KING COUNTY

1200 King County Courthouse
516 Third Avenue
Seattle, WA 98104

Signature Report

March 4, 2014

Motion 14086

Proposed No. 2013-0477.1 **Sponsors** Phillips

A MOTION acknowledging receipt of a report on combined sewer overflow control project sequencing in accordance with the 2013 Budget Ordinance, Ordinance 17476, Section 132, wastewater treatment capital improvement, Proviso P1; and authorizing the release of $500,000 for the combined sewer overflow comprehensive planning and reporting program.

WHEREAS, the 2013 Budget Ordinance, Ordinance 17476, Section 132, Proviso P1, states that $500,000 of the appropriation for capital improvement plan ("CIP") project 113334, combined sewer overflow ("CSO") comprehensive planning, shall not be expended or encumbered until the executive transmits by September 1, 2013, a report on CSO control project sequencing and a motion that acknowledges receipt of the report, and

WHEREAS, in accordance with the proviso, the executive obtained review by council staff and the county auditor of the scope of work in February 2013 and the draft report in October 2013, and

WHEREAS, in accordance with the proviso, the report documents an analysis of an alternative sequencing option for completing King County's long-term CSO control plan that was approved by the county council in 2012 through Ordinance 17413;

NOW, THEREFORE, BE IT MOVED by the Council of King County:

The report on combined sewer overflow control project sequencing, which is Attachment A to this motion, is hereby acknowledged and the $500,000 currently held in reserve through Ordinance 17476, Section 132, Proviso P1, is hereby released.

Motion 14086 was introduced on 11/12/2013 and passed by the Metropolitan King County Council on 3/3/2014, by the following vote:

Yes: 8 - Mr. Phillips, Mr. von Reichbauer, Mr. Gossett, Ms. Lambert, Mr. Dunn, Mr. McDermott, Mr. Dembowski and Mr. Upthegrove
No: 0
Excused: 1 - Ms. Hague

KING COUNTY COUNCIL
KING COUNTY, WASHINGTON

Larry Phillips, Chair

ATTEST:

Anne Noris, Clerk of the Council

Attachments: A. Proviso Report-Combined Sewer Overflow Control Project-Response to 2013 Budget Ordinance

Proviso Report on Combined Sewer Overflow Control Project Sequencing

Response to 2013 Budget Ordinance 17476, Section 132, Proviso P1

October 22, 2013

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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This information is available in alternative formats on request at 206-477-5371 (voice) or 711 (TTY).

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Executive Summary

Section 132, Proviso P1 of 2013 Budget Ordinance 17476 requires that the Wastewater Treatment Division (WTD) in the Department of Natural Resources and Parks provide additional financial and cost-effectiveness analyses, as outlined in the King County Auditor's Office 2012 Performance Audit of Combined Sewer Overflow Program. Through the proviso, the King County Council sought information onthe effects of accelerating one or more of the projects in the adopted 2012 long-term combined sewer overflow (CSO) control plan in an effort to initiate more projects while borrowing costs and interest rates are at historic lows.

The 2012 CSO control plan includes nine projects that when completed, will bring all County CSOs under control to Washington State standards. While completion of each project will benefit waters of the region, developers of the plan needed to identify which projects to implement first. The process to weigh the relative merits of various project sequences reflected policy direction in the King County Code, guidance from the U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology), and input from stakeholders. The project sequence in the plan is an important component of the consent decree that was filed in the U.S. District Court in July 2013. Two of the projects are already under way.

The proviso analyses compared this CSO control project sequence to an alternative project sequencing optionin which the Hanford #2-Lander St-King St-Kingdome (HLKK) CSO treatment plant project starts seven years sooner. The HLKK project illustrates the maximum impact from accelerating a single project because it is the most complex and costly of the seven future CSO projects and has the largest CSO volume. The analyses assumed that schedules for all other CSO control projects and WTD Capital Improvement Program projects would not change to accommodate the acceleration. The purpose of the analyses was to look at the effects of implementing *more* projects while interest rates are low, and the consent decree does not allow for delays in CSO control project schedules. Also, delaying other WTD projects could lead to unacceptable consequences such as sanitary sewer overflows.

The analyses found that disadvantages outweigh advantages of the alternative sequencing option. From a financial standpoint, accelerating the HLKK project would increase project lifecycle costs by as much as $0.8 million per year during the life of the facility. In terms of pollutant loading, the HLKK project would control the largest CSO volume. However, comparing the reduction for three major pollutants after project completion for all CSO projects demonstrates the pollutant reduction value is lower for HLKK than the other CSO projects. Moreover, WTD's other CSO projects are located in areas with a higher risk of human contact and environmental impact. To arrive at this conclusion, WTD analyzed the effects of pollutants in CSOs by comparing the public health and environmental sensitivities of receiving waters to determine the best water quality benefit for each discharge area as early as possible. The optimal project sequence based on receiving water sensitivities is similar to the 2012 CSO control plan sequence approved by the County Council.

Additional highlights resulting from the analyses are as follows:

- With respect to the sewer rate, the monthly rate could increase by as much as $3.00 during construction of the accelerated project.

- The estimated number of WTD capital program staff hours needed to complete the HLKK project is the same regardless of when the project is implemented. However, WTD would have to hire additional personnel if the project is accelerated because the existing staff is fully allocated to projects that are part of WTD's current approved capital improvement plan.

- The inflation-adjusted capital costs of the project do not change with acceleration of the HLKK project; however,when you add the opportunity cost of expending these funds sooner to the higher lifecycle costs for an HLKK project that comes on line earlier, acceleration does not result in a cost savings notwithstanding current low interest rates.

- Scopes and schedules for other planned projects near the HLKK siting area are yet to be determined; therefore, any potential financial, regulatory, and other issues or benefits of coordinating the accelerated HLKK project with nearby projects could not be assessed. However, it should be noted that depending on the timing of these projects, one potential benefit of acceleration is that the County may be able to purchase or lease staging areas for HLKK construction that were used previously for the other projects.

- Planning has already begun on the Brandon St-S Michigan CSO treatment plant project to meet the schedule in the federal consent decree. The CSO control plan schedule calls for early implementation of this project because of its importance in reducing pollutant discharge into a designated Superfund area. It will begin operating in 2022. This facility will use the same treatment technology as the HLKK project, and it is best to schedule the HLKK project after the Brandon St-S Michigan project to get the benefit of lessons learned from its design and construction.

Results of the Water Quality Assessment-Monitoring Study that was authorized through Ordinance 17413 will provide additional information that may lead to consideration of changes in the sequence of future CSO control projects. The results of the study will be incorporated into the next CSO control program review and CSO control plan amendment, scheduled to be submitted to the King County Council in 2017.[1] The study will also inform decisions on whether to develop an integrated plan under the EPA framework. Such a plan would sequence and

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[1]The County issues two documents in approximately five-year intervals for comprehensivereview of the CSO Control Program successes, updates, and future projects. These twodocuments are CSO Control Program reviews and plan updates or amendments. Reviews are tosupport county decision-making and are submitted by the King County Executive to the KingCounty Council for input. Plan updates describe progress in the CSO Control Program over thepast five years and commit to the projects for CSO control for the next National Pollutant Discharge Elimination System(NPDES) permit phase.Amendments modify the plan with any adopted changes. Plan updates or amendments are submitted as part of the renewal to the NPDES permit for the West Point Treatment Plant.

integrate CSO control projects with other water quality improvement projects in the discharge areas to achieve the greatest water quality improvement as early and cost-effectively as possible.

1.0 INTRODUCTION

This report responds toProviso P1 in Section 132 of 2013 Budget Ordinance 17476. It documents an analysis of an alternative sequencing option for completing the County's long-term CSO control plan that was approved by the King County Councilin 2012 through Ordinance 17413.[1] This chapter provides background on the proviso, presents the reasons for selecting the alternative project sequencing option, and describes the content and organization of the remainder of the report.

1.1 Proviso Background

Ordinance 17476 includes a proviso requiring the King County Executive to transmit a report and a motion by to the King County Council, documenting an analysis of accelerating one or more CSO control projects while borrowing costs and interest rates are at historic lows. The proviso called for the analysis to include issues and benefits of coordination with other capital projects, necessary regulatory approvals, staffing requirements, additional financial and cost-effectiveness analyses, and a summary of the advantages and disadvantages of the adopted CSO control project sequencing compared to the alternative sequencing option.

The entire proviso is included in Exhibit A.

1.2 Alternative Project Sequencing Option

Acceleration of the HLKK CSO treatment plant project was selected as the alternative sequencing option for this analysis for the following reasons:

- Analyzing the acceleration of the HLKK project illustrates the maximum impact of accelerating any single CSO control project. HLKK is the largest and most costly of all the CSO control projects and has the largest CSO volume.

- The alternative sequencing option conforms to the recommendation in the King County Auditor's Office 2012 performance audit of the CSO control program.[2] The audit report recommended that WTD consider the cost-effectiveness of the program as a whole in removing pollution. The audit report indicated that HLKK is the most expensive CSO control project in terms of net present value and therefore could be the most cost-effective in terms of volume of discharge avoided.

- If the County were to accelerate HLKK and keep the schedule of the other CSO control projects, the County would continue to meet its regulatory commitments to control all County CSOs by 2030 and maintain consistencyunder the consent decree the County has entered into with EPA and Ecology.[3] The alternative sequencing option does not delay any projects, which would require a consent decree modification.

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[1] Information on the County's long-term CSO control plan is available at http://www.kingcounty.gov/environment/wastewater/CSO/ProgramReview/Plan.aspx.

[2] The performance audit report can be found at http://www.kingcounty.gov/operations/auditor.aspx.

[3] Information on the consent decree can be found at http://www.kingcounty.gov/environment/wastewater/CSO/ConsentDecree.aspx.

1.2.1 Description of the HLKK Project

The HLKK project will control the Hanford #2, Lander St, Kingdome, and King St CSOs to the Washington State standard of no more than one untreated CSO discharge per year on a 20-year average. These CSOs currently discharge to Elliott Bay and the East Duwamish Waterway.

As described in the Council-approved plan, the project will build a 151-million-gallon-per-day CSO treatment facility; associated conveyance, diversion, and bypass structures to divert combined sewage flows to the HLKK facility from the Elliott Bay Interceptor (EBI); and a new outfall structure. The flows that enter the HLKK facility will be treated through either a ballasted sedimentation or chemically enhanced primary treatment (CEPT) process. The four existing outfalls will remain in place to discharge the allowed one untreated CSO per year and any emergency flows.

It is assumed for this analysis that the facility will be located within the siting area shown in Figure 1-1and that the new outfall structure will be built in the East Duwamish Waterway. The project siting area was evaluated for its potential to accommodate green stormwater infrastructure (GSI) to reduce the volume of flows that must be treated at the HLKK facility.[4] It was found that the area is not cost effective for GSICSO reduction because there are insufficient large stormwater connections to change the peak flows that the HLKK project must control.Peak flows drive the size and cost of CSO treatment facilities.

1.2.2 Approved and Alternative CSO Project Sequences and Schedules

Figure 1-2shows the sequence and the schedules for completing the nine CSO control projects as approved by the King County Council in the 2012 CSO control plan amendment and the alternative sequencing option evaluated in this report. Under the alternative sequencing option, the HLKK project would start in 2014, seven years earlier than in the approved schedule. Schedules for all other CSO control projects remain unchanged to show the impact of initiating projects sooner.

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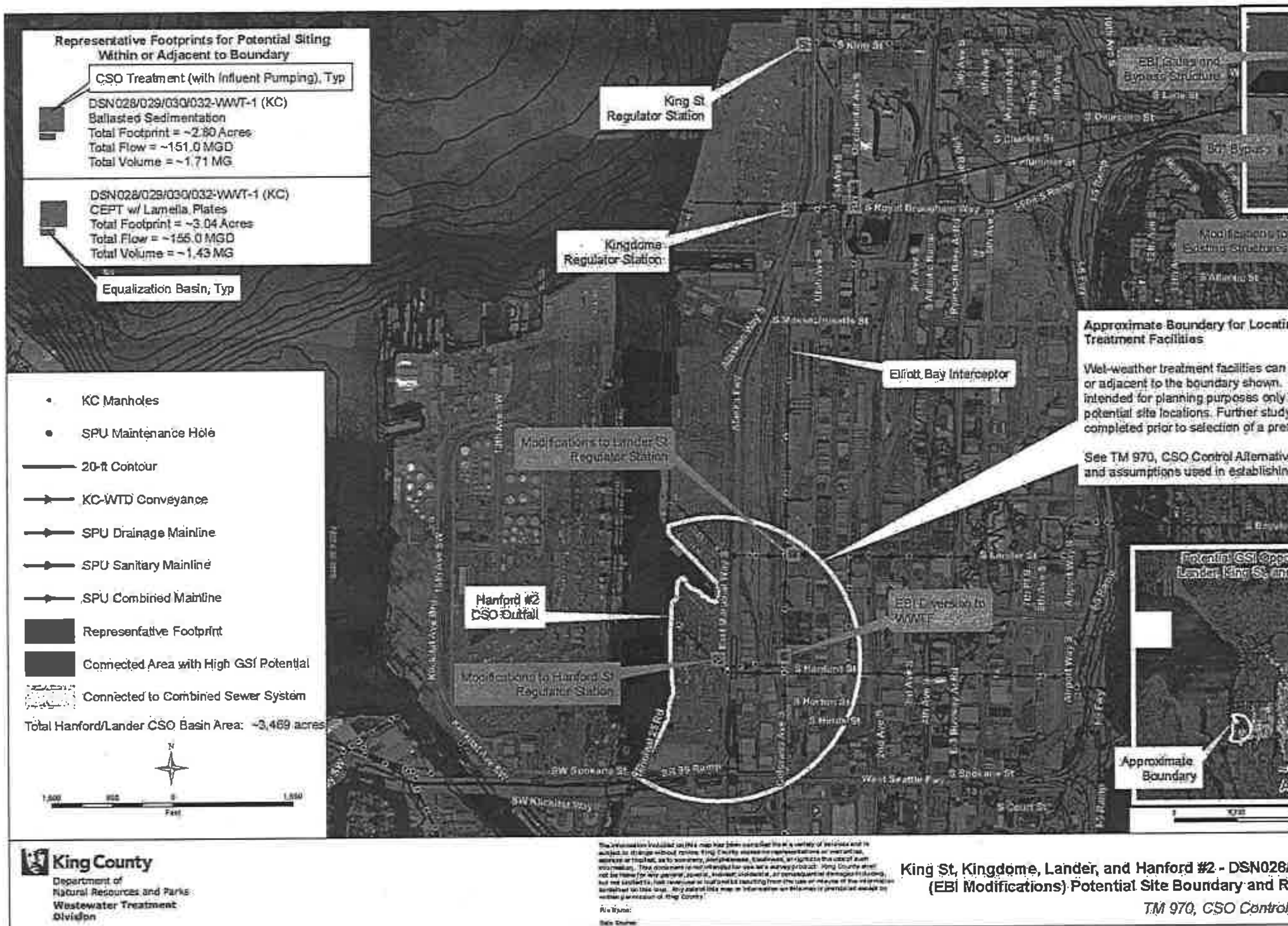
[4] Green stormwater infrastructure, such as rain gardens, mimics natural processes in order to infiltrate, evaporate, and/or reuse stormwater. For more information, see http://www.kingcounty.gov/environment/wastewater/CSO/Controlling/Reducing/GSI.aspx.



CEPT = chemically enhanced primary treatment.
GSI = green stormwater infrastructure.
EBI = Elliott Bay Interceptor.

Figure 1-1. Assumed Siting Area for the HLKK Treatment Facility

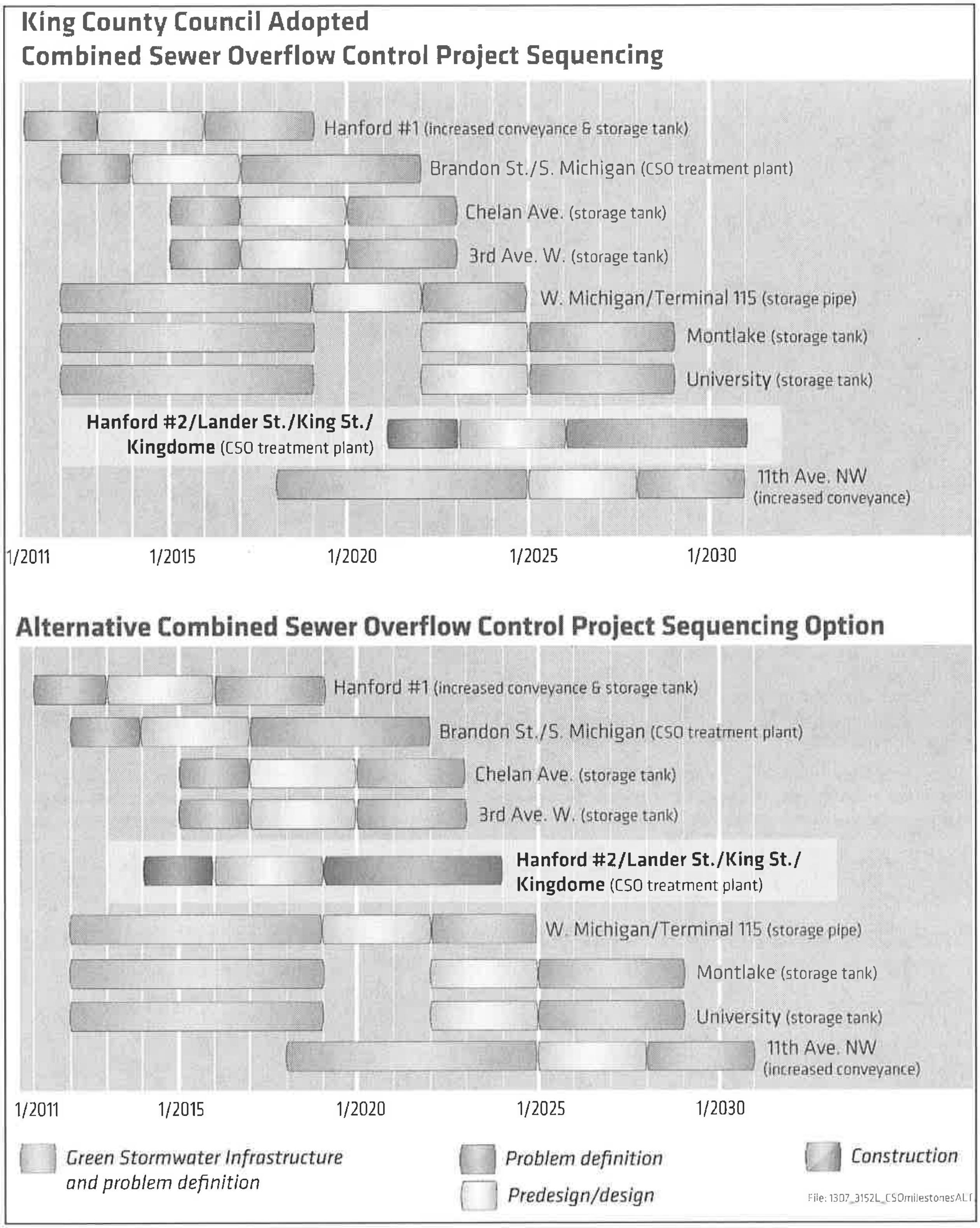


Figure 1-2. Approved and Alternative CSO Control Project Sequences and Schedules

1.3 Report Contents and Organization

The content and organization of the report are as follows:

- Chapter 2 addresses the issues and benefits of coordinating the alternative sequencing option with other projects.
- Chapter 3 summarizes the regulatory approvals necessary for the alternative sequencing option.
- Chapter 4 describes the effort to quantify the public and environmental health benefits of each CSO control project and the results of this quantification in terms of priorities for implementing the projects.
- Chapter 5 estimates the staffing requirements for completing and operating the accelerated project.
- Chapter 6 documents additional financial analyses and rate impacts.
- Chapter 7 summarizes the major findings of the analyses.

