EXECUTIVE SUMMARY

Task 4 of the King County Combined Sewer Overflow (CSO) Control Plan 5-Year Update (Update) was established to generate preliminary alternatives to control CSOs for each King County overflow. Specific alternatives have been developed to a preliminary level that includes descriptions and capital cost estimates. This report presents the alternatives developed to achieve the once-per-year CSO control level in compliance with the State of Washington Department of Ecology regulations (WAC 173-245-020). These CSO control alternatives were the basis for developing system-wide alternatives (Task 5 report), and the service strategies in the Regional Wastewater Services Plan (RWSP). This report provides a table cross-referencing the CSO control alternatives presented herein with the CSO control components of the RWSP.

The discussion of CSO control alternatives is organized by drainage basins in the King County combined sewer collection and conveyance system. Development of alternatives included identification of potential control alternatives and sites, sizing of the control features, and development of planning level capital costs. Cost estimating was completed using a component cost method wherein the construction cost of various facilities were estimated from a planning level take-off of quantities combined with construction costs for similar items taken from recent construction contracts. Sizing and performance were estimated based on the results of King County's hydraulic model.

ALTERNATIVES DEVELOPMENT

CSO control alternatives were conceptually developed based on the results of King County's hydraulic model. Some of these alternatives were tested with the model to determine effectiveness and to refine sizing. This approach has been used for most of the alternatives presented in this report. In some cases, notably storage alternatives, the overflow volumes predicted by the model in the unaltered system have been used to size facilities. In the case of CSO treatment facilities, the analysis was conducted using basin hydrographs supplied by King County and the city of Seattle (Denny Way) or using the peak overflow rate predicted from a once per year storm event.

Current Ecology requirements for CSO control [WAC 173-245-020(22)] call for the reduction of untreated discharge events to a frequency of once per year on average at every CSO location. Control may be achieved by flow reduction (e.g., stormwater separation), storage to hold overflow volumes and bleed them back into the system for delivery to the West Point treatment plant as capacity becomes available after storms, or by providing the equivalent of primary treatment at the CSO locations (onsite treatment). Based on work completed during the 1988 CSO Control Plan development, control of overflows predicted by the hydraulic model for the specific storm known as Design Storm #6 would result in a long-term average of one untreated discharge per year. Accordingly, alternatives were formulated to control the overflows from this storm – either by storage or a combination of storage and partial separation of the overflow volume predicted from this storm, or by the equivalent of primary treatment with sizing criteria based on the peak rate of overflow from this storm. Specific criteria and considerations associated with treatment alternatives are discussed in this report. The treatment alternatives include some storage associated with the treatment tanks; this volume would be returned to West Point following storms and thereby reduces the annual overflow volume by about 30 percent.

During the CSO planning work, the U.S. EPA issued the federal CSO policy that requires control to four to six untreated overflows per year rather than the once per year level specified by

Ecology. This report includes the volumes and peak overflow rates for Storm #5 (four per year event) as well as Storm #6 (once per year event). Estimates of the size and cost reductions available by controlling to the federal standard can be made using these data based on the method described in this report.

BASIS OF SIZING AND COST ESTIMATING

Capital costs for those alternatives developed were performed in a manner consistent with King County's specifications. The method used for estimating costs provides planning level cost estimates for specific CSO control technologies such as separation, offline storage, treatment, and other associated elements (e.g., pump stations and force mains). This method, known as "component cost estimating," computes costs for specific CSO control facilities, based on costs for general components as opposed to specific construction items. The component cost estimating method is consistent with the other cost estimating methods used in preparing the RWSP. This method was selected for the following reasons: 1) it is more detailed than a method that uses only typical cost curves for specific CSO control facilities although not as detailed as a predesign cost estimating method, which is based on detailed material takeoffs; 2) it is capable of providing a planning level cost estimate with a minimum number of input parameters into the cost estimating spreadsheets; 3) it is capable of providing a planning level cost estimate for a specific CSO control system over a range of sizes and/or volumes; and 4) it provides consistent and professionally accepted cost estimates.

Sources of unit prices used in the method included the manufacturers of specific items, the Seattle Engineering Quarterly Unit Cost Report for 1992, construction cost bid tabulations for projects that were similar to the specific CSO control technology, and the Means Construction Cost Data document. All unit prices were adjusted to an ENR factor of 5630.

Other assumed allied costs used for the cost estimating included the addition of 10 percent for mobilization/demobilization and 10 percent for contractor's overhead and profit, 30 percent for contingency, 8.2 percent for sales tax on all items, and 35 percent for design and owner management. Property acquisition costs were based on $18.00 per square foot for central business property, $11.50 per square foot for suburban business property, and $6.90 for residential property. The sum of the estimated construction cost, allied costs, and property acquisition costs is termed the "Project Cost."

