species diversity is another indicator of the state of the benthic community and can be measured by calculating a variety of well-established diversity indices from the benthic community data, such as the Shannon-Wiener diversity index or the Pielou's evenness index.

King County proposes to collect benthic community samples at the Brightwater outfall in a manner and frequency that is comparable to monitoring performed at other King County outfalls. King County would collect sediment samples in the immediate vicinity of the outfall diffuser and from a distant "reference" station for benthic community analysis. The benthic community samples would be collected once every two to five years in conjunction with and from the same stations as sediment samples collected for chemical analysis (Section 3). Three replicate benthic community samples would be collected from each station in order to assess environmental variability within the sampling area.

The benthic community data would be used to calculate abundance and richness values along with species diversity indices. The data would also be used to evaluate whether a disproportionate number of pollution-tolerant organisms is present in the sampling area. Benthic community data from the outfall diffuser stations would be compared to evaluate whether abundance, richness, or species diversity gradients exist with respect to distance from the diffuser. Benthic community data from the outfall diffuser stations would also be compared to the reference station to evaluate whether significant differences in benthic community indices exist between impacted and unimpacted areas.

Benthic community results, coupled with sediment chemistry results, would provide the tools necessary to fully characterize sediment quality in the vicinity of the outfall diffuser.

6.0 MONITORING INTERTIDAL WATER IN THE OUTFALL VICINITY

Monitoring the potential impact of wastewater discharges to the intertidal environment at Puget Sound beaches is another important component of King County's marine monitoring program. The intertidal area is of critical importance because of the diversity of species inhabiting this ecological niche and the spawning and rearing functions this environment provides for several species of fish and invertebrates. Marine beaches also offer many recreational opportunities and can be highly used throughout the year.

One way to monitor the impact of wastewater discharges on the intertidal environment is to measure certain water quality parameters at marine beaches. Water quality at marine beaches throughout King County is monitored on a monthly basis. Two existing King County beach monitoring stations are located in the vicinity of both proposed Brightwater Treatment System marine outfall alternatives. King County would continue collecting monthly intertidal water samples from both of these beaches, located just south of Point Wells and at Edwards Point. These water samples would be analyzed for indicator bacteria (fecal coliforms and enterococci), salinity, and nutrients (ammonia, nitrate/nitrite, phosphorus, and silica).

Bacteria results from the two Brightwater beach monitoring stations would be compared to Ecology's water quality standard for Class AA waters (fecal coliforms) as well as the water quality standard for Washington State's BEACH monitoring program (enterococci). Ammonia results would be also compared to Ecology's water quality standard. Results for bacteria, ammonia, and the other nutrients from the Brightwater monitoring area would be compared with all other King County intertidal monitoring stations both spatially and temporally. Salinity results would be used to assess whether there is a fresh water source entering the intertidal area. Fresh water, both from natural streams and storm water runoff, can be a source of bacteria and nutrients to the intertidal environment.

7.0 MONITORING INTERTIDAL SEDIMENT IN THE OUTFALL VICINITY

The potential impact of wastewater discharges on the intertidal environment can also be monitored by measuring concentrations of metals and organic chemicals in intertidal sediments. King County monitors intertidal sediment quality at several Puget Sound beaches, both in the vicinity of its outfalls and at ambient locations. Two existing King County beach monitoring stations are located in the vicinity of both proposed Brightwater Treatment System marine outfall alternatives. King County would continue collecting intertidal sediment samples from both of these beaches, located just south of Point Wells and at Edwards Point. These sediment samples would be analyzed for metals, semivolatile organic chemicals (PAHs, chlorobenzenes, phthalates, and others), chlorinated pesticides, and PCBs. The intertidal sediment sampling program is currently conducted on an annual basis each August. Data collected from this program is currently undergoing long-term trend analysis to reevaluate the frequency with which this sampling will be performed.

Sediment chemistry results from the Brightwater intertidal monitoring stations would be compared to Washington State sediment management standards to assess sediment quality at the two beaches. Data from the Brightwater intertidal monitoring stations would also be compared interannually to establish long-term trends in concentrations of metals and organic chemicals in intertidal sediments. These sediment data would also be compared to data from other King County intertidal sediment monitoring stations, both in the vicinity of King County outfalls and at ambient locations.

8.0 MONITORING SHELLFISH AND ALGAE IN THE OUTFALL VICINITY

Finally, the potential impact of wastewater discharges on the intertidal environment can be monitored by measuring concentrations of bacteria, metals, and organic chemicals in shellfish tissue, particularly bivalves (clams, mussels, etc). Bivalves accumulate bacteria that can be introduced from both natural and anthropogenic sources and they can also be used as an indicator of spatially and temporally averaged concentrations of bioavailable chemicals. King County monitors bacterial and chemical concentrations in butter clams from several Puget Sound beaches, two of which are located in the vicinity of both proposed Brightwater Treatment System marine outfall alternatives. Butter clams are a useful biomonitor because they are ubiquitous, easily collectible, and represent an important recreational resource in the Puget Sound region. Algae are also a useful biomonitor for metals concentrations in marine water since many of these aquatic plants readily uptake and concentrate metals from their surrounding environment.

King County would continue collecting butter clams (*Saxidomus giganteus*) each year from both of these beaches, located just south of Point Wells and at Edwards Point. Clams would be collected once a month in May, June, July, August, and September for bacterial analysis (fecal coliforms and enterococci). Additional clams would be collected each August for analysis of metals and organic chemicals (PAHs, phthalates, chlorobenzenes, chlorinated pesticides, PCBs, and others). Algae (*Ulva fenestrata*) would also be collected annually in August, concurrently with butter clams, for analysis of trace metals.

Shellfish tissue bacteria results from the Brightwater intertidal monitoring stations would be compared to other intertidal monitoring stations, both in the vicinity of King County outfalls and at ambient locations. Bacteria data would also be evaluated over the course of each annual monitoring period as well as interannually to assess both short- and long-term temporal trends in concentrations of these indicators. Shellfish tissue and algae chemistry results from the Brightwater intertidal monitoring stations would be compared to other King County monitoring stations. Chemistry data from the Brightwater stations would also be compared interannually to establish long-term trends in concentrations of metals and organic chemicals in shellfish tissue and metals in algae. Shellfish tissue concentrations of certain metals (arsenic, cadmium, chromium, lead, mercury, and nickel) would also be evaluated against Food and Drug Administration (FDA) guidelines (FDA 1993a, b, c, d, e, 1995).

9.0 REPORTING THE MONITORING RESULTS

All monitoring results would be published annually in King County's Water Quality Status Report for Marine Waters. This report provides an assessment of the health of Puget Sound's marine environment within King County, both in the vicinity of King County's wastewater outfalls and in ambient waters. The report is available to the public both in hard copy and compact disk formats. All monitoring data would also be available on King County's Marine Waters website, located at <http://dnr.metrokc.gov/wlr/waterres/marine/>.

Subtidal sediment chemistry and benthic community data collected around the Brightwater outfall diffuser would also be published in a separate King County report. This report would summarize monitoring activities including sample collection and analytical methodologies and would present the data along with an assessment of sediment quality in the vicinity of the Brightwater marine outfall. The sediment quality report would also be available to the public both in hard copy and compact disk formats.

The Brightwater outfall sediment data would also be submitted to Ecology for inclusion in their SEDQUAL database. SEDQUAL is a statewide database of sediment data collected throughout Puget Sound and other marine areas in Washington. SEDQUAL contains many useful analytical tools for assessing sediment quality and comparing information between different monitoring areas.

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