2.0 COORDINATING WITH OTHER PROJECTS

This chapter identifies issues and benefits of coordinating the accelerated HLKK project with other WTD projects and regional activities. The effort corresponds to the following requirement in the 2013 budget proviso:

> "In addition, the report should address issues and benefits of coordinating King County CSO projects with other wastewater treatment division projects and other activities, including but not limited to, the Duwamish waterway cleanup, Harbor Island cleanup, reconstruction of State Route 99 through downtown Seattle, bridge replacement of State Route 520 and implementation of Seattle CSO projects, and should quantify financial, regulatory or other issues associated with project coordination or lack thereof."

2.1 Methodology and Results

WTD reviewed the results of previous similar investigations of project coordination done for the 2012 CSO control program review; researched websites and other sources for potential projects near the HLKK project area; and obtained information from people involved in implementing such projects.[1] The following sections describe the results of this work.

2.1.1 East Duwamish Waterway Cleanup Projects

Construction of the HLKK new outfall structure in the East Duwamish Waterway will require in-water work, triggering the necessity for federal and state permits and coordination with the East Waterway Operable Unit of the Harbor Island Superfund cleanup. Preliminary estimates indicate that the remedial investigation/feasibility study (RI/FS) for the cleanup could be completed in 2014, a record of decision (ROD) issued in 2015–2016, cleanup negotiations conducted in 2016–2017, a cleanup plan designed in 2018–2019, and cleanup completed in 2021.

In addition to Superfund activities, a natural resource damage assessment (NRDA) is under way for the Lower Duwamish River. Natural resource trustees are authorized under Superfund and other statutes to evaluate potential injury to natural resources from releases of hazardous substances and, if warranted, to take actions that restore, replace, rehabilitate, and/or acquire the equivalent of the injured natural resources and their services. In the case of the Lower Duwamish River, numerous releases of hazardous substances have resulted in natural resource injuries.

The NRDA process is driven by individual settlements and projects, the timing and certainty of which are not yet known. However, the County will continue to look for opportunities to coordinate its CSO control efforts with NRDA projects.

2.1.2 City of Seattle CSO Control

The current timing of the HLKK project can potentially accommodate the City of Seattle's interest in exploring, in its CSO control planning process, the transmission of some stormwater flows to the HLKK facility for treatment.

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[1] Documentation associated with the 2012 CSO control program review can be found at http://www.kingcounty.gov/environment/wastewater/CSO/ProgramReview.aspx.

The County's long-term CSO control plan includes the potential for three joint King County-City of Seattle CSO control projects: the 3rd Ave W, University, and Montlake projects. These projects would not be affected by acceleration of the HLKK project.

King County is committed to continuing its coordination with the City of Seattle on opportunities to optimize CSO control projects. Opportunities for joint projects and other forms of coordination will be solidified after adoption of the city's CSO control plan, scheduled for 2014.

2.1.3 Other Projects

No planned WTD capital projects were found to have a similar location or construction schedule with the accelerated HLKK project. One benefit to maintaining the Council-approved HLKK schedule would be the experience gained from operating the County's new Brandon St-S Michigan St CSO treatment plant. Planning has begun on the project; it is scheduled to begin operating in 2022. This facility will be using the same treatment technology as the HLKK facility, and the current schedule for the HLKK project will allow WTD to get the benefit of lessons learned from the design and construction of Brandon St-S Michigan St. Also, it is best to construct a facility that controls a smaller volume and then applies those lessons learned to the larger facility which in this case is HLKK.

WTD staff identified four non-WTD projects that will be built near the HLKK siting area. These projects are described below; their general locations in relation to the HLKK siting area and associated regulator stations are shown in Figure 2-1.

- **Elliott Bay Seawall Project.** The City of Seattle Department of Transportation plans to replace the existing seawall and restore habitat along Elliott Bay between Broad Street and South Washington Street. The project will be completed in two phases. The first phase, to be constructed from September 2013 through early 2016, will replace the southern part of the seawall near the HLKK project area. Construction of the second phase is expected to begin in 2018.

- **Alaskan Way Viaduct Replacement Program.** The Washington State Department of Transportation is replacing the Alaskan Way Viaduct with a 2-mile-long tunnel to carry State Route 99 under downtown Seattle from theSoDo neighborhood to South Lake Union. Construction began in 2008. The SR 99 tunnel is projected to open in 2015. Although the two regulator stations scheduled for upgrade as part of the HLKK project are near the viaduct replacement project, construction does not appear to impact the HLKK project.

- **Waterfront Seattle Project.** The City of Seattle will transform the Seattle waterfront as the seawall and viaduct projects open up new public space from Olympic Sculpture Park to Pioneer Square. Improvements will be implemented as the need and opportunity arise and funding allows. A preliminary project schedule calls for construction to occur from 2016 through 2019.

- **Sonics Arena Project.**The City of Seattle, King County, and WSA Properties III (ArenaCo) entered into a memorandum of understanding in 2012 under which ArenaCo would develop, design, and construct a multipurpose sports arena. ArenaCo has acquired land south of downtown adjacent to First Avenue South between South Massachusetts Street and South Holgate Street for the arena. This project is in its early planning stages.

2.2 Discussion

The construction schedules for projects described in Section 2.1.3 are not firm. Some of the projects are in the planning stage, without definite schedules or secure funding. With the exception of the East Duwamish Waterway Superfund cleanup, none of the schedules coincide with construction of the accelerated HLKK project. Construction of the Waterfront Seattle project could end shortly before HLKK construction would begin under an accelerated schedule. Schedules for both the Superfund and Waterfront Seattle projects have not been established yet. In any event, completion of the HLKK project, whether accelerated or not, will require coordination with any ongoing programs for the remediation of contaminated sediment and restoration of habitat in the East Duwamish Waterway and Elliott Bay. One potential benefit of acceleration is that the County may be able to purchase or lease staging areas for HLKK construction that were used previously for the other projects.

Accelerating HLKK early could exacerbate construction fatigue. If the HLKK project maintains its Council-approved schedule, construction would begin about eight years after the other projects are completed, potentially reducing construction fatigue, and planning for the HLKK project would benefit from the operational experience of the County's new Brandon St–S Michigan CSO treatment plant scheduled to start operating in 2022.

Because of the preliminary nature of the scopes and schedules for the non-WTD projects and the apparent limited potential for construction coordination with the accelerated HLKK project, no associated financial, regulatory, and other issues or benefits could be clearly defined or measured. WTD will continue to monitor the progress of other projects in the HLKK area and to work with the City of Seattle on CSO control to identify opportunities for coordination.

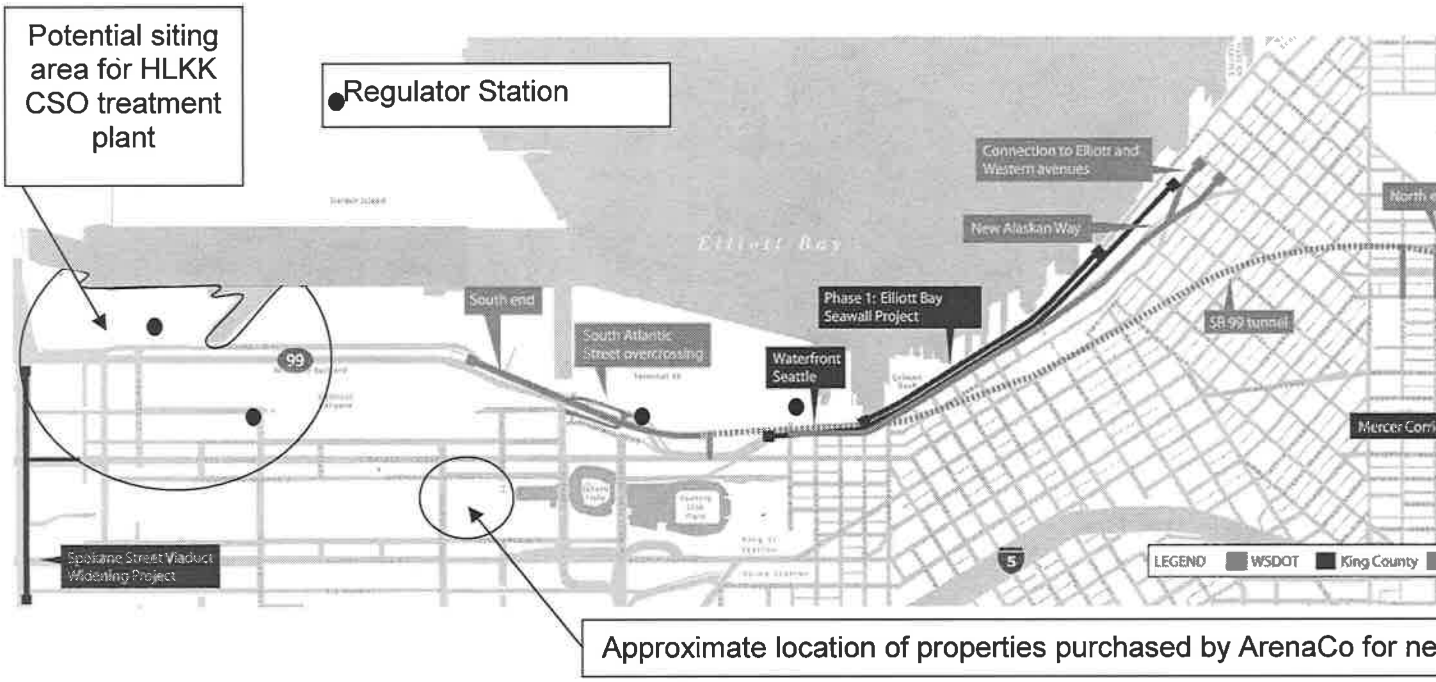

Figure 2-1. Location of Downtown Waterfront Projects, WTD Regulator Stations, HLKK Siting Area, an
(Source: www.wsdot.wa.gov/Projects/Viaduct/About, modified to show WTD's and ArenaCo's propos

3.0 NECESSARY REGULATORY APPROVALS

This chapter describes an analysis of regulatory reviews and approvals that may be needed to build and operate the new HLKK CSO treatment plant, conveyance lines, and outfall structure and how acceleration of the HLKK project could affect the approval process.

3.1 Methodology and Results

Initiating a complex siting and construction project such as HLKK will involve many regulatory reviews and approvals regardless of when the project is undertaken. Because the East Duwamish Waterway is a component of the Harbor Island Superfund site, it is highly likely that obtaining permits to construct the new outfall structure will require significant coordination with the multiple agencies involved in the Superfund process, including the EPA, U.S. Army Corps of Engineers (USACE), National Oceanographic and Atmospheric Administration'sNational Marine Fisheries Service, Ecology, Port of Seattle, and City of Seattle.

WTD staff with experience in obtaining regulatory permits and approvals prepared descriptions of federal, state, county, city, and other regulatory approvals that may be required for the HLKK project regardless of when the project is implemented. These descriptions are summarized below. The exact type and number of required permits and approvals will depend on where project components will be located.

3.1.1 Federal

The federal Clean Water Act of 1972 requires three major types of permits for the discharge of pollutants or fill into surface waters of the United States: National Pollutant Discharge Elimination System (NPDES) permit issued by Ecology, Section 404 permit issued by USACE, and Section 401 water quality certification, also issued by Ecology.

In addition, the project must comply with the 2013 consent decree that King County signed with EPA and Ecology to implement the County's approved CSO control plan. The decree requires King County to complete all CSO control projects by 2030 and gives specific milestones for each project.

Other likely federal reviews and approvals include a USACE Section 10 of the Rivers and Harbors Act permit and an Endangered Species Act review and biological assessment.

3.1.2 Washington State

The analysis identified a number of Washington State review, permits, and approvals. Some may not be required, depending on site selection:

- State Environmental Policy Act review to determine whether construction and operation could have significant environmental impacts.
- NPDES Construction Stormwater Permit, issued by Ecology and requiring installation of erosion and sediment control measures during construction to prevent stormwater from washing soil and pollutants into local water bodies.

- Hydraulic Project Approval, issued by the Washington State Department of Fish and Wildlife for projects that use, divert, obstruct, or change the natural flow of waters of the state.
- Aquatic Use Authorization, issued by the Washington State Department of Natural Resources for projects located on any state-owned aquatic lands.
- Prevention of Significant Deterioration Air Quality Permit, issued by Ecology for projects at large facilities that may significantly increase air pollutant emissions.
- Underground Storage Tank Permit, issued by Ecology for installation or removal of underground storage tanks.

3.1.3 King County and City of Seattle

King County issues Industrial Waste permits for large construction projects that plan to discharge dewatering water to the county wastewater system.

The City of Seattle requires a Conditional Use Permit approval by the City Council for projects in Urban Industrial and Industrial General zones, a Shoreline Substantial Use Permit for developments and uses of water bodies and associated upland areas, and construction permits. The Seattle Department of Transportation issues 60 types of permits for use, occupation, and/or construction in city rights-of-way, some of which will likely apply to the HLKK project.

3.1.4 Other Approvals

Owners of railways typically require a railroad pipeline license for installation of pipelines in their rights-of-way or a temporary occupancy permit for conducting surveys and other activities.

3.2 Discussion

Obtaining the majority of the permits will take the prescribed amount of time accounted for in the 10-year planning, design, and construction period allotted in the CSO control plan. However, beginning HLKK seven years earlier than planned would potentially add to the complexity of obtaining some of the permits, especially permits from USACE, because of the need to coordinate and integrate the siting and construction of the HLKK outfall structure during the contaminated sediment cleanup construction under the federal Superfund program in the East Duwamish Waterway.

Design and construction of an accelerated HLKK project is anticipated to coincide with planning and implementation of the cleanup, estimated to occur between 2014 and 2021. (See Chapter 2.) The permitting agencies may impose more conditions on the type, configuration, and placement of the new outfall structure to account for uncertainties as to the timing, location, and nature of the cleanups. Negotiating approvals for the HLKK project and responding to public interests and concerns while cleanups are being designed will likely complicate the process and would potentially require additional time and expense and add to remediation efforts. Therefore, accelerating HLKK may increase the complexity of obtaining permits and future changes to the facility may be needed to meet any conditions imposed later as part of the cleanup.

4.0 PUBLIC AND ENVIRONMENTAL HEALTH BENEFITS

This chapter describes the application of metrics developed to quantify the qualitative public and environmental health factors used in the 2012 CSO control program review to assign priorities to CSO control projects and evaluate alternative project sequences. This analysis was conducted to respond to the requirement in the proviso for additional cost-effectiveness analyses as outlined in the 2012 performance audit of the CSO control program. The audit report included a recommendation for WTD to begin developing quantitative measures of the impacts on water quality from CSO control projects and consider the effectiveness of the various projects in reducing pollution. The audit report stated, "In this case, we are using volume, which can be quantified, as a proxy for pollution. Of course, if a more sophisticated approach using weighted pollution effects were available, the same analysis could be done with that information."

To move the analysis forward from the volume proxy, the metrics analysis provides an approach in quantifying the pollution effect of CSO discharges on each water body to assess project effectiveness. The analysis scored the water bodies based on their sensitivity to CSO pollution and used a methodology similar to that called for by EPA's CSO screening and ranking guidance (EPA 832-B-95-004). The guidance is an informal tool to help permitting authorities establish CSO permitting priorities. It may also help permittees rank their CSOs to best allocate limited resources.[1]

The metrics analysis recognizes that the impact of CSOs to receiving water bodies depends on the characteristics of both the potential discharge and the receiving water body. It can be a complex relationship where the volume reduced is not directly related to receiving water benefits. The use of the water body, the potential for human contact, and the sensitivity of the water body to the impacts of both treated and untreated discharges are used to determine the best sequence for CSO control. In determining project sequences, strong consideration is given to achieving the greatest public and environmental health benefits at the earliest time. This is why the Council-approved CSO control plan did not prioritize projects solely on volumereduction.

4.1 Methodology and Results

The County's 14 remaining uncontrolled CSOs discharge to six areas. The sensitivity of the water bodies in these areas to the effects of pollutants in CSOs and the priorities for CSO control based on these sensitivities were scored in terms of four public and environmental health factors:

- Public exposure to pathogens
- Public consumption of resident fish
- Recontamination of sediments
- Salmon exposure to contaminants

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[1]The EPA guidance document is available at http://cfpub.epa.gov/npdes/docs.cfm?document_type_id=1&view=Policy%20and%20Guidance%20Documents&program_id=5&sort=name.

These factors are consistent with the policy direction in Ordinance 17587 and King County Code 28.86.080 on the highest priority for controlling CSO discharges.[2]

The methodology used is as follows:

- Metrics, such as the type and number of fish habitat sites, fishing and swimming areas, and shoreline access, were developed to assign scores to characteristics of the water body that could indicate the potential for exposure to pollutants from CSOs.
- The resulting scores for each of the four public and environmental health factors were used to determine priorities for sequencing CSO control by receiving waters.
- The scores for all four factors were combined for each receiving water to determine an overall sequencing priority for CSO control ("metrics-based" sequence).
- To respond to the budget proviso, the metrics-based sequence was revised to show the order of projects with an accelerated HLKK project.
- Both the metrics-based and HLKK accelerated sequences were compared to the CSO control project sequence in the Council-approved 2012 CSO control plan and federal consent decree.
- Sensitivity scores were plotted against estimated CSO control project costs for each discharge area to give a sense of which areas provide the best public health and environmental benefit at least cost.

The analysis relied on water quality studies used to develop the 2012 CSO control program review. No additional water quality studies were conducted. Exhibit B provides more detail on methodology and sensitivity scores.

4.1.1 Sensitivity Scores and CSO Control Project Sequences

Table 4-1shows the combined sensitivity scores for all four factors for each discharge area and the resulting sequence for CSO control compared to the same sequence with the acceleration of the HLKK project and tothe sequence in the 2012 CSO control plan. The higher the score, the higher the sensitivity of the water body and the priority for CSO control. Figure 4-1 shows the discharge locations and the priority assigned to each area based on the sensitivity scores. Based on this analysis, the alternative project schedule to achieve the greatest public health and environmental benefit would rank the East Ship Canal first. However, this project was prioritized second in the long-term CSO plan to allow for coordination with the City of Seattle's CSO projects, construction of the new light rail station, and the University of Washington's new stadium.

[2] The policy states that the County shall give the highest priority for control of CSO discharges that have the highest potential to impact (1) human health through contact with CSO flows or fish consumption or (2) environmental health, such as in areas where sediment remediation is under way or anticipated or where there is potential to impact species listed under the Endangered Species Act.

Table 4-1. Combined Sensitivity Scores by Discharge Area and Resulting Sequence Compared to the Same Sequence with Accelerated HLKK Project and the 2012 CSO Control Plan Sequence

Discharge Area and Planned CSO Control Projects	Sensitivity Score (Likelihood of Exposure)					Sequence		
	Pathogen	Fish Consumption	Sediment Recontamination	Salmon Exposure	Total	2012 CSO Plan	Priority Based on Sensitivity Scores	Revised Sequence with Early HLKK
East Lower Duwamish Hanford #1 Brandon/Michigan	3	2	3	3	11	 1[a] 2	1	1
West Lower Duwamish (W Michigan-Terminal 115)	2	0	3	3	8	3	3	4
East Duwamish Waterway (Hanford #2-Lander St-King St-Kingdome [HLKK])	***0.3***	***0***	***2***	***1.3***	***3.6***	***6***	***6***	***2[b]***
West Duwamish Waterway (Chelan)	1	2	0	3	6	3	4	5
East Ship Canal (University and Montlake)	3	3	1	1.3	8.3	5	2	3
West Ship Canal 3rd Ave W 11th Ave NW	2	1	2	0.3	5.3	 4[c] 6	5	6

Note: Individual projects are shown for discharge areas if the projects were assigned different priorities in the 2012 CSO control plan.
[a] Hanford #1 was swapped with University in1999 to avoid construction conflicts in the Montlake Cut area and minimize recontamination of an earlier remediation at Hanford #1. Both the Hanford #1 and Brandon/Michigan CSO control projects are under way.
[b] The earliest that construction can begin on the HLKK project is 2017, after completion of enhanced monitoring and modeling, predesign and design.
[c] The 3rd Ave W project was brought forward at the request of the City of Seattle for a joint project.