The estimated costs for partial separation alternatives presented in this document were derived from detailed cost estimates developed for the Ballard No. 3 basin and for basins tributary to the Denny Regulator (including both Denny Local and Denny-Lake Union). In these detailed estimates, storm sewers were laid out according to current city of Seattle standards. Costs for installation of these sewers were then developed in detail based on experience from the recent pre-designs conducted for the Michigan, Brandon, and Connecticut regulator project areas. Costs developed vary by street type (concrete or asphalt) and by land use (residential or commercial/industrial), and include necessary appurtenances such as manholes and catchbasins. Sewers were sized for runoff from the entire area, but it is assumed that only street runoff and large easily separated parking lots are intercepted. A separate estimate was made for stormwater pollutant mitigation facilities, using compost filters as the representative technology.

The cost estimates for Ballard and Denny basins were used as the basis for projecting partial separation costs in other areas. The total project costs resulting from the detailed estimates were evaluated to determine project costs of separation per acre of residential and

commercial/industrial land use. These per acre costs were then applied to separation alternatives developed in other basins.

As is noted in a separate report (*Separation Alternative Ballard Regulator and No. 1 Weir: Basin No. 3 - 16th Avenue NW / 25th Avenue NW*) on the detailed separation studies, separation may result in a small decrease or an increase in annual loading of certain pollutants to the receiving waters. It is also known that stormwater sediments in the urban area do not meet Ecology sediment standards for marine waters. While it is not yet clear exactly what measures will be required to mitigate pollutant loading associated with separation, some measure of Best Management Practices (BMPs) will be required. To estimate the cost that could be associated with BMPs, this study used compost filters as a representative technology usable in the urban environment to pretreat stormwater. A discussion of the performance of compost filters is presented in the separation report.

An alternative BMP for storm drains is the use of low flow diversions. Such structures divert a small flow from the storm drains back to the combined sewer to capture the day-to-day small flows generated by moderate rain. The captured flows reduce the chronic loading of pollutants to the receiving waters. Low flow diversions have been a feature of city of Seattle partial separation projects constructed since the mid 1980s.

Unit-per-acre costs ranges used in alternative development outside the Ballard and Denny basins are significantly higher than used in previous studies due to differences in city of Seattle standards and cost estimating method. Current standards call for use of a 25-year storm for drainage design rather than a 10-year storm used in previous studies. In addition, Seattle requires replacement of the entire half panel of the street surface for installation of sewers in concrete covered streets and will not permit sewers to be installed in parking strips. The current estimates also include a significant item for utility interference that was not included in previous studies.

CSO CONTROL PROJECT IMPACTS

Both temporary and permanent impacts on the natural environment can result from project construction. Minor temporary impacts include sediment transport from construction sites. Treatment plant outfall construction has the more significant temporary impact of disturbing bottom-dwelling marine life and possibly disrupting anadromous fish passage-ways. Permanent environmental impacts may include, depending on the particular technology associated with each alternative, the handling of significant quantities of construction spoils, permanent rerouting of surface water drainage ways, and, for the separation alternatives, the possibility of increasing the loadings of some metals and organic contaminants into receiving waters.

Impacts on the social environment may include temporary construction-related disturbances and more permanent disruptions. Construction-related impacts include traffic detours and restrictions and limitations in access to residences, businesses, schools, and recreational areas. Permanent impacts include noise, odor, and the possible unappealing aesthetics of above-ground structures. Related to the effects of each alternative project on the social environment is the issue of fairness and equity. The social impacts of each project will be directly related to the perceptions of the residents concerning the impacts their neighborhoods have already shouldered for industrial and municipal facilities. This issue will assume less importance in industrial areas than in residential neighborhoods.

Direct impacts to public health and safety from any of the CSO projects are limited; however, the traffic congestion resulting from construction can be seen as posing some risk to public safety.

Also, the potentially hazardous treatment chemicals that may be used in particular odor control and CSO treatment plants, may present a slight risk to health and safety in the event that routine safety handling procedures are disrupted.

In general, potentially negative impacts to the natural and social environment, and public health and safety need to be weighed against the benefit of all alternatives of reducing CSO discharges to once per year. This reduction will be beneficial to marine and freshwater biological systems, enhance the recreational value of the affected waterways, and reduce the potential for negative impacts to human health.

The impacts of the alternative CSO control projects are generally similar for projects involving similar facility components. The various impacts associated with storage tanks, treatment plants, and separated storm drains are shown on Table 4-4. Impacts peculiar to particular projects are addressed in the sections describing the individual alternatives.

OTHER ISSUES

A number of other issues associated with the planning efforts for system-wide CSO control are discussed in this report. A summary of these issues is listed below:

- Ongoing costs associated with sewer separation projects
- Impact of garbage grinders on CSO projects
- Roof drain disconnections
- Modifications in street cleaning practices
- West Point bypass as a CSO discharge location
- West Point secondary clarifiers used for CSO treatment
- Seasonal discharge to the Duwamish River
- New technologies (vortex separators, Microsep or Actiflo, fine screens, direct filtration, dissolved air floatation).