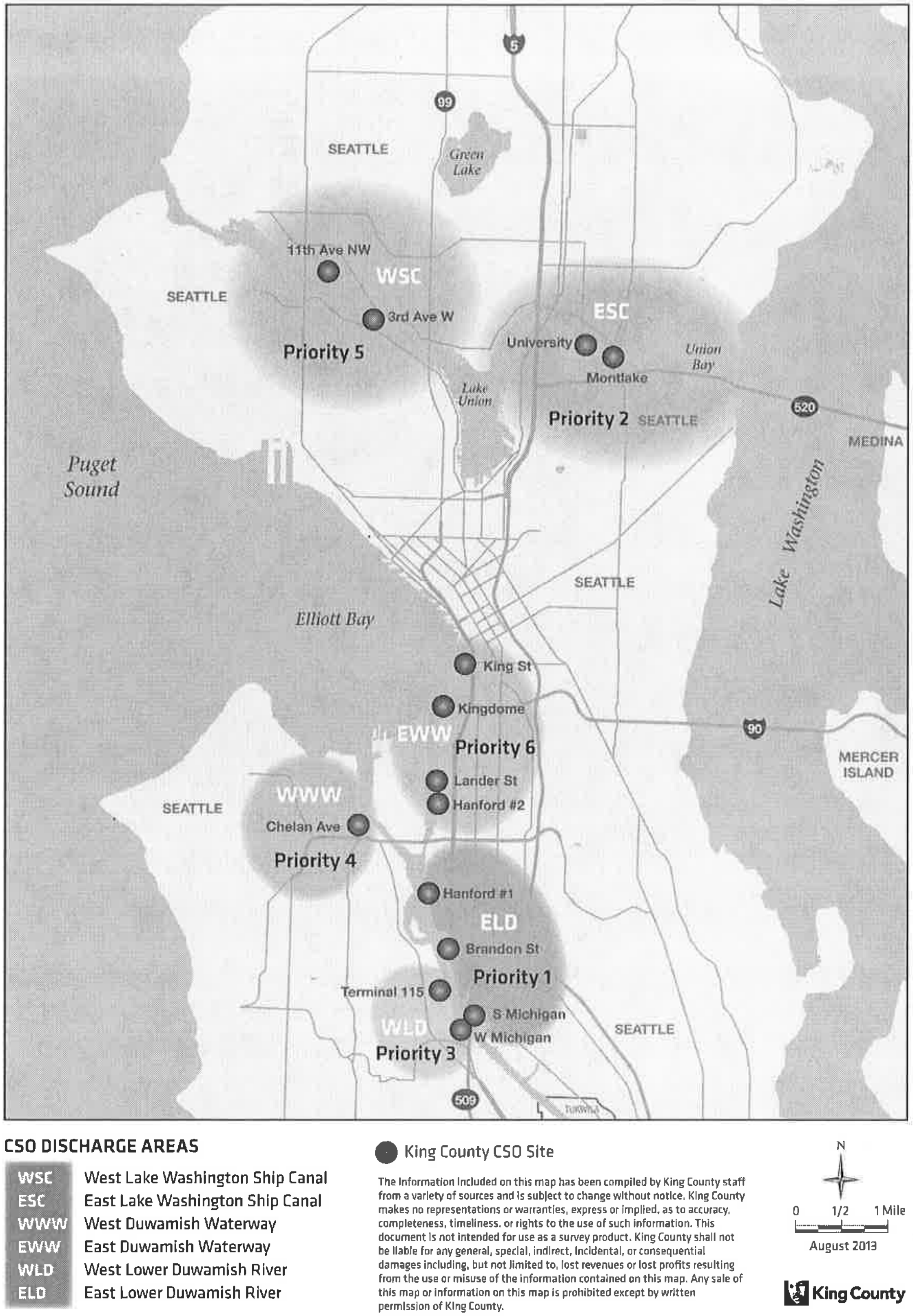

Figure 4-1. Locations of CSO Discharge Areas and their Priority for CSO Control Based on Public and Environmental Health Factors

4.2 Sensitivity Versus Cost

Figure 4-2shows CSO control cost compared to combined sensitivity scores for all projects in each discharge area. Water body sensitivity is color-coded. Greater cost-benefit is found in the lower left quadrant (highest public and environmental health sensitivity score and least cost). The East Lower Duwamish River (ELD) carries the highest sensitivity at relatively high cost, while the West Lower Duwamish River (WLD) carries the next highest sensitivity at lowest cost. The East Duwamish Waterway (EWW), which is the water body to where the HLKK project willdischarge, shows the lowest sensitivity at the highest cost.

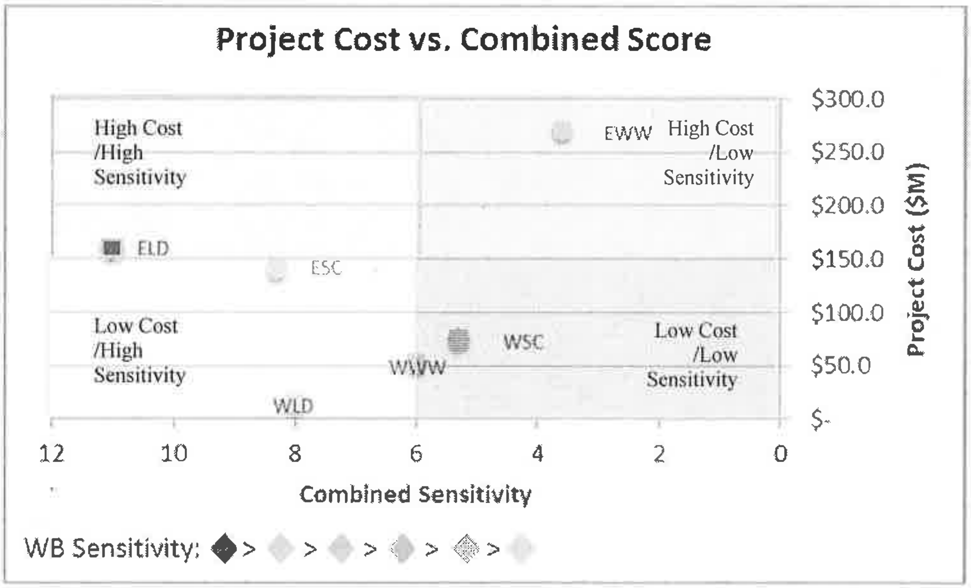

Figure 4-2. Project Cost Versus Public and Environmental Health Scores (Sensitivity) for Each Discharge Area (Acronym Chart at Figure 4-1)

4.3 Discussion

The sensitivity analyses is similar to the prioritization required by both EPA,through its screening and ranking guidance,and Ecology (173-245-040(2)(d)WAC). EPA and Ecology list a variety of criteria to be considered in prioritizing CSO control, primarily around the uses of water bodies where discharges occur and their sensitivity to specific pollution impacts.

Based on this new sensitivity analysis, the resulting optimal project sequence is generally similar to the 2012 CSO control plan sequence. The East Duwamish Waterway, where the HLKK facility will discharge, received the lowest priority in both the sensitivity scoring and in the CSO control plan. The HLKK project would control the largest CSO volume, but would not achieve the same public and environmental health benefit as the other CSO projects. The small differences between the metrics-based sequence and the CSO control plan sequence reflect other factors considered in the CSO control program review, such as the need to coordinate with other projects in the area (for example, the Lower Duwamish Superfund cleanup) and the desire to minimize the rate of increase in sewer rates.

Results of the Water Quality Assessment-Monitoring Study that was authorized through Ordinance 17413 will provide additional information that may lead to consideration of changes in the sequence of future CSO control projects. The study will also inform decisions on whether to develop an integrated plan under the EPA framework. Such a plan would sequence and integrate CSO control projects with other water quality improvement projects in the discharge areas to achieve the greatest public health and environmental benefit as early and cost-effectively as possible.

5.0 STAFFING REQUIREMENTS

The proviso requires that this report "address projected staffing requirements" of the alternative sequencing option. This chapter describes the analysis of WTD capital program staffing required to complete the HLKK project during the accelerated schedule and the impact of this requirement on the capital program. It also documents the estimated number of operation and maintenance staff that will be needed after the HLKK project is completed.

5.1 Methodology and Results

The following sections describe WTD and consultant staffing needs and availability to accommodate an accelerated schedule for the HLKK project.

5.1.1 Capital Staffing Needs

The following methodology and assumptions were used to estimate capital staffing needs for the HLKK project:

- The schedules for all other projects and programs in the existing WTD capital program were not changed in the approved schedule to be consistent with the direction of the proviso to show the impact of initiating more projects while interest rates are low.
- Consultant services will be procured for design and specific activities to support construction management.
- WTD's project management database, which is based on total anticipated construction cost and historical records, was used to estimate capital staffing needs for each year based on planning-level construction cost estimates for the HLKK project.
- The WTD staff requirements were broken down across the accelerated project schedule into further detail regarding staff type based on historical staffing requirements in the database.

Table 5-1estimates that between 4 and 12 full-time employees (FTEs) would be needed to complete the accelerated HLKK project, depending on project phase.

Table 5-1. Estimated HLKK Capital Program Staffing Needs by Project Phase and Year

Staff Type	Number of FTEs									
	Problem Definition		Predesign	Final Design		Construction				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Operations	0.3	0.3	0.9	1.0	1.0	0.4	0.4	0.4	0.4	0.4
Community Services	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Environmental	0.2	0.2	0.5	0.6	0.6	0.2	0.2	0.2	0.2	0.2
Permitting/Real Estate	0.1	0.1	0.4	0.5	0.5	0.2	0.2	0.2	0.2	0.2
Engineering	0.6	0.6	1.7	2.0	2.0	0.8	0.8	0.8	0.8	0.8
Facilities Inspection	0.2	0.2	0.5	0.6	0.6	0.2	0.2	0.2	0.2	0.2
Construction Management	0.6	0.6	1.1	1.1	1.1	3.2	3.2	3.2	3.2	3.2
Program Management	1.0	1.0	3.0	3.5	3.5	1.4	1.4	1.4	1.4	1.4
Project Controls	0.7	0.7	2.1	2.4	2.4	1.0	1.0	1.0	1.0	1.0
Total	3.8	3.8	10.4	11.9	11.9	7.5	7.5	7.5	7.5	7.5

5.1.2 Operation and Maintenance Staffing Needs

During development of planning-level cost estimates for WTD's two planned CSO treatment plants (Brandon St-S Michigan and HLKK), Operation and Maintenance (O&M) staff estimated that 1.8 FTEs would be needed to run each plant (3.6 FTEs working as a team to run both plants). The FTEs represent an aggregate of offsite O&M, process control, lab, instrumentation and control, and other staff. The estimate assumes that this staff need is driven by plant operation during peak flows and the work required during non-storm periods to ensure the facility is ready to operate when needed. Because staff is fully engaged in operating existing facilities, WTD would need to hire the additional 3.6 FTEs for the two plants. If HLKK were accelerated, 1.8 FTEs would need to be hired seven years earlier.

5.2 Discussion

The estimated WTD staff hours required would be the same whether the HLKK project is implemented under the current approved project schedule or the accelerated project schedule. However, if the project is accelerated, WTD will have to hire additional personnel because existing capital program staff is fully allocated to projects that are part of WTD's approved capital improvement plan (CIP), including the current CSO project construction schedule.

In addition, the 1.8 FTEs required to operate and maintain the HLKK plant will have to be hired sooner if the project is accelerated. Additional staff time may also be needed to negotiate permits because of potential complexities associated with sediment cleanup construction in the East Duwamish Waterway. Therefore, acceleration of the HLKK project would result in greater staffing costs than if the project is completed as scheduled under the long-term CSO control plan.

6.0 FINANCIAL CONSIDERATIONS AND RATE IMPACTS

This chapter compares the estimated annual expenditures, lifecycle costs, financing costs, and sewer rates associated with the adopted CSO control plan project sequence to those associated with the alternative sequencing option. In addition, the chapter discusses the sensitivity of the results of the analysis to changes in interest rates and the ability to mitigate the rate impacts through alternative financing arrangements.

The financial analysis responds to the proviso's requirements for information on additional financial analyses, analysis of initiating more projects while borrowing costs and interest rates are at historic lows, associated sewer rate impacts, and alternative financing strategies. The analysis does not assign monetary values to the benefits of achieving CSO control seven years earlier through acceleration of the HLKK project. To do this would require substantially more data than is currently available.

6.1 Methodology and Results

To evaluate the alternative CSO control project sequencing option relative to the approved sequence, the following financial analyses were completed:

- Compared annual HLKK project capital expenditures through 2030, with a 3 percent rate of inflation, for the approved and accelerated project schedules.
- Estimated annual startup and ongoing O&M costs, in 2013 dollars, for the HLKK project, including additional startup costs for the first two years of operation.
- Compared HLKK project lifecycle costs (present value) for the approved and accelerated project schedules. The lifecycle costs were translated into an average annual cost for each alternative.
- Analyzed the sensitivity of lifecycle costs to changing interest rates using two series of real interest rate forecasts and two discount rates.
- Compared annual monthly sewer rates for 2014–2040 for the CIP with the accelerated and the approved HLKK project schedules.
- Examined the sewer rate impact, with inflation, for the range of planning-level cost estimates for the accelerated project.
- Examined the advantages and disadvantages of using various financing strategies to manage the impact of the accelerated HLKK project on sewer rates through 2026.

Exhibit C presents additional information on the financing and rate analysis.

6.1.1 Capital and Lifecycle Costs

The majority of capital spending on the HLKK project will occur during construction: 2023–2030 for the approved schedule and 2018–2023 for the accelerated schedule. Nominal capital costs for the project would be about $87 million less if the project were started sooner because the effects of inflation would be less.

When evaluating two alternatives for a capital project, it is important to compare the costs and benefits in a common reference year (2013 in this analysis) by calculating the present value of each. Present value analysis reflects that, economically, one would prefer to receive benefits earlier in time while delaying costs as much as possible. However, when O&M and financing costs are taken into account to estimate lifecycle costs in 2013 dollars, accelerating the HLKK project would increase the total cost of the project byapproximately $24 to $40 million (Table 6-1).This means the project will cost more by an average of $0.5 to $0.8 million per year more for the 50-year life of the facility (Table 6-2).

Lifecycle costs consider both inflation and the timing of expenditures. Any cost that occurs farther out in the period is given less weight (more heavily discounted). Thus, in today's dollars, incurring an expense next year is generally more expensive than incurring it in five years. Moreover, O&M costs for the accelerated project would start sooner and continue longer.

The result shows increased capital and lifecycle costs for the HLKK project,which does not have the same public health and environmental benefit as the other CSO projects.

Table 6-1. Total Estimated HLKK Lifecycle Costs for Approved and Accelerated Project Schedules (2013–2073, millions)

	Capital Outlay (2013$)	Total Lifecycle Cost(2013$)	
		Lower Discount Rate (0.73%)	Higher Discount Rate (7%)
Approved schedule	$299.9	$402.8	$68.4
Accelerated schedule	$299.9	$426.5	$108.9
Level difference	0	$ 23.8	$ 40.4
% difference	0	5.9%	59.1%

Table 6-2. Estimated Average Annual HLKK Costs for Approved and Accelerated Project Schedules (2013–2073, millions)

	Capital Outlay (2013$)	Average Annual Cost(2013$)	
		Lower Discount Rate (0.73%)	Higher Discount Rate (7%)
Approved schedule	$299.9	$8.3	$1.4
Accelerated schedule	$299.9	$8.8	$2.2
Level difference	0	$ 0.5	$0.8
% difference	0	5.9%	59.1%

6.1.2 Impacts on Sewer Rates

The difference in average monthly sewer rates from 2014 through 2040 between the WTD CIP with the accelerated and with the approved project schedules is modest—($0.36 and $0.40

without and with inflation, respectively). However, these average rates mask the much more pronounced differences in certain years. With acceleration of HLKK, the monthly sewer rate from 2016 through 2029 would be greater than the rate with the approved HLKK schedule, achieving a maximum difference of $3.17 in 2024, and would be lower by a modest amount after 2030 (Table 6-3 and Figure 6-1).

Table 6-3. Monthly Sewer Rates with Approved and Accelerated HLKK Project Schedules (2014–2040, with inflation)

	Monthly Sewer Rate ($, with inflation)				
	2014	2020	2025	2030	2040
Approved schedule	$39.79	$46.86	$54.86	$64.36	$68.91
Accelerated schedule	$39.79	$47.87	$57.89	$63.93	$68.21
Difference	0	$1.01	$3.03	<$0.43>	<$0.70>

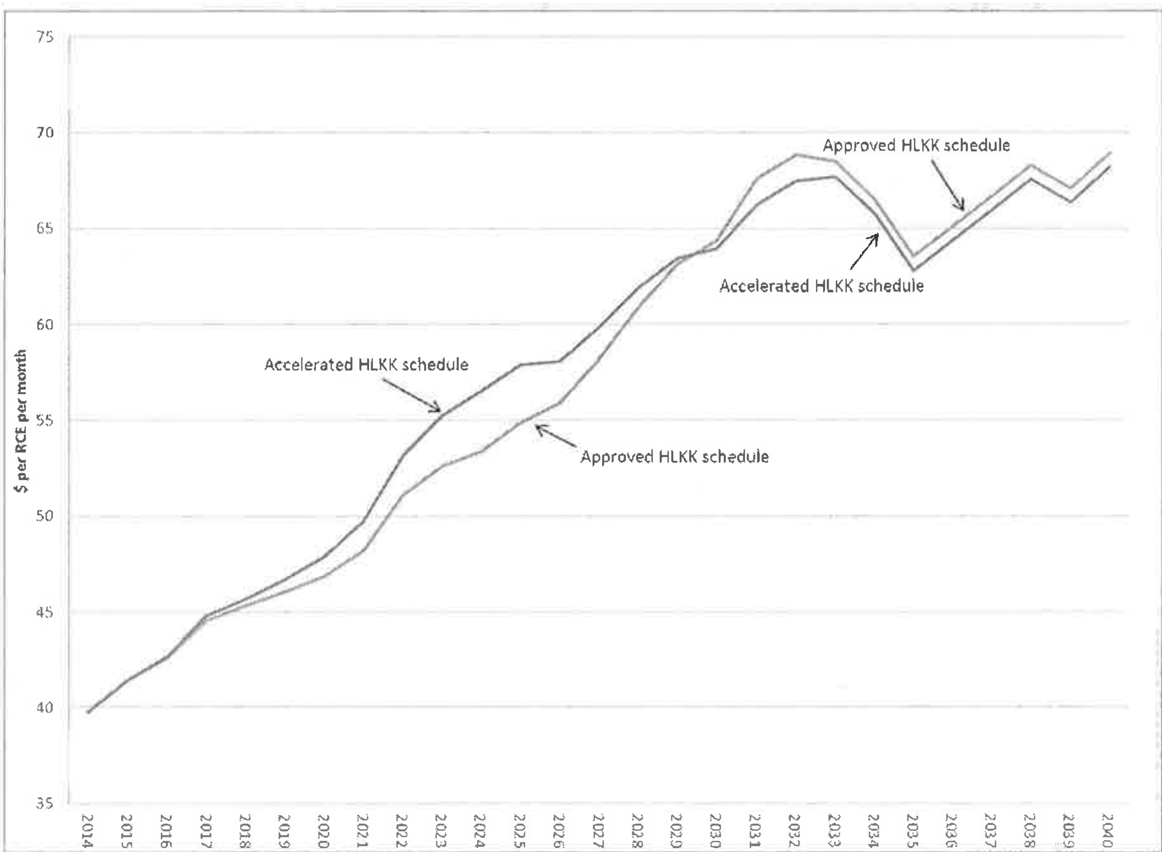

Figure 6-1. Monthly Sewer Rates with Approved and Accelerated HLKK Project Schedules (with inflation)

6.1.3 Mitigating Sewer Rate Impacts

Rate management effectiveness refers to the ability to target sewer rates to particular levels while continuing to meet all revenue requirements and financial requirements. In forecasting sewer rate impacts, WTD assumes level amortization of principal and interest over the term of the bonds. Variations to this approach include structuring the bonds to include periods of deferred principal, capitalizing the interest, and issuing zero coupon bonds. Each strategy represents a different mix of rate management effectiveness and additional cost. Prior to use of alternative debt structures, the risks, costs, WTD's current and future debt profile, and perceptions of the financial industry need to be carefully considered. It cannot be assumed that these alternative bond structures will be available to finance the capital program without possible interest rate penalties or potential bond rating implications.

As shown in Table 6-4, use of these alternative structures increases the overall debt service by $137 to $281 million. The following describes the effectiveness from 2014 through 2040 of each of the structures for keeping sewer rates through 2026 as close as possible to the rates if no alternative financing were used:

- Principal-deferred bonds offer the least ability to manage rates but are the least costly of the alternative structures, with interest rate differentials of 0 to 10 basis points over level principal and interest. The debt service would increase by $137 million (0.70 percent) if this structure were used.

- Capitalizing interest is an effective rate management tool but increases the cost of financing. This approach produces results similar to zero coupon bonds but is less flexible because the period of full amortization coincides with when the facility goes online. Total debt service would increase by $207 million (1.00 percent) if this structure were used.

- For the zero coupon analysis, approximately $346 million of zero coupon bonds are issued between 2017 and 2026. Issuing zero coupon bonds entails a significant interest rate differential of 100 to 150 basis points yet is powerful in managing rates. Total debt service would increase by $281 million (1.40 percent) if this structure were used.

Table 6-4. Comparison of Total Debt Service of the Accelerated HLKK Project Using Standard and Alternative Bond Structures (2013–2073, with inflation)

	Rate Management Effectiveness	Debt Service (millions)	Difference from Level Principal and Interest	
			Level (millions)	%
Level Principal and Interest	N/A	$20,274	0	0
Principal-deferred	Low	$20,410	$137	0.70
Capitalized interest	Medium	$20,480	$207	1.00
Zero coupon	High	$20,555	$281	1.40

Note: Rate management effectiveness is a general assessment of the ability to achieve specific rate targets.

6.2 Discussion

There are several ways to view the effects of accelerating the HLKK capital project. In terms of the lifecycle cost of the project, moving the project forward increases the total cost of the project by approximately $24 to $40 million, measured in 2013 dollars. In an annual equivalent, this is approximately $0.5 to $0.8 million a year over the life of the project. These cost estimates represent the minimum benefits that need to be achieved to make acceleration financially beneficial.

If WTD is unable to defer any projects in the approved six-year CIP, the acceleration of the HLKK facility will require additional capital funding in the time period. Although interest rates have been lower in recent years, the difference between current interest rates and anticipated future(higher) interest rates is likely not significant enough to offset the increased costs of borrowing more in the near term.

Additional effects from the acceleration are higher sewer rates in the near-term followed by somewhat lower sewer rates in the more distant future, compared to the approved HLKK schedule. The near-term rate increases can be mitigated through the use of alternative financing structures, with attendant increases in total costs. However, credit-rating agencies may view WTD in a less favorable light because of the use of some of these financing structures, and it may increase concern by some entities regarding WTD's current debt profile.

7.0 CONCLUSION

The results of the analyses show more disadvantages than advantages of accelerating the HLKK project. The results confirm that the project sequencing that the Council approved in September 2012 as part of the County's long-term CSO control plan is sound and efficiently meets the County's CSO control obligations while contributing to ensuring stable sewer rates.

The major findings of the elements that were analyzed as part of this proviso report are as follows:

- *Additional financial analyses and rate impacts.*
  Results show that the alternative sequencing option with an accelerated HLKK project would cost more by approximately $0.8 million per year than the Council-approved CSO control project sequencing.

  Additionally, the monthly sewer rate would increase by as much as $3 during the years when the accelerated project is being constructed. Alternative financing strategies might mitigate these increases, but total debt service would be considerably higher. Finally, bond rating agencies may view WTD in a less favorable light because of the use of some of these strategies, and it may increase concern by some entities regarding WTD's current debt profile.

- *Quantification of public and environmental health benefits of each CSO project in the Council-approved long-term CSO control plan.*
  Results of the metrics analysis showed the impacts of CSO discharges are highly dependent on receiving water characteristics. The HLKK project would control the largest CSO volume, but would not achieve the same environmental and public health benefit as the other CSO projects. Therefore, the resulting optimal project sequence is generally similar to the 2012 CSO control plan sequence that was approved by Council.

- *Potential for coordinating with other planned projects in the HLKK siting area.*
  Because the scopes and schedules for other planned projects in the HLKK area are uncertain or preliminary, the benefits of coordinating with other projects could not be demonstrated at this time.

- *Necessary regulatory approvals.*
  In general, the required regulatory permits and approvals and the timeframe for obtaining them are the same whether HLKK is accelerated or not. However, beginning HLKK seven years earlier than planned could potentially add to the complexity of obtaining some of the permits because of the need to coordinate and integrate the siting and construction of the new outfall structure with the work to clean up contaminated sediments in the East Duwamish Waterway.

- *Staffing requirements.*
  The capital program staff hours needed for the various phases of work to complete the HLKK project is the same regardless of the timing of the project. However, if the project were accelerated, WTD would have to hire additional personnel because existing capital

program staff are 100 percent allocated to projects that are part of WTD's approved CIP, which takes into account the CSO control plan schedule. In addition, the 1.8 FTEs required to operate and maintain the HLKK plant would have to be hired sooner if the project were accelerated.

WTD is committed to continuing to look at opportunities to maximize the County's CSO control investments. The Water Quality Assessment-Monitoring Study that was authorized through Ordinance 17413 will provide additional information that may lead to consideration of changes in the sequence of future CSO control projects. The assessment will provide information on how CSO control can work in conjunction with other water quality projects, identify opportunities to lower the cost of CSO control, evaluate the effectiveness of emerging technologies, and build a foundation for conducting post-construction monitoring of CSO control projects. Results of the assessment will also help in deciding whether to pursue an integrated CSO control plan under the consent decree.

Exhibit A

Proviso 1, Section 132, Ordinance 17476, adopting the 2013 King County budget

P1 PROVIDED THAT:
Of the appropriation for CIP project 1113334, combined sewer overflow comprehensive planning and reporting, $500,000 shall not be expended or encumbered until the executive transmits a report and a motion that acknowledges receipt of the report. The motion shall reference the proviso's ordinance, ordinance section, proviso number and subject matter in both the title and the body of the motion. The executive shall obtain the review by council staff and the King County auditor of: 1) the scope of work for the report on combined sewer overflow control project sequencing, prior to the report preparation; and 2) the draft report, prior to transmittal to the council. Implementing this proviso shall be carried out in compliance with the consent decree between King County and regulatory agencies.

The executive should file the report and motion required by this proviso by September 1, 2013, in the form of a paper original and an electronic copy with the clerk of the council, who shall retain the original and provide an electronic copy to all councilmembers, the council chief of staff and the lead staff for the regional water quality committee and transportation, economy and environment committee and or its successor.

The report shall provide additional financial and cost effectiveness analyses, as outlined in the King County Auditor's Office 2012 Performance Audit of Combined Sewer Overflow Program, of the 2012 adopted long-term combined sewer overflow ("CSO") control plan project sequencing and alternate project sequencing. The report shall include analysis of acceleration of one or more combined sewer overflow control projects to initiate more projects while borrowing costs and interest rates are at historic lows.

The sequencing analyses contained in the report should address projected staffing requirements and all estimated costs for the phases of project execution, including anticipated and alternative milestones for enhanced project specific flow monitoring, problem definition, design and construction. The report shall also include calculations of wastewater rate impacts between 2014 and 2030 for alternative project sequencing options. The report should also consider other significant capital projects and current capital financing assumptions that are drivers of near and long-term wastewater rate projections. Alternative financing strategies for capital projects shall also be included in the report for alternative project sequencing options.

In addition, the report should address issues and benefits of coordinating King County CSO projects with other wastewater treatment division projects and other activities, including but not limited to, the Duwamish waterway cleanup, Harbor Island cleanup, reconstruction of State Route 99 through downtown Seattle, bridge replacement of State Route 520 and implementation of Seattle CSO projects, and should quantify financial, regulatory or other issues associated with project coordination or lack thereof. The report shall also detail the regulatory approval or approvals necessary for alternative project sequencing options.

Based on the analyses, the report should summarize and quantify the advantages and disadvantages of the adopted long term CSO control project sequencing versus alternative sequencing options.

ExhibitB

Prioritization of CSO Control Areas Using Metrics That Quantify Public and Environmental Health Impacts

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Introduction

This exhibit details the application of metrics developed to quantify the qualitative public health and environmental factors used in the 2012 CSO control program review to assign priorities to CSO control projects and evaluate alternative project sequences.

This analysis was conducted to respond to the direction in the proviso for additional cost-effectiveness analyses as outlined in the 2012 performance audit of the CSO control program. The audit report included a recommendation for WTD to begin developing quantitative measures of the impacts on water quality from CSO control projects and consider the effectiveness of the various projects in reducing pollution. The audit report stated, "In this case, we are using volume, which can be quantified, as a proxy for pollution. Of course, if a more sophisticated approach using weighted pollution effects were available, the same analysis could be done with that information."

To move the analysis forward from the volume proxy, the metrics analysis quantifies the pollution effect of CSO discharges on each water body to assess project effectiveness. The analysis scored the water bodies based on their sensitivity to CSO pollution and used a methodology similar to that called for by EPA's CSO screening and ranking guidance.[1]

The metrics analysis recognizes that the impact of CSOs to receiving water bodies depends on the characteristics of both the potential discharge and the receiving water body. It is a complex relationship where the volume reduced is not directly related to receiving water benefits. The use of the water body, the potential for human contact, and the sensitivity of the water body to the impacts of both treated and untreated discharges are used to determine the best sequence for CSO control. In determining project sequences, strong consideration is given to achieving the greatest public and environmental health benefits at the earliest time. This is why the Council-approved CSO control plan did not prioritize projects based solely on volume reduction.

Background

The purpose of King County's CSO control program is to implement CSO control projects to obtain the best water quality in local water bodies at the earliest time. The most effective projects are those that achieve the best water quality. The control target for each County CSO site is the Washington state standard of one untreated event per year on a 20-year average. The volume of the once-per-year discharge will vary greatly from site to site because of differences in the City of Seattle combined sewer areas that drain to each County CSO site.

Policy CSOCP-2 in the King County Regional Wastewater Services Plan (RWSP), approved in 1999, requires that CSO control projects be prioritized by their benefit to public health and endangered species.[2] The RWSP included a prioritized list of control projects based in part on

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[1]The document is available at http://cfpub.epa.gov/npdes/docs.cfm?document_type_id=1&view=Policy%20and%20Guidance%20Documents&program_id=5&sort=name.

[2] In May 2013, this policy was revised via Ordinance 17587. It is now Policy CSOCP-3, as codified in King County Code 28.86.110.

the CSO Water Quality Assessment published in 1999. The 2012 CSO control program review assessed risks and benefits of alternative CSO control projects and sequences based on studies conducted since the 1999 assessment. The program review affirmed the RWSP priorities, with minor changes in recommended technologies, number of projects, and project sequences to take into account new scientific information about endangered salmon, the need to coordinate with other projects in the area, and the desire to minimize the rate of increase in sewer rates.

The 2012 program review assessed the following CSO discharge areas:

- East Duwamish Waterway, including the HLKK project
- East Lower Duwamish River, including the Brandon/Michigan and Hanford #1 projects
- West Lower Duwamish River, including the West Michigan/Terminal 115 project
- West Duwamish Waterway, including the Chelan project
- East Lake Washington Ship Canal, including the Montlake and University projects
- West Lake Washington Ship Canal, including the 11th Ave NW and 3rd Ave W projects

The resulting 2012 CSO control plan prioritizes CSO control projects based on water body uses and the public and environmental health risks posed by CSO discharges into the water bodies. The order of the projects is based on risks after control is achieved. Projects in the water bodies that are most sensitive to public and environmental health risks will be completed first.Prior to the RWSP, WTD used CSO volume as a key component to set project priorities. This approach was discontinued with agreement of our regulatory agencies when it became clear that volume reduction does not fully capture the benefits of CSOs control. The relationship between CSO volume and pollutant loading is described later in the CSO volume and pollutant loading section.

For this proviso analysis, metrics were developed and applied to quantify the qualitative assessment of public and environmental health risks and benefits used in the 2012 CSO control program review. The metrics were used to assess the public and environmental health sensitivity of water bodies to determine the best water quality benefit for each discharge area as early as possible. No additional water quality studies were conducted for this analysis.

Results of the Water Quality Assessment-Monitoring Study that was authorized through Ordinance 17413 will provide additional information that may lead to consideration of changes in the sequence of future CSO control projects. Information from the study will also inform decisions on whether to develop an integrated plan under the EPA framework. Such a plan would sequence and integrate CSO control projects with other water quality improvement projects in the discharge areas to achieve the greatest water quality improvement as early and cost-effectively as possible. Ecology and EPA must approve any recommended amendments to the 2012 CSO control plan.

Methodology

The sensitivity of discharge areas to the effects of pollutants in CSOs and the resulting priorities for CSO control were evaluated in terms of four public and environmental health factors:

- Public exposure to pathogens
- Public consumption of resident fish
- Recontamination of sediments
- Salmon exposure to contaminants

The methodology used is as follows:

- Metrics were developed, such as the type and number of fish habitat sites, fishing and swimming areas, and shoreline access, to assign scores to characteristics of the water body that could indicate the potential for exposure to pollutants from CSOs.
- The sensitivity scores for each of the four public and environmental health factors were used to determine priorities for sequencing CSO control by discharge area. Because the scores for public exposure and salmon exposure were each based on metrics for two characteristics, they were divided by three (normalized) to bring them into the same range as fish consumption and sediment remediation for which only one characteristic was used.
- The scores for all four factors were combined for each discharge area to determine an overall sequencing priority for CSO control ("metrics-based" sequence).
- To respond to the budget proviso, the metrics-based sequence was altered to accommodate acceleration of the HLKK project.
- Both the metrics-based and HLKK accelerated sequences were compared to the CSO control project sequence in the 2012 CSO control plan.
- Sensitivity scores were plotted against estimated CSO control project costs for each discharge area to give a sense of which areas provide the best public health and environmental benefit at least cost.

Metrics

This section describes the metrics used to assign sensitivity scores for each public and environmental health factor.

Public Exposure to Pathogens (Public Health Sensitivity)

A discharge area's sensitivity to pathogens from CSOs was based on the type of exposure and number of locations where exposure could occur. In addition, Seattle Shoreline Master Program use designations were considered as indications of actual or desired uses of a water body.[3] Sensitivity to exposure is the product of the score for the type of water body use multiplied by the number of use locations.

Metrics for type of water use:

Swimming/net fishing (high contact use) = 3

Hand-carry boat launching (medium contact use) = 2

Shoreline access/incidental contact (low contact use) = 1

Metrics for number of locations where the use can occur:

High number = 3

Medium number = 2

Low number = 1

No use = 0

Table B-1 shows the sensitivity scores based on the metrics for human exposure to pathogens and the resulting sequencing priorities for each discharge area. The higher the score, the higher the sensitivity of the water body and the priority for CSO control.

Table B-1. Sensitivity Scores and Implementation Sequence Priority by Discharge Area for Human Exposure to Pathogens

Discharge Area	Sensitivity Score	Normalized Score[a]	Sequence Priority
East Lower Duwamish	3 x 3 = 9	3	1
West Lower Duwamish	3 x 2 = 6	2	2
East Duwamish Waterway	1 x 1 = 1	0.3	4
West Duwamish Waterway	3 x 1 = 3	1	3
East Ship Canal	3 x 3 = 9	3	1
West Ship Canal	2 x 3 = 6	2	2

[a] Sensitivity scores were divided by three to bring them into the same range as the factors for which metrics were assigned to only one indicator.

[3] The Seattle Shoreline Master Program use designations are shown in Table B-5.

Consumption of Contaminated Fish (Public Health Sensitivity)

The potential for human consumption of contaminated fish that reside in a water body was based on the number of locations where fishing can occur—fishing piers and non-industrial docks—in each discharge area. In addition, Seattle Shoreline Master Program use designations in the discharge area were used as indications of the actual and desired uses of the water body.

No studies are available on the number of occurrences of fishing from boats in the discharge areas. These water bodies are navigation routes, and boaters are not likely to stop in the channel to fish for resident fish. While the tribes do fish for salmon from boats in these areas, salmon do not take up significant contamination during their short feeding periods in these waterways.

Metrics for number of fishing piers and non-industrial docks in the discharge area:

High number = 3

Medium number = 2

Low number = 1

No accessible sites = 0

Table B-2 shows the sensitivity scores based on the metrics for human consumption of contaminated resident fish and the resulting sequencing priorities for each discharge area. The higher the score, the higher the sensitivity of the water body and the priority for CSO control.

Table B-2. Sensitivity Scores and Implementation Sequence Priority by Discharge Area for Resident Fish Consumption

Discharge Area	Sensitivity Score	Sequence Priority
East Lower Duwamish	2	2
West Lower Duwamish	0	4
East Duwamish Waterway	0	4
West Duwamish Waterway	2	2
East Ship Canal	3	1
West Ship Canal	1	3

Sediment Recontamination (Environmental Sensitivity)

The sensitivity of a discharge area to sediment recontamination was based on the timing of expected remediation. Near-term expected cleanups increase the sensitivity. Depending on the extent of remaining CSO volume and duration after control, the public prefers that CSO control be completed before sediment remediation to minimize the risk of recontamination. The timing will depend on remediation schedules, which are still uncertain for remediation not yet under way, and on CSO control schedule commitments.

Metrics for timing of expected remediation:

Present = 3

Near future = 2

Distant future = 1

No remediation required = 0

Table B-3 shows the sensitivity scores based on the metrics for sediment recontamination and the resulting sequencing priorities for each discharge area. The higher the score, the higher the sensitivity of the water body and the priority for CSO control.

Table B-3. Sensitivity Scores and Implementation Sequence Priority by Discharge Area for Sediment Recontamination Potential

Discharge Area	Sensitivity Score	Sequence Priority
East Lower Duwamish	3	1
West Lower Duwamish	3	1
East Duwamish Waterway	2	2
West Duwamish Waterway	0	4
East Ship Canal	1	3
West Ship Canal	2	2

Salmon Exposure (Endangered Species Sensitivity)

The sensitivity of salmon exposure to chemicals in CSOs in a discharge area was estimated by the size of the Chinook and Coho salmon runs and the speed at which the salmon move through the discharge area. If higher quality habitat is available, salmon may stay in the area longer. Downstream obstacles to survival were noted, and Seattle Shoreline Master Program use designations were considered as indications of the actual and desired uses of the discharge area.

Literature reviewed for the 2012 CSO control programreview indicates that salmon can be adversely impacted by metals in the water.[4] Juvenile salmon's sense of orientation can be disrupted and their ability to avoid prey can be impaired. Their immune systems may also be affected, reducing their chances of survival. Some studies have also indicated that metal exposure can impair adult salmon's ability to navigate back to their natal waters.

Sensitivity of exposure was assessed as the product of the number of available habitat sites multiplied by the size of the Chinook and Coho salmon runs based on the Washington State Department of Fish and Wildlife status designation for each species.

Metrics for number of habitat sites available for fish:

High number of sites = 3

Medium number of sites = 2

Low number of sites = 1

No habitat = 0

Metrics for size of salmon run:

Healthy = 3

Depressed = 2

Critical = 1

Table B-4 shows the sensitivity scores based on the metrics for salmon exposure to contaminants and the resulting sequencing priorities for each discharge area. The higher the score, the higher the sensitivity of the water body and the priority for CSO control.

[4] Technical Memorandum 540, Environmental and Habitat Priorities. 2010. King County Wastewater Treatment Division. http://www.kingcounty.gov/environment/wastewater/CSO/ProgramReview/Plan.aspx.

Table B-4. Sensitivity Scores and Implementation Sequence Priority by Discharge Area for Salmon Exposure to Contaminants

Discharge Area	Sensitivity Score	Normalized Score[a]	Sequence Priority
East Lower Duwamish	3 x 3 = 9	3	1
West Lower Duwamish	3 x 3 = 9	3	1
East Duwamish Waterway	2 x 2 = 4	1.3	2
West Duwamish Waterway	3 x 3 = 9	3	1
East Ship Canal	2 x 2 = 4	1.3	2
West Ship Canal	1 x 1 = 1	0.3	3

[a] Sensitivity scores were divided by three to bring them into the same range as the factors for which metrics were assigned to only one indicator.

Data Used to Assign Sensitivity Metrics

Table B-5 summarizes the information by CSO discharge area used to assign sensitivity metrics. The approximate numbers of shoreline parks, hand-carry boat launches, fishing areas, and salmon habitat shown in the table were considered in relation to inventories found in various reports and to Seattle shoreline use designations. The use and exposure section that is provided later on this exhibit gives more detail and provides references to the information sources.

Table B-5. Data Used to Assign Sensitivity Metrics

Discharge Area	Seattle Shoreline Designation	Approx. No. of Shoreline Parks and Hand-Carry Boat Launces	Approx. No. of Fishing Piers and Tribal Fishing Areas	Timing of Sediment Remediation	Available Salmon Habitat/Size of Run
East Lower Duwamish	Urban Industrial	5	2	Now	3 completed and 1 planned habitat project/healthy run size
West Lower Duwamish	Urban Industrial except Kellogg Island (Conservancy Protection)	1	0	Now	5 habitat areas/healthy run size
East Duwamish Waterway	Urban Industrial	2	0	Approximately 2018–2019	2 planned habitat projects; lesser juvenile migration pathway/healthy run size
West Duwamish Waterway	Urban Industrial up to Seacrest Marina	3 (2 are near scuba diving areas)	2	None needed	1 completed and 2 planned habitat projects; greater juvenile migration pathway/healthy run size
East Ship Canal	Conservancy Recreation, Conservancy Protection, Urban Residential, and Urban Commercial	7 (also floating homes)	1, plus many private docks	None on the horizon (not yet assessed)	Moderate habitat upstream; Ballard locks are high risk for undermining effectiveness of upstream protections/ depressed run size
West Ship Canal	Urban Industrial, Urban Maritime, Conservancy Management, and Urban Residential downstream of Locks	13	1	Future (expected but not in yet development)	2 planned habitat projects; Ballard locks are high-risk habitat/depressed run size

Note: Juvenile salmon do not accumulate enough contamination to impact adult fish tissue, and adult salmon acquire their contaminant load in the ocean environment.

Combined Sensitivity Scores and Priorities

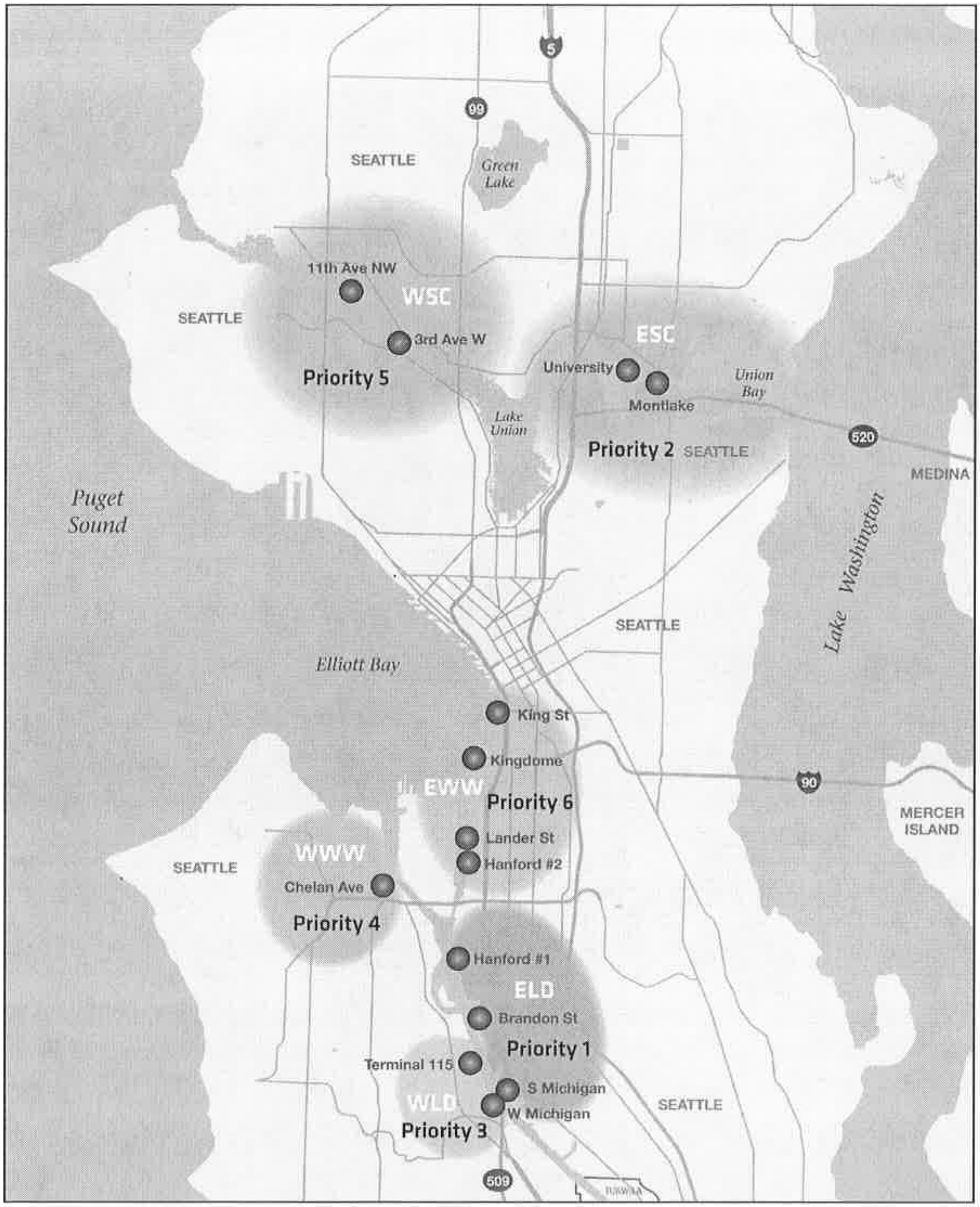
Table B-6 and Figure B-1 show the combined sensitivity scores for all four factors for each discharge area and the resulting sequence priority, which is compared to the same sequence with the acceleration of the HLKK project and with the 2012 CSO control plan sequence.

The resulting optimal project sequence is generally similar to the 2012 CSO control plan sequence. The East Duwamish Waterway, where the HLKK facility will discharge, received the lowest priority in both the sensitivity scoring and in the CSO control plan. The HLKK project would control the largest CSO volume, but would not achieve the same public and environmental health benefit as the other CSO projects. The small differences between the metrics-based sequence and the CSO control plan sequence reflect other factors considered in the CSO control program review, such as the need to coordinate with other projects in the area (for example, the Lower Duwamish Superfund cleanup) and the desire to minimize the rate of increase in sewer rates.

Table B-6. Combined Sensitivity Scores by Discharge Area and Resulting Sequence Compared to the Same Sequence with Accelerated HLKK Project and the 2012 CSO Control Plan Sequence

Discharge Area and Planned CSO Control Projects	Sensitivity Score (Likelihood of Exposure)					Sequence		
	Pathogen	Fish Consumption	Sediment Recontamination	Salmon Exposure	Total	2012 CSO Plan	Priority Area Based on Sensitivity Scores	Revised Sequence with Early HLKK
East Lower Duwamish Hanford #1 Brandon/Michigan	3	2	3	3	11	 1[a] 2	1	1
West Lower Duwamish (W Michigan-Terminal 115)	2	0	3	3	8	3	3	4
East Duwamish Waterway (Hanford #2-Lander St-King St-Kingdome [HLKK])	***0.3***	***0***	***2***	***1.3***	***3.6***	***6***	***6***	***2[b]***
West Duwamish Waterway (Chelan)	1	2	0	3	6	3	4	5
East Ship Canal (University and Montlake)	3	3	1	1.3	8.3	5	2	3
West Ship Canal 3rd Ave W 11th Ave NW	2	1	2	0.3	5.3	 4[c] 6	5	6

Note: Individual projects are shown for discharge areas if the projects were assigned different priorities in the 2012 CSO control plan.
[a] Hanford #1 was swapped with University in 1999 to avoid construction conflicts in the Montlake Cut area and minimize recontamination of an earlier remediation at Hanford #1. Both the Hanford #1 and Brandon/Michigan CSO control projects are under way.
[b] The earliest that construction can begin on the HLKK project is 2017, after completion of enhanced monitoring and modeling, predesign and design.
[c] The 3rd Ave W project was brought forward at the request of the City of Seattle for a joint project.



CSO DISCHARGE AREAS

WSC	West Lake Washington Ship Canal
ESC	East Lake Washington Ship Canal
WWW	West Duwamish Waterway
EWW	East Duwamish Waterway
WLD	West Lower Duwamish River
ELD	East Lower Duwamish River

● King County CSO Site

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August 2013

King County

Figure B-1. Priorities for CSO Control Based on Sensitivity Scores for Discharge Areas

Discharge Area Sensitivity Versus CSO Control Project Costs

Figure B-2 shows CSO control cost compared to combined sensitivity scores for all projects in each discharge area. Water body sensitivity is color-coded. Greater cost-benefit is found in the lower left quadrant (highest public and environmental health sensitivity score and least cost). The East Lower Duwamish River carries the highest sensitivity at relatively high cost, while the West Lower Duwamish River carries the next highest sensitivity at lowest cost.

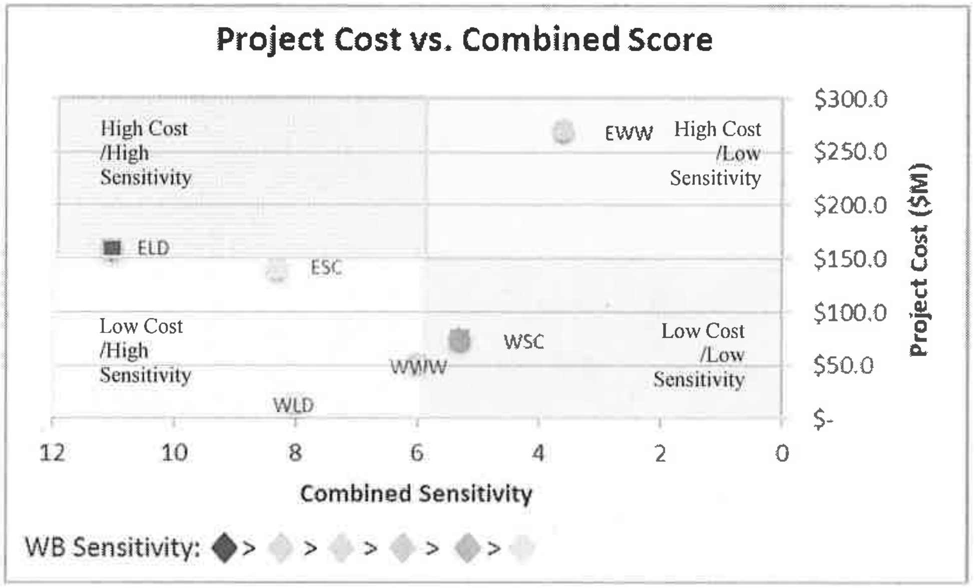

Figure B-2. Project Cost Versus Environmental and Public Health Scores (Sensitivity) for Each Discharge Area

CSO Volume and Pollutant Loading

Because the impacts of CSO discharges are not equal for every receiving water body, the amount of untreated CSO volume reduced is not necessarily the best indicator in determining pollution reduction benefits. The use of the water body and its sensitivity to the impacts of both treated and untreated discharges are important considerations when assessing the sequence of CSO control projects. The goal is to determine where the best water quality can be achieved the earliest. This is why the Council-approved CSO control plan did not prioritize projects based solely on the amount of volume controlled. Both the EPA and the Ecology (173-245-040-(2)(d) WAC) list a variety of criteria to be considered in prioritizing CSO control, primarily around the uses of the water bodies where discharges occur but also pollution impacts.[5]

Combined flows from the seven CSO storage facilities to be built as part of the 2012 CSO control plan will be sent to other facilities for treatment when conveyance capacity becomes available after a storm. The plan assumes that stored flows along the Lake Washington Ship Canal will be sent to West Point Treatment Plant for secondary treatment and that stored flows south of the Interbay Pump Station in Magnolia will drain to the HLKK facility for CSO treatment. The conveyance pipelines that lead to West Point from this southern area are large and take a long time to drain. If storage facilities were designed to drain to these pipelines, the size and cost of the storage facilities would increase.[6]

In 2009, pilot testing was conducted of CSO treatment technologies that will be used at the two new CSO treatment facilities in the plan (HLKK and Brandon-Michigan).[7] The testing measured removal efficiencies of three pollutants identified as having public and environmental health concerns: polychlorinated biphenyls, or PCBs (fish consumption) and total and dissolved copper (harm to salmon populations). These pollutants are likely representative of other pollutants of concern. The following average removal efficiencies were noted:

- 72 percent PCB removal
- 49 percent total copper removal
- 20 percent dissolved copper removal

The following tables and figures show projected pre-control and post-control discharge volumes and concentrations for these pollutants for each CSO discharge area. The volumes are based on

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[5]Combined Sewer Overflows Screening and Ranking Guidance, August 1995. http://cfpub.epa.gov/npdes/docs.cfm?document_type_id=1&view=Policy%20and%20Guidance%20Documents&program_id=5&sort=name.

[6] Assessing the impacts of these stored flows on the HLKK treatment facility will require complex system modeling that will be done for final project sizing during design.

[7] King County Department of Natural Resources and Parks, Wastewater Treatment Division. 2010.CSO Pilot Study (Final) Contract No. E00046E06. Combined Sewer Overflow TreatmentSystems Evaluation and Testing, Phase 2, Subtask 340 – Pilot Test Report. Seattle, WA.

modeling done for the CSO control program review; the concentrations are based on the average removal efficiencies and on concentrations of pollutants in combined flows. The tables and figures show that the discharge of the three pollutants from the HLKK facility will contribute more pollution into its water body (East Duwamish Waterway) *after* control than the total discharges to the other water bodies *without* control projects.

Treated and Untreated Discharge Volumes

Table B-7. Discharge Volumes Before and After CSO Control
(based on modeling done for the 2012 CSO control plan)

Discharge Area	Pre-Control Volume (2012) (MG/yr)	Volume Discharged After CSO Control (MG/yr)			Total Volume Removed (MG/yr)
		Untreated	Treated	Total	
East Duwamish Waterway	499.40	2.20	497.20	499.40	0.00
West Lower Duwamish (WLD)	3.50	2.99	0	2.99	0.51
East Lower Duwamish	131.27	6.83	118.37	125.20	6.07
West Duwamish Waterway	17.20	4.09	0	4.09	13.11
East Ship Canal	48.20	26.57	0	26.57	21.64
West Ship Canal	28.60	5.15	0	5.15	23.45

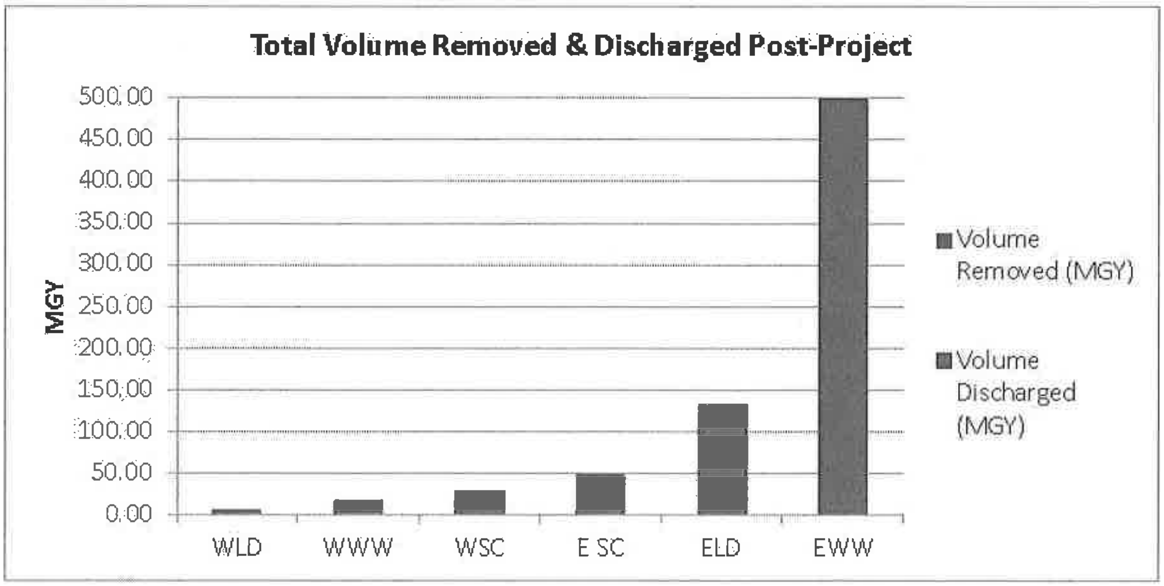

Figure B-3. Volume Removed and Discharged After CSO Control
(based on modeling done for the 2012 CSO control plan)

Pollutant Concentrations

Monitoring done in recent years for the Lower Duwamish Superfund process found the following mean concentrations of PCBs and total and dissolved copper in untreated CSOs:[8]

Total PCBs	0.00022 mg/L
Total copper	0.0432 mg/L
Dissolved copper	0.0044 mg/L

Loadings (pounds of pollutants discharged per year) from CSO treatment facilities were calculated using the following formula:

Pounds per year discharged = volume discharged (MG/yr) x effluent concentration (untreated concentration x 100 percent removal) x 8.34 (conversion factor)

Table B-8. Total Copper Discharges Before and After CSO Control

Discharge Area	Pre-Control Total Copper Discharged (lb./yr.)	Total Copper Discharged After CSO Control (lb./yr.)			Total Copper Removed (lb./yr.)
		Untreated Discharge	Treated Discharge	Total Discharge	
East Duwamish Waterway	179.93	0.79	91.36	92.15	87.78
West Lower Duwamish	1.26	1.08	0	1.08	0.18
East Lower Duwamish	43.66	0.98	21.75	22.73	20.92
West Duwamish Waterway	6.20	1.47	0	1.47	4.72
East Ship Canal	17.37	9.57	0	9.57	7.79
West Ship Canal	10.30	1.86	0	1.86	8.45

[8] http://your.kingcounty.gov/dnrp/library/wastewater/iw/CSO_DataReport/DuwRiverBasin_CSO_DataReport_Dec2011.pdf.

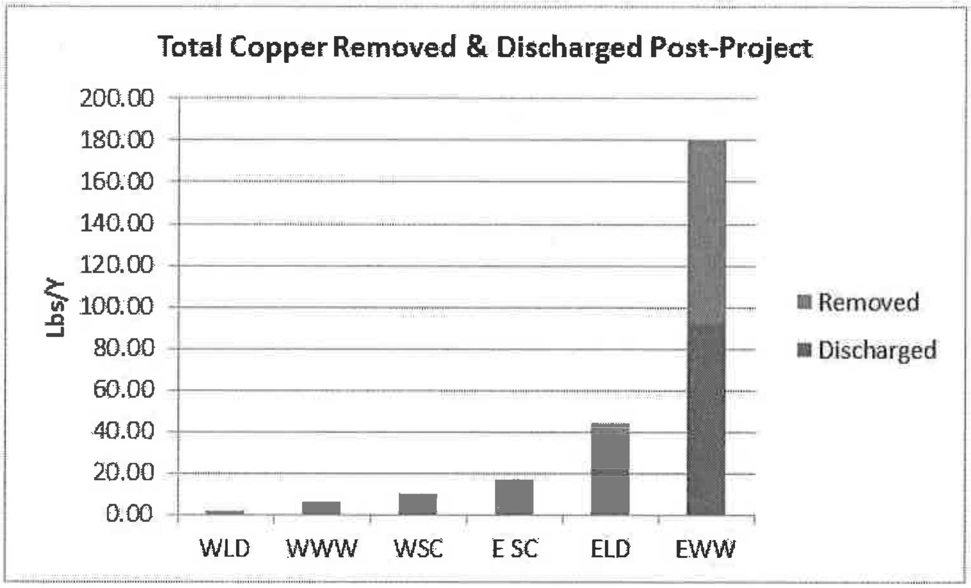

Figure B-4. Total Copper Removed and Discharged After CSO Control

Table B-9. Dissolved Copper Discharges Before and After CSO Control

Discharge Area	Pre-Control Dissolved Copper Discharged (lb./yr.)	Dissolved Copper Discharged After CSO Control (lb./yr.)			Dissolved Copper Removed (lb./yr.)
		Untreated Discharge	Treated Discharge	Total Discharge	
East Duwamish Waterway	18.33	0.08	14.60	14.68	3.65
West Lower Duwamish	0.13	0.11	0	0.11	0.02
East Lower Duwamish	4.45	0.10	3.47	3.57	0.87
West Duwamish Waterway	0.63	0.15	0	0.15	0.48
East Ship Canal	1.77	0.97	0	0.97	0.79
West Ship Canal	1.05	0.19	0	0.19	0.86

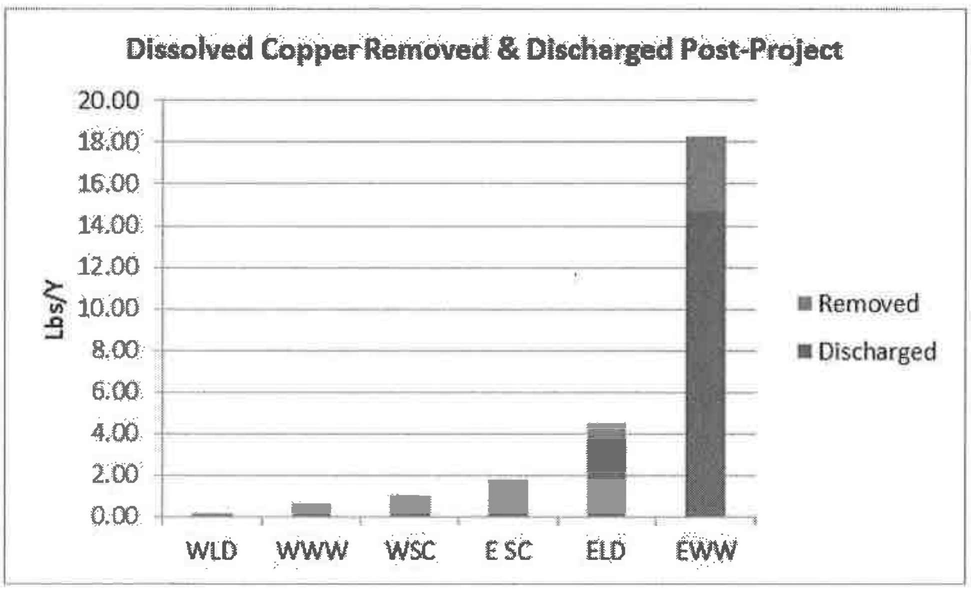

Figure B-5. Dissolved Copper Removed and Discharged After CSO Control

Table B-10. PCB Discharges Before and After CSO Control

Discharge Area	Pre-Control PCBs Discharged (lb./yr.)	PCBs Discharged After CSO Control (lb./yr.)			Dissolved PCBs Removed (lb./yr.)
		Untreated Discharge	Treated Discharge	Total Discharge	
East Duwamish Waterway	0.9145	0.0040	0.2549	0.2589	0.6555
West Lower Duwamish	0.0064	0.0055	0	0.0055	0.0009
East Lower Duwamish	0.2219	0.0050	0.0607	0.0657	0.1562
West Duwamish Waterway	0.0315	0.0075	0	0.0075	0.0240
East Ship Canal	0.0883	0.0486	0	0.0486	0.0396
West Ship Canal	0.0524	0.0094	0	0.0094	0.0429

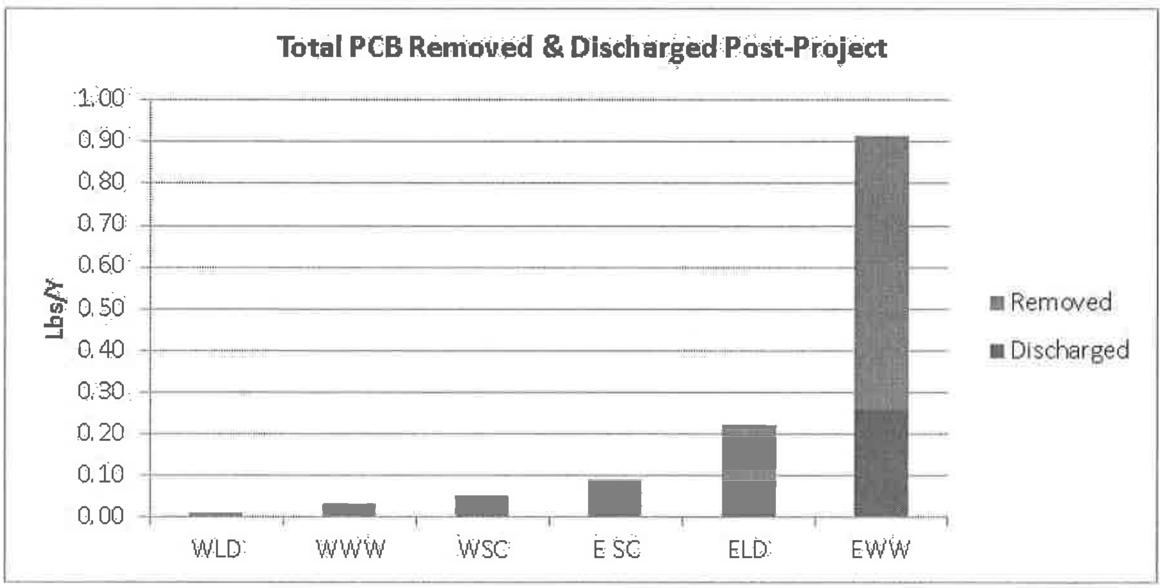

Figure B-6. PCBs Removed and Discharged After CSO Control

Use and Exposure Information

This section provides a summary (Table B-11) of use and exposure and the associated information sources.

Table B-11. Use and Exposure Summary

Discharge Area	Seattle Shoreline Designations	Parks with Waterfront Access and Number of Hand-Carry Boat Launches	Fishing piers, and Tribal Usual and Accustomed Fishing Areas	Timing of Sediment Remediation	Salmon Rearing and Migration Pathways
East Lower Duwamish	All Urban Industrial (UI)	Jack Block Park (Terminal 5) Terminal 115 Shoreline Diagonal Ave S Public Access Duwamish Public Access – T105 Duwamish Public Access – T107	Fishing pier at Terminal 5 park, Terminal 105	Part of Lower Duwamish Waterway (LDWW) Superfund process – Record of Decision (ROD) and allocation underway; early action cleanups completed	3 Port of Seattle (Port) habitat projects completed Planned Brandon Habitat
West Lower Duwamish	All UI except Kellogg Island designated Conservancy Protection (CP)	SW Edmunds street end park		Part of LDWW Superfund process – ROD and allocation underway; early action cleanups completed	3 Port habitat initiative projects, Kellogg Island Habitat, SR 509 Habitat NW of 1st Ave S. Bridge
East Duwamish Waterway	All UI	Jack Perry Memorial Shoreline Public Access SW Spokane Street end park		Hanford & Lander existing outfall, and possible treatment plant outfall are within the Harbor Island Superfund process; cleanup up to 10 years out; Port dredging removes much sediment on regular basis King & Kingdome existing outfalls are in the area proposed for a joint clean up with	Lesser juvenile salmon migration pathway; 2 Port habitat initiative projects

Discharge Area	Seattle Shoreline Designations	Parks with Waterfront Access and Number of Hand-Carry Boat Launches	Fishing piers, and Tribal Usual and Accustomed Fishing Areas	Timing of Sediment Remediation	Salmon Rearing and Migration Pathways
				Seattle and Washington State Department of Transportation (WSDOT).	
West Duwamish Waterway	All UI (up to Seacrest Marina)	Seacrest Park and marina (scuba) Don Armeni boat ramp (scuba) Terminal 18 Public Access Park	Seacrest Park & Don Armeni boat ramp piers	Part of Harbor Island Superfund process; 9/11/03 ROD was no remediation needed	Greater juvenile salmon migration pathway; 2 Port habitat initiative projects; 1 completed
East Ship Canal	Conservancy Recreation, (CR), Conservancy Preservation (CP),Urban Residential (UR)	Washington Park Arboretum Sunnyside boat ramp North & South Passage Parks (view only) McCurdy Park University of Washington Watercraft Activities Center Floating Homes Brooklyn Ave Street End Park	Sunnyside boat ramp piers Floating homes docks Numerous private docks		
West Ship Canal	UI, Urban Mixed (UM), Conservancy Management (CM). UR downstream of Locks	14th Ave NW Boat Ramp Maintained Street end parks at Fremont Bridge, 3rd N & Etruria, Cremona, Bertona, Queen Anne N, 3rd Ave W, 36th Ave NW, 24th Ave NW, Gilman Ave. Fisherman's Terminal (marina) Numerous private	14th Ave NW Boat Ramp piers		2 Port mitigation projects

Discharge Area	Seattle Shoreline Designations	Parks with Waterfront Access and Number of Hand-Carry Boat Launches	Fishing piers, and Tribal Usual and Accustomed Fishing Areas	Timing of Sediment Remediation	Salmon Rearing and Migration Pathways
		marinas			

Use and Exposure Information Sources

City of Seattle Shoreline Master Program Update - Director's Report, June 2012

http://www.seattle.gov/dpd/Planning/ShorelineMasterProgramUpdate/Overview/

King County CSO Control Annual Reports, King County, 2008, 2009, 2010, 2011

Seattle Department of Transportation street end park map:
http://www.seattle.gov/transportation/stuse_stends.htm

Seattle Parks & Recreation Search for a Park by Feature:
http://www.seattle.gov/parks/feature_search.htm

Seattle Parks & Recreation shoreline access map:
http://www.seattle.gov/parks/boats/boatingmapsall.htm

Seattle Shoreline Park Inventory and Habitat Assessment, Anchor Environmental, June 2003:
http://www.seattle.gov/parks/projects/SeattleShorelineManagement.pdf

Port of Seattle Parks & Shoreline Access Guide: http://www.portseattle.org/parks-public-access/Pages/default.aspx

Habitat Restoration along the Duwamish, King County:
http://www.kingcounty.gov/environment/watersheds/green-river/OurDuwamish/Cleanup/HabitatRestoration.aspx

Lower Duwamish River Habitat Restoration Plan, An Inventory of Port of Seattle Properties, AHBL Seaport Planning Group, Adopted July 2009

Inventory and Mapping of City of Seattle Shorelines along Lake Washington, the Ship Canal, and Shilshole Bay; Toft, Jason; Simenstad, Charles; Young, Carl; Stamatiou, Lia; Wetland Ecosystem Team, School of Aquatic and Fishery Sciences, University of Washington, Seattle, WA, April 2003

Washington Department of Fish and Wildlife Salmon Inventory website:
http://wdfw.wa.gov/conservation/fisheries/sasi/

ExhibitC

Rate, Financing, and Lifecycle Cost Analysis

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Introduction

This exhibit compares the estimated annual expenditures, lifecycle costs, financing costs, and sewer rates associated with the adopted CSO control plan project sequence to those associated with the alternative sequencing option. In addition, the exhibit discusses the sensitivity of the results of the analysis to changes in real interest rates and the ability to mitigate the rate impacts through alternative financing arrangements.

Background

WTD's CIP is funded through a mix of proceeds from long-term revenue bonds, short-term variable-rate borrowing, capacity charge revenues, and transfers from the operating fund. The operating fund derives the majority of its revenue from monthly charges to customers (sewer rates) collected by the local sewer agencies served by the County's regional wastewater system:

- **Monthly sewer rate.** The 2013–2014 monthly sewer rate charged to local agencies is $39.79 per single-family home, or Residential Customer Equivalent (RCE). Commercial customers, including multi-family buildings, are charged the same rate based on metered water use (1 RCE = 750 cubic feet per month). The monthly sewer rate generates approximately 82 percent of total operating revenues.
- **Capacity charge.** The capacity charge is a fee that new sewer connections pay in addition to the regular monthly sewer rate. Because existing customers must pay for the capacity necessary to serve growth customers before the growth arrives, the capacity charge provides a means for growth customers to pay their equitable share of the cost of service. Given current policies for the capacity charge, changes in the CSO control program affect the sewer rate only, not the capacity charge. The capacity charge generates approximately 14 percent of total operating revenues.

King County financial policies require that WTD maintains a minimum debt service coverage ratio of 1.15 for all debt service payments and a minimum of 1.25 for all parity debt (sewer revenue bonds and county general obligation bonds backed by sewer revenues). Thus, the monthly sewer rate is set so that operating revenues will exceed debt service plus operating expenses by an amount equal to at least 15 percent of the total debt service expense. This buffer reduces the risk to bondholders and provides the County with funds to reduce the amount of borrowing necessary to finance the CIP.

Financing decisions are based on the entire CIP rather than individual projects, with the exception of alternative low-cost financing that the County may pursue for specific capital projects from sources such as the State Revolving Fund and the Public Works Trust Fund. As a result, some capital projects may be funded or partially funded by grants or low-interest loans. However, grant funding tends to be relatively scarce.

An important factor in assessing alternative CSO control project sequences during development of the 2012 CSO control plan was their impact on sewer rates. In recommending a sequence and project schedules, the County sought to minimize and distribute rate increases over time through sound and sustainable financial approaches that would yield affordable rates. The acceleration of the HLKK project was chosen as the alternative sequencing option for this proviso analysis because it is the most complex and costly of the seven future CSO projects. This option will illustrate the maximum impact from accelerating a single project by yielding the largest potential savings from relatively low interest rates and having the largest effect on sewer rates.

An analysis of the effects of accelerating the HLKK project needs to include an investigation of both CIP and HLKK project costs that captures the impact of changing prices, financial conditions, and operating costs during the period when CSO control projects will be completed. The cost analysis must include a number of elements, including inflation, timing of expenditures, and interest rates at the time of expenditure. By accelerating the project, some costs will be incurred earlier and thereby will be subject to smaller nominal increases in prices as the result of inflation. However, the earlier spending will put upward pressure on the lifecycle cost of the project when expressed in present value.

Regardless of relative cost, accelerating a project, all else being equal, will increase near-term sewer rates. While there are a number of financing approaches that can shift and manage patterns of rate increases, they come with a cost and must be considered in the broader context of WTD's current and future debt profile. During construction of the Brightwater Treatment Plant and Conveyance project (2003 to 2013), WTD's total outstanding debt more than doubled from approximately $1.6 to $3.5 billion. WTD issued over $1.2 billion in long-term bonds from 2008 to 2010 alone. Although WTD's excellent bond ratings have been reaffirmed throughout this period, any increases in WTD's total debt burden from project acceleration would require careful analysis to ensure that WTD's debt service and bond rating are not negatively impacted.

Methodology and Assumptions

To evaluate the alternative sequencing option relative to the approved sequence, the following analyses were performed:

- Compared annual HLKK project capital expenditures through 2030, with inflation, for the approved and accelerated project schedules.
- Estimated annual startup and ongoing O&M costs, in 2013 dollars, for the HLKK project.
- Compared a range of HLKK project lifecycle costs (present value) for the approved and accelerated project schedules. The lifecycle costs were translated into an average annual cost for each alternative.
- Analyzed the sensitivity of lifecycle costs to changing real interest rates using two series of interest rate forecasts and two discount rates.
- Compared annual monthly sewer rates for 2014–2040 for the CIP with the accelerated and the approved HLKK project schedules.
- Examined the sewer rate impact, with inflation, for the range of planning-level cost estimates for the accelerated project.
- Examined the advantages and disadvantages of using various financing strategies to manage the impact of the accelerated HLKK project on sewer rates through 2026.

Several assumptions were used in the analysis:

- All CSO control projects will be completed by the end of 2030.
- The approved CSO control project sequence calls for the HLKK project to start in 2021; the alternative sequencing option accelerates the start date to 2014.
- No other changes are made to the CIP.
- The annual rate of inflation is 3 percent throughout the period of analysis (2014–2030).
- Costs reflect planning-level project estimates, with an accuracy range of –50 to +100 percent.
- The planning-level cost estimate to construct the HLKK project (in 2013 dollars) is the same for the approved and accelerated sequences. This planning-level estimate is used for all analyses, except where the sewer rate impacts of the upper (+100 percent) and lower (–50 percent) bounds of the estimate range are examined for the accelerated project.
- The HLKK facility will have a 50-year life.
- Startup costs for HLKK will be incurred for two years.
- WTD's practice of securing financing through 40-year-term bonds and borrowing for new funds annually was assumed.

Annual Expenditures

This section presents estimates of annual CIP capital expenditures from 2014 through 2030 (the period when the CSO control plan will be implemented) and annual O&M expenditures for the HLKK project. These estimates were used as input in the analysis of lifecycle and annual costs and of rate impacts of the HLKK project under both the approved and accelerated schedules.

Total Capital Program Expenditures for Each Sequence

Figure C-1 compares the annual capital expenditures, in 2013 dollars, of the WTD CIP program with the two CSO project sequences analyzed. During the entire period of analysis (2014–2030), the HLKK project accounts for $299.9 million, or approximately 10 percent of total spending, regardless of when the project is implemented. However, the percentage of total spending can be significantly higher on an annual basis. The planning phase of a project does not require a significant amount of capital spending. Consequently, capital spending in 2014 through 2016 is close to the same under both the approved and the accelerated sequences. In the first 12 years of the period, the CIP with the accelerated sequence spends $209 million more compared to the CIP with the approved sequence; by 2030, the CIP will have spent the same amount.

Figure C-2 presents the same information on total capital program spending but in nominal dollars, which include inflation and the effects of price increases over time. All else being equal, accelerating the project can lower the total project cost in nominal terms because the prices paid for labor, materials, and contracts will tend to be lower.

The effect on annual capital expenditures, both without and with inflation, would be greatest from 2019 through 2022 for the accelerated HLKK sequence and from 2026 through 2030 for the approved sequence.

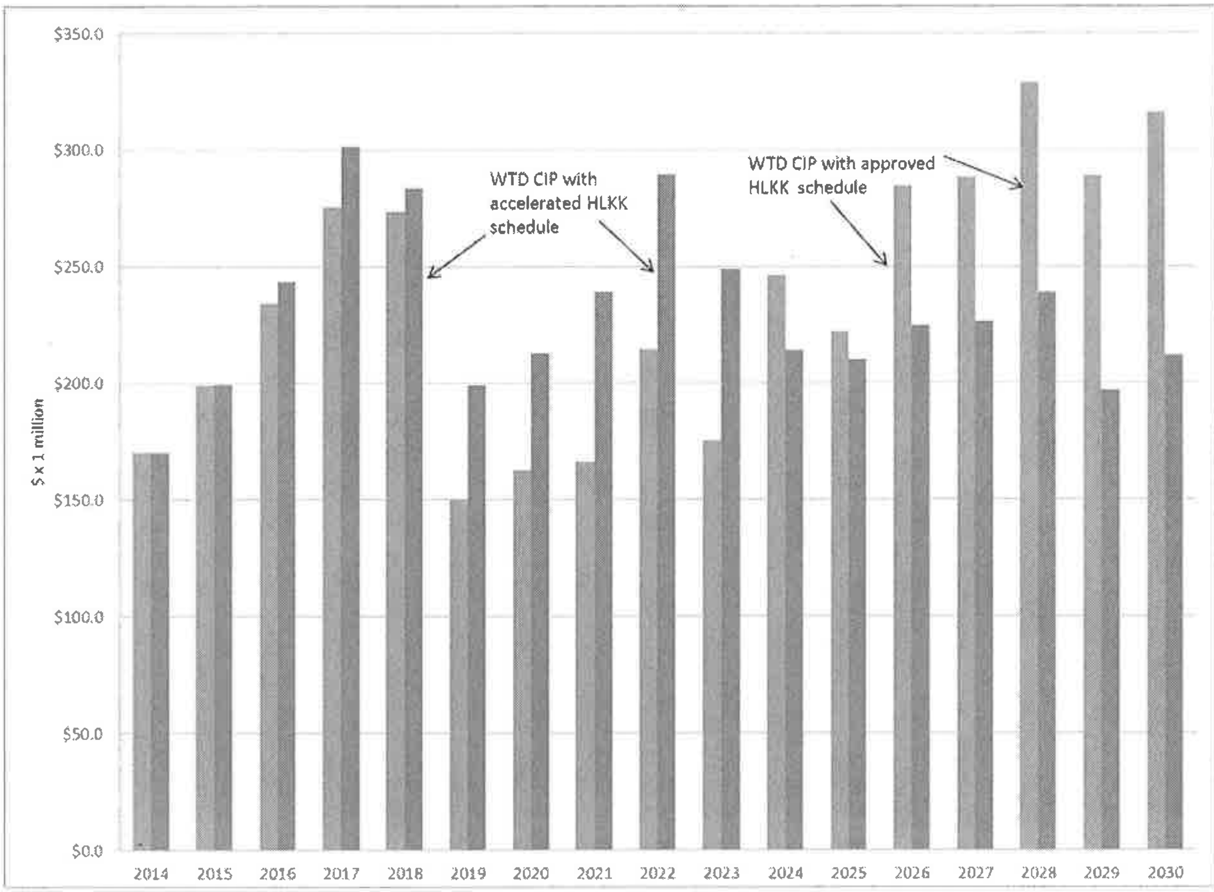

Figure C-1. Total WTD Capital Expenditures for Both CSO Control Project Sequences(2014–2030, 2013 dollars)

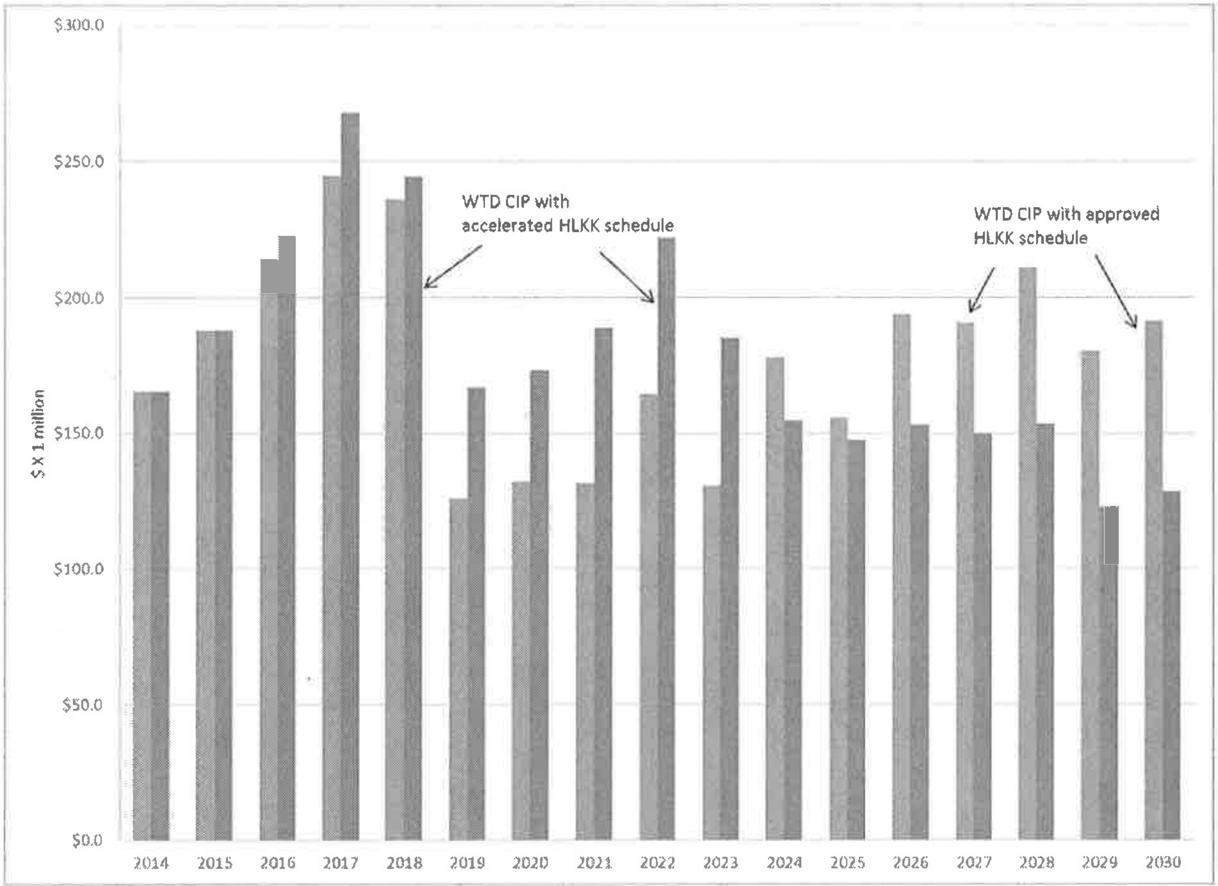

Figure C-2. Total WTD Capital Expenditures for Both CSO Control Project Sequences (2014–2030, with inflation)

HLKK Project Capital Expenditures for Each Sequence

Figure C-3 presents capital spending with inflation for the HLKK project under both the approved and accelerated sequences. Because prices will tend to be higher later in the period, the total project cost in nominal dollars is higher for the approved sequence. With a uniform 3 percent annual rate of inflation, total cost for the project is $463.4 million for the approved sequence compared to $376.8 million for the accelerated sequence.

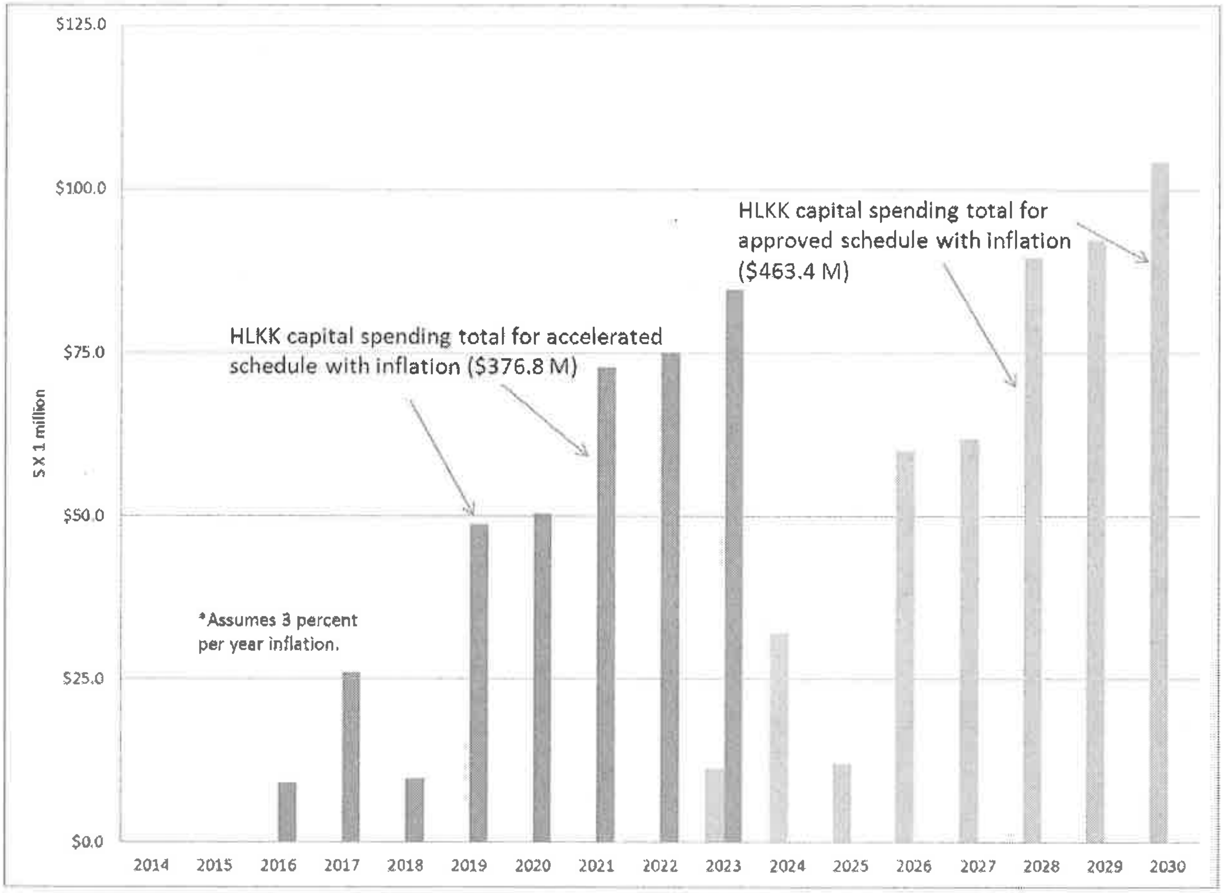

Figure C-3. Annual Capital Expenditures for the HLKK Project for Accelerated and Approved Project Schedules (2014–2030, with inflation)

Annual HLKK Operation and Maintenance Expenditures

Once completed, CSO control facilities incur ongoing O&M costs for electric power, chemicals, and staff time. CSO treatment facilities such as HLKK incur relatively high startup costs to optimize plant operations for an assumed two-year period. HLKK startup costs are estimated at $4.4 million per year in 2013 dollars. Once the startup period is complete, it is assumed that O&M costs will enter a sustained level of $1.42 million annually in 2013 dollars.

One of the sewer rate impacts associated with accelerating the HLKK project is that the O&M costs will be incurred earlier in the period and therefore for a longer time. This is important because O&M costs have a more direct and stronger impact on sewer rates compared to capital spending because they are paid directly from rate revenues and do not involve borrowing.

Lifecycle and Annual Costs for HLKK Alternatives

Lifecycle cost analysis is a means of combining capital, O&M, and financing costs into a single, consistent framework that accounts for both the magnitude and timing of expenditures and costs. The analysis translates future costs into present values to provide a consistent means of comparing alternatives with costs occurring in different periods of time. It does this by accounting for the time value of money and the effects of inflation.

Methodology and Assumptions

The following methods and assumptions were used in the lifecycle cost analysis of the HLKK project under the approved and accelerated sequences:

- The HLKK facility is assumed to have a 50-year life.
- The lifecycle costs were estimated in 2013 dollars.
- The costs include long-term financing, including 1.25 percent issuance costs on the borrowed amount. It is assumed that financing is secured with 40-year-term sewer revenue bonds.
- The period used for the lifecycle analysis is 2013–2073 (61 years), which encompasses one lifecycle of the accelerated HLKK project with no costs occurring in 2013.
- It was assumed that the HLKK project would be accelerated without real cost increases or additional costs from producing a larger capital program, such as costs associated with hiring additional employees, contractors, and consultants. The effects of these omitted costs could be significant.
- WTD uses a range of discount rates in estimating lifecycle costs of alternatives to identify the sensitivity of the analysis to changes in the relative value of future costs and revenues. Using a range helps identify whether the relative ranking of the alternatives changes due to the discount rate used. A higher discount rate places less weight on costs and revenues that occur farther in the time period, thereby shifting the weight to more near-term activities. The lower and upper bounds of the range were established as follows:
    - The lower bound of the range was established by estimating the real interest rate associated with WTD's costs of issuing debt. The combination of a long-term bond interest rate of 3.75 percent and a 3 percent inflation assumption yields a real interest rate of 0.73 percent.
    - The upper bound of the range reflects the discount rate recommended by the King County Auditor's Office as appropriate for reflecting the private sector cost of money at a real interest rate of 7 percent. The current revision of the White House Office of Management and Budgets Circular A-94 indicates a real interest rate on 30-year treasury notes and bonds at 1.1 percent, slightly higher than the low discount rate in this analysis. Using the 7 percent high discount rate gives a range for sensitivity analysis that is likely high but is in accordance with current County policy. Future discount rate policies for these types of analyses at the County are currently being discussed.

Lifecycle and Annual Cost Estimates

The total HLKK lifecycle costs for the approved and accelerated project schedules for the two discount rates are shown in Table C-1.

TableC-1. Total Estimated HLKK Lifecycle Costs for Approved and Accelerated Project Schedules (2013–2073, millions in 2013 dollars)

	Capital Outlay	Lifecycle Cost	
		Lower Discount Rate (0.73%)	Higher Discount Rate (7%)
Approved schedule	$299.9	$402.8	$68.4
Accelerated schedule	$299.9	$426.5	$108.9
Level difference	0	$ 23.8	$ 40.4
% difference	0	5.9%	59.1%

The acceleration of HLKK results in higher total lifecycle costs, ranging from 5.9 to 59.1 percent, than the project without acceleration:

- With the lower bound discount rate of 0.73 percent, accelerating the HLKK project results in additional lifecycle costs of approximately $23.8 million, or 5.9 percent.
- With the upper bound discount rate of 7 percent, accelerating the HLKK project results in additional lifecycle costs of approximately $40.4 million, or 59.1 percent.

Table C-2 presents the HLKK lifecycle costs as average annual costs for the two project schedules.

Table C-2. Estimated Average Annual HLKK Costs for Approved and Accelerated Project Schedules (2013–2073, millions in 2013 dollars)

	Capital Outlay	Average Annual Cost	
		Lower Discount Rate (0.73%)	Higher Discount Rate (7%)
Approved schedule	$299.9	$8.3	$1.4
Accelerated schedule	$299.9	$8.8	$2.2
Level difference	0	$ 0.5	$0.8
% difference	0	5.9%	59.1%

As with total lifecycle costs, the average annual costs are higher for the accelerated project:

- With the lower bound discount rate of 0.73 percent, accelerating the HLKK project results in additional annual costs of $0.5 million or 5.9 percent.
- With the upper bound discount rate of 7 percent, accelerating the HLKK project results in additional annual costs of $0.8 million, or 59.1 percent.

Sensitivity of Lifecycle Costs to Changing Interest Rates

Interest Rate Forecasts

WTD forecasts long-term interest rates through the following process:

- Estimation of the historical relationship between The Bond Buyer's 20-Bond General Obligation (GO) Index for municipal bonds and the 30-year fixed rate mortgage average in the United States.[1] These two series are used because they are publicly available; movements in the two series are closely related; the bond index correlates highly with WTD's historical cost of borrowing; and external forecasts are available for the 30-year mortgage average.
- Generation of a forecast of the municipal bond index as an estimate of long-term rates for WTD sewer revenue bonds, using the Puget Sound Economic Forecaster's (Conway Pedersen Economics, Inc.) forecast of the 30-year mortgage average.[2]

This lifecycle cost analysis examines net present values in real terms. Once a forecast is made for nominal interest rates, it must be converted to a forecast of real interest rates using an appropriate forecast for inflation. Because the 3 percent inflation rate used in the analysis of capital costs may be high given the current low inflation environment, the Federal Reserve's forecast of Personal Consumption Expenditures (PCE) inflation is used as an alternative inflation forecast for constructing the real interest rate forecast.[3] Table C-3 shows the forecasted nominal interest rate, the Federal Reserve's forecast of PCE inflation as of the September 2013 Federal Open Market Committee meeting, the real interest rate calculated assuming 3 percent inflation per year, and the real interest rate calculated using the Federal Reserve's forecasted inflation.

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[1]The 20-Bond GO Index is based on an average of certain general obligation municipal bonds maturing in 20 years and having an average rating equivalent of Moody's Aa2 and Standard & Poor's AA. The Bond Buyer's website is http://www.bondbuyer.com/.
[2]http://www.economicforecaster.com/aboutus/index.php
[3] Use of the assumed the 3 percent inflation rate for calculation of the real capital outlay numbers provides a small amount of financial conservatism in the analysis, given that the inflation rate that impacts capital spending may be higher than the general inflation rate. There are several ways to assess the sensitivity of assumptions. The method used in this analysis represents a middle ground between the two extremes of assuming a constant inflation rate and a constant real interest rate over the time period.

Table C-3. Long-Term Interest Rate Forecasts (2013–2030)

Year	Forecast Nominal Interest Rate (%)	Federal Reserve's Forecast of PCE Inflation (%)	Real Interest Rate (%) (3 percent inflation)	Real Interest Rate (Federal Reserve's PCE Inflation Forecast) (%)
2013	3.33	1.20	0.32	2.10
2014	3.45	1.80	0.44	1.62
2015	4.02	2.00	0.99	1.98
2016	4.45	2.00	1.41	2.41
2017	4.77	2.00	1.71	2.71
2018	5.02	2.00	1.96	2.96
2019	5.08	2.00	2.02	3.02
2020	5.14	2.00	2.08	3.08
2021	5.14	2.00	2.08	3.08
2022	5.14	2.00	2.08	3.08
2023	5.14	2.00	2.08	3.08
2024	5.14	2.00	2.08	3.08
2025	5.14	2.00	2.08	3.08
2026	5.14	2.00	2.08	3.08
2027	5.14	2.00	2.08	3.08
2028	5.14	2.00	2.08	3.08
2029	5.14	2.00	2.08	3.08
2030 forward	5.14	2.00	2.08	3.08

PCE = Personal Consumption Expenditures.

HLKK Lifecycle Costs Using Two Interest Rate Series

Table C-4 shows how the estimated total HLKK lifecycle cost for the HLKK alternatives (in 2013 dollars) varies with each interest rate forecast series between the upper and lower discount rates. The results show that accelerating HLKK results in higher costs in present value terms.

The cost difference ranges from $23.8 million (5.9 percent), using forecast interest rates with a 3 percent inflation rate assumption at a 0.73 percent discount rate to $48.9 million (59.1 percent), using the pivoted interest rate series with the Federal Reserve's inflation rate assumptions at a 7 percent discount rate.

Table C-4. Sensitivity of HLKK Total Lifecycle Costs to Interest Rate Forecasts (2013–2073, 2013 dollars)

Interest Rate Forecast Series	Total Lifecycle Cost (millions in 2013 $)	
	Lower Discount Rate (0.73%)	Higher Discount Rate (7%)
Forecast interest rates (3 percent inflation)		
Approved schedule	$402.8	$68.4
Accelerated schedule	$426.5	$108.9
Level difference	$ 23.8	$ 40.4
% difference	5.9%	59.1%
Forecast rates plus 50 basis points (Federal Reserve Personal Consumption Expenditures inflation)		
Approved schedule	$466.3	$79.2
Accelerated schedule	$492.9	$126.1
Level difference	$ 26.7	$ 48.9
% difference	5.7%	59.1%

Sewer Rate Impacts

The differences in the timing and amount of capital and O&M spending will result in different annual revenue requirements that, in turn, result in different sewer rate patterns during the period of analysis. The following rate analysis estimates and evaluates the impact on the monthly sewer rate per single-family residence of accelerating the HLKK project while keeping the remainder of the capital program the same.

Rate Impacts from Accelerating HLKK

Figure C-4 compares the monthly sewer rates from 2014 through 2040 (with inflation) with the approved and accelerated HLKK project schedules. Table C-5 shows the rates for selected years, and Table C-6 shows average rates, both with and without inflation, during the entire period. The period of analysis extends to 2040 to illustrate the full pattern of how rates respond to accelerating HLKK.

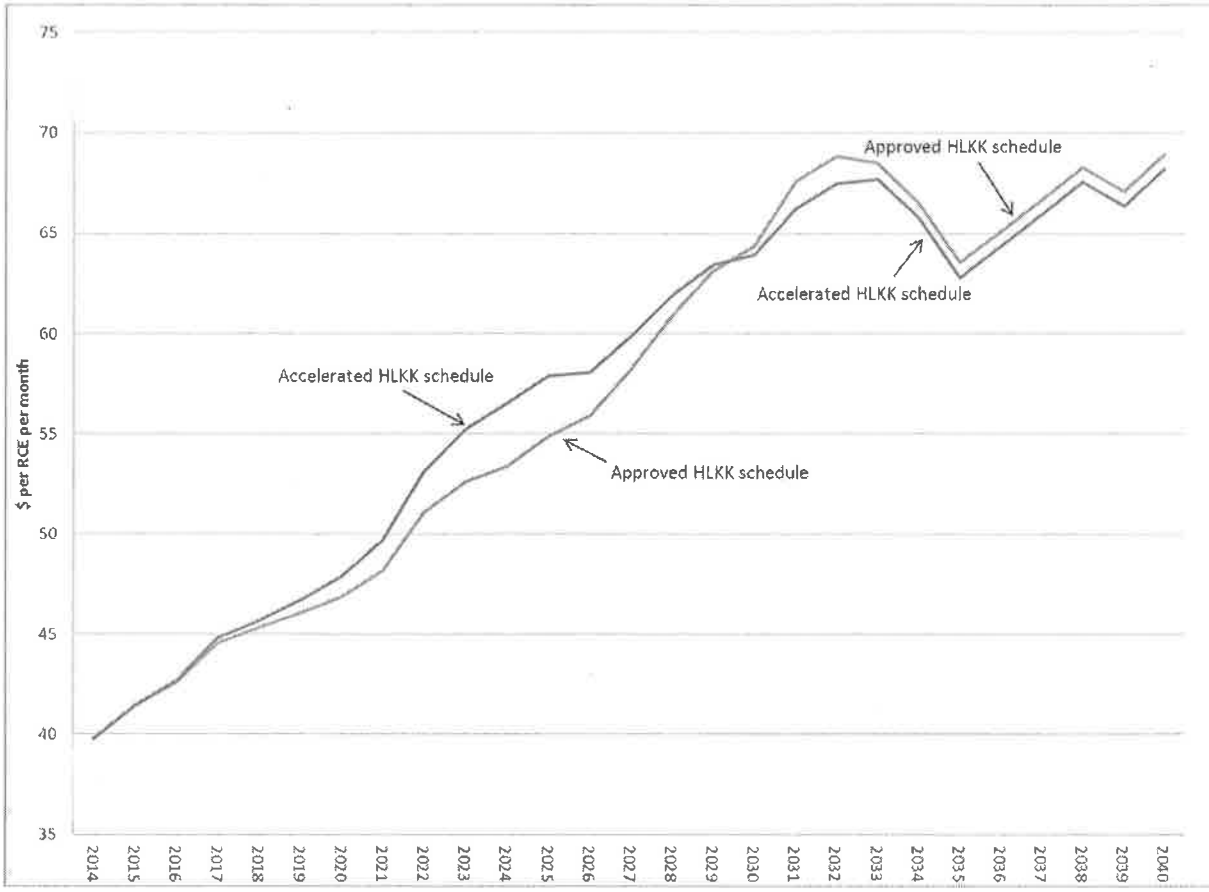

Figure C-4. Monthly Sewer Rates with Approved and Accelerated HLKK Project Schedules (with inflation)

Table C-5. Monthly Sewer Rates with Approved and Accelerated HLKK Project Schedules (2014–2040, with inflation)

	Monthly Sewer Rate ($, with inflation)				
	2014	**2020**	**2025**	**2030**	**2040**
Approved schedule	$39.79	$46.86	$54.86	$64.36	$68.91
Accelerated schedule	$39.79	$47.87	$57.89	$63.93	$68.21
Difference	0	$1.01	$3.03	<$0.43>	<$0.70>

Table C-6. Average Monthly Sewer Rates with Approved and Accelerated HLKK Project Schedules (2014–2040, without and with inflation)

	Average Rate
2013 $ (without inflation)	
Approved schedule	$37.24
Accelerated schedule	$37.60
Difference	$ 0.36
Nominal $ (with inflation)	
Approved schedule	$57.04
Accelerated schedule	$57.44
Difference	$ 0.40

The rates for the two alternatives are similar at the beginning of the period (2014 to 2017) with differences no greater than $0.25; diverge as the accelerated project requires higher rates (2018 to 2024), reaching a maximum difference of $3.17 in 2024; begin to converge and then reverse the pattern when startup for the project under the approved sequence occurs (2025 to 2033), reaching no difference between the alternatives around 2030; and then are slightly higher for the approved sequence for the remainder of the period.

As shown in Table C-6, accelerating HLKK would have a small impact on average monthly sewer rates for the entire period of analysis ($0.36 and $0.40 without and with inflation, respectively). The impact is small because the same revenue is required over the period for each alternative. In the approved sequence, rates increase an annual average of 2.1 percent during the 2014 to 2040 period; accelerating HLKK results in nearly identical rates of sewer rate growth, increasing an annual average of 2.02 percent. These averages over the entire period mask differences during the specific periods when the HLKK project would be completed under each schedule. From 2014 through 2025, sewer rates increase an annual average of 3.2 percent in the accelerated sequence compared to 2.7 percent in the approved sequence. From 2021 through 2032, rates increase an annual average of 3.3 percent in the approved sequence compared to 2.9 percent in the accelerated sequence.[4]

The more pronounced rate differences for individual years occur during HLKK construction periods for each alternative. Most construction activity would take place from 2023 through 2030 under the approved HLKK schedule and from 2018 through 2023 under the accelerated schedule. Table 5 shows that with inflation, the monthly sewer rate with the approved schedule is forecast to increase from $39.79 in 2013 to approximately $46.86 in 2020, $54.86 in 2025, $64.36 in 2030, and $68.91 in 2040. The rate with the accelerated sequence increases more rapidly in the

[4] Project completion timeframes for both alternatives include a two-year startup period.

early years, reaching a monthly sewer rate of $47.87 in 2020 and $57.89 in 2025, ending slightly lower than the approved sequence at $63.93 in 2030 and $68.21 in 2040.

Rates Reflecting a Range of HLKK Project Capital Costs

The $299.9 million capital cost in 2013 dollars of the HLKK project is a planning-level estimate that reflects uncertainty commensurate with the American Association of Cost Engineering (AACE) International Class 5 estimates.[5] These order-of-magnitude estimates are based on a low level of project definition and have an accuracy range of –50 to +100 percent. This range yields project cost estimates for HLKK of $149.9 million to $599.8 million (in 2013 dollars). Although the cost estimates for all the CSO control projects and for many other projects in the WTD CIP are subject to a common level of uncertainty, this range is applied only to the HLKK project in this analysis to illustrate the sensitivity of the results to changes in project costs.

Figure C-5 shows the annual distribution of the planning-level cost estimate and the upper bound (planning-level estimate plus 100 percent) and lower bound (planning-level estimate minus 50 percent) estimates for the accelerated HLKK project (with inflation). Figure C-6 and Table C-7 show the increase in sewer rates (with inflation) resulting from these costs and compares them with rates under the approved schedule. Figure C-7 compares the monthly sewer rates from 2014 through 2030 with the approved sequence and the sequence with accelerated HLKK at the three cost-estimating levels.

The greatest cost expenditures for all three levels of the cost estimate for the accelerated project would occur between 2019 and 2023. The rate impacts would reach their peak around 2024. If costs of the accelerated HLKK project reach the upper bound of the range, monthly sewer rates from 2014 to 2030 will be an average of $1.65 higher than those supporting the planning-level estimate; if the costs of the HLKK project are at the lower bound of the range, monthly sewer rates will be an average of $0.83 less than those supporting the planning-level estimate.

[5] The organization started as the AACE and then became the Association for the Advancement of Cost Engineering before adopting the current official title of AACE International. The following site gives AACE International's classifications: http://www.aacei.org/non/rps/18R-97.pdf.

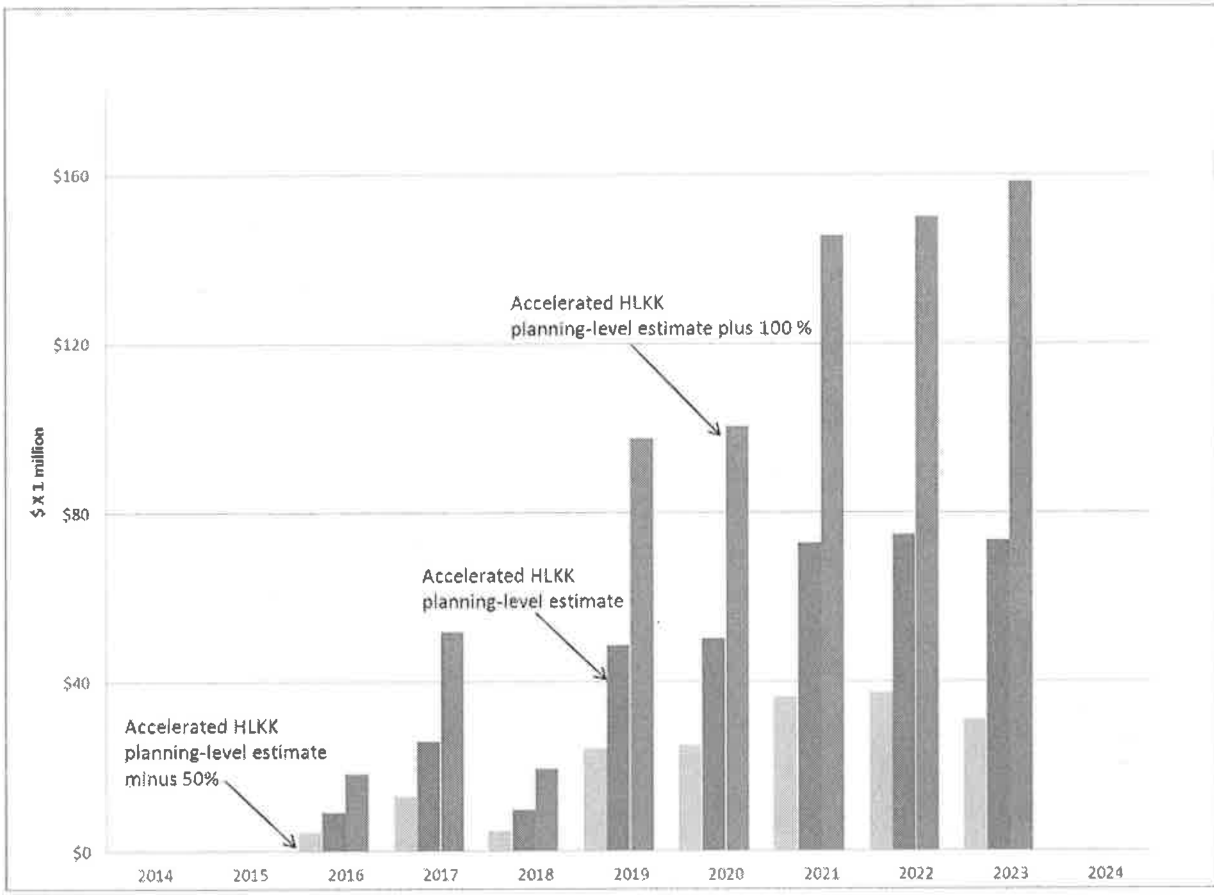

Figure C-5. Range of Annual Capital Costs for the Accelerated HLKK Project (2016–2023, with inflation)

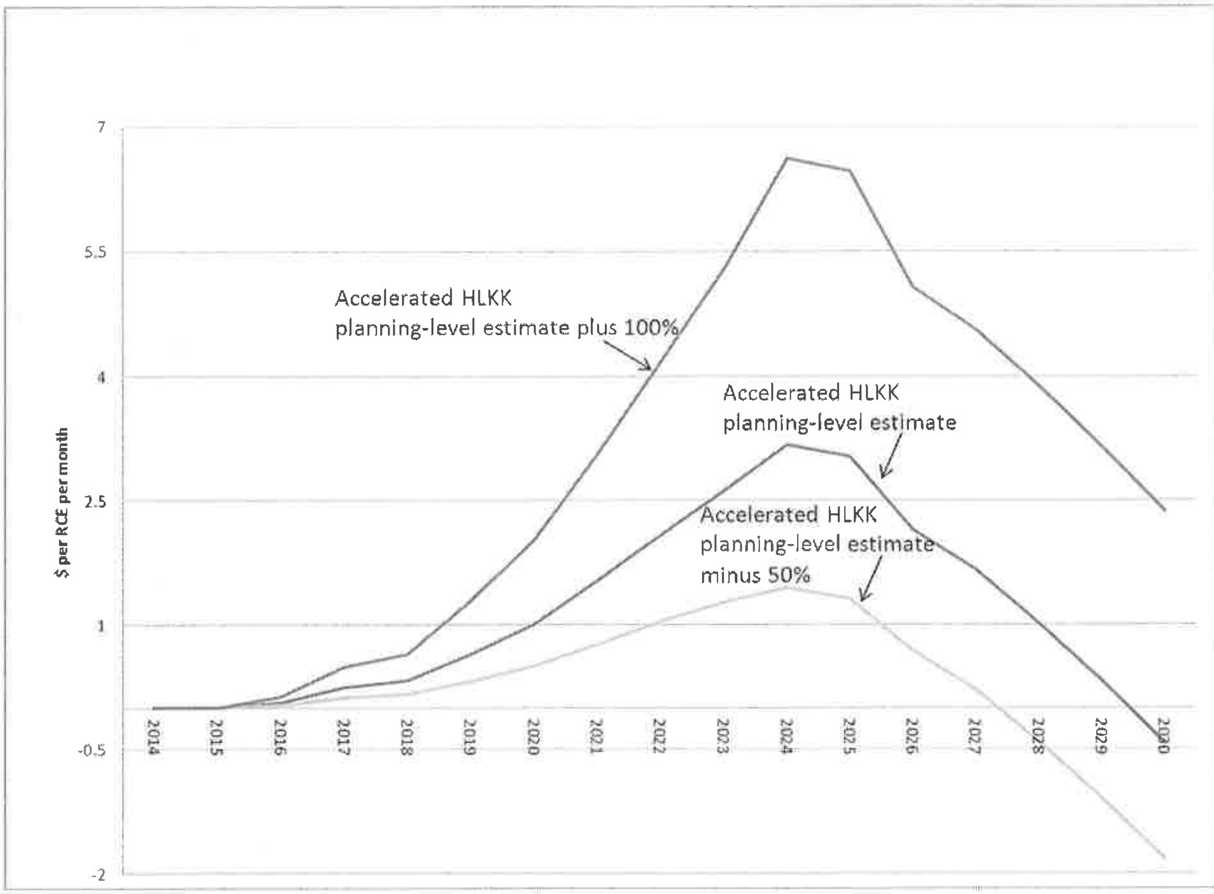

Figure C-6. Amount Added to Monthly Sewer Rate for Range of Estimated Capital Costs for the Accelerated HLKK Project (2014–2030, with inflation)

Table C-7. Amount Added to Monthly Sewer Rate by Range of Estimated Capital Costs for the Accelerated HLKK Project (2014–2030, with inflation)

Cost Estimating Level	2014	2020	2025	2030
Planning-level estimate	$0.00	$1.01	$3.03	$(0.43)
Planning-level estimate minus 50%	$0.00	$0.50	$1.32	$(1.83)
Planning-level estimate plus 100%	$0.00	$2.02	$6.06	$2.37

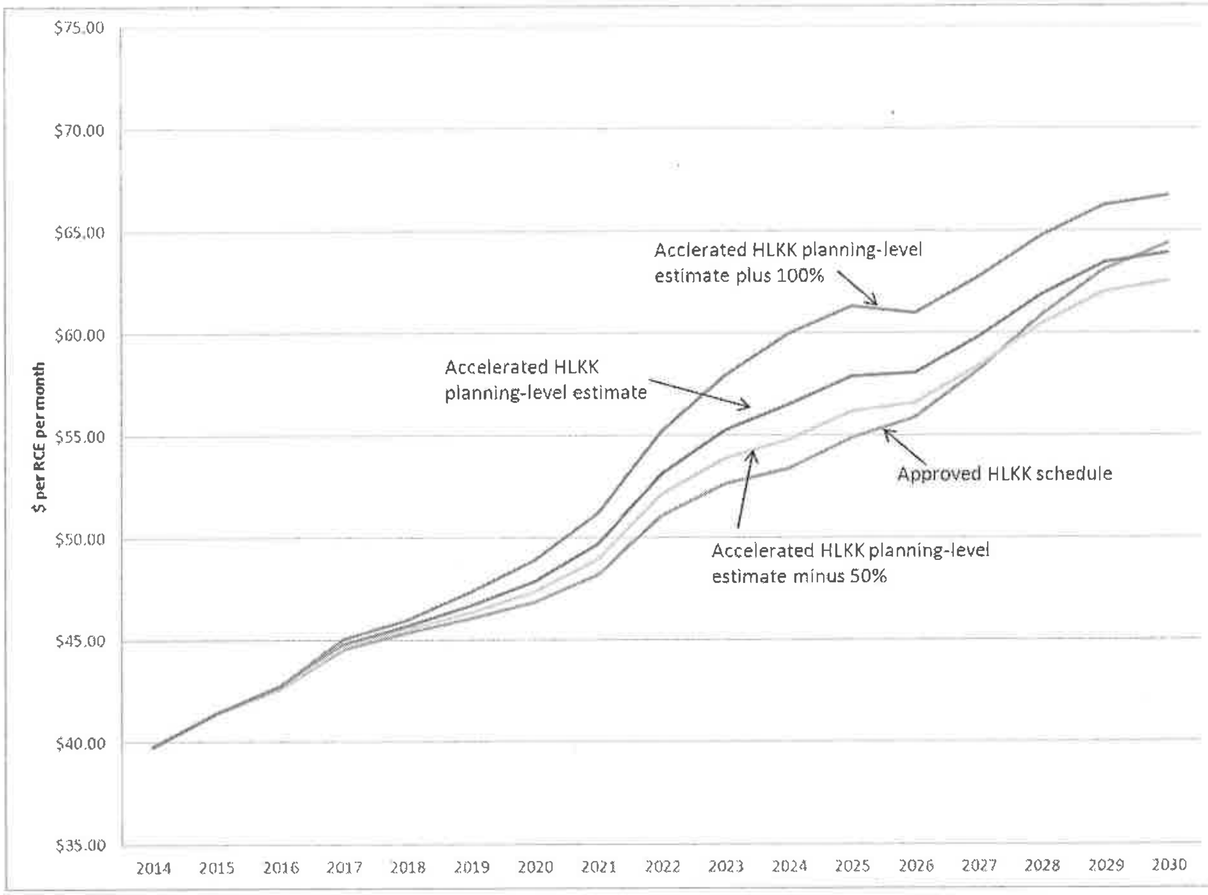

Figure C-7. Comparison of Monthly Sewer Rates of Approved HLKK Schedule to Monthly Sewer Rates for a Range of Capital Costs for the Accelerated HLKK Schedule (2014–2030, with inflation)

Rate Management and Bond Financing Strategies

The rate analysis shows that with acceleration of HLKK (assuming the planning-level estimate), the monthly sewer rate from 2016 through 2029 would be greater than the rate with the approved HLKK schedule, with a maximum difference of $3.17 in 2024, and would be lower by a modest amount after 2030. This rate scenario offers a potential opportunity for mitigating near-term rate increases by transferring some of the revenue requirements to later years with an attendant increase in rates. The following sections describe two ways this transfer can be done: delaying or canceling other projects in the capital program or varying the debt structure.

Delaying or Canceling Other Capital Projects

In addition to increasing sewer rates, the addition of another project in a given period, especially one as costly and complex as HLKK, will necessarily result in inefficiencies in the delivery of other projects if accommodation is not provided. One means of managing rate impacts and preventing inefficiencies would be to delay or cancel other capital projects to make room for the one that is being added. Doing this would mitigate the impacts to the sewer rate but may not be feasible for the following reasons:

- Capital programs are long-term in nature. The length of time it takes to bring a project through conceptualization, design, and construction often leads to delays and associated large increases in costs, both from inflation and from inefficiencies related to restarting suspended projects.
- The WTD capital program consists of carefully vetted and prioritized projects. Delaying or cancelling projects could result in greater potential for equipment failures, sanitary sewer overflows, fines, and other risks and could lead to higher costs in the future.
- By delaying expenditures (and associated financing), WTD would lose the advantage of today's low interest rates.

Varying the Debt Structure

In forecasting sewer rate impacts, WTD assumes level amortization of principal and interest over the entire term of the bonds. Variations to this approach include structuring the bonds to include periods of deferred principal, capitalizing the interest, and issuing zero coupon bonds. Each strategy represents a different mix of rate management effectiveness and additional cost. Prior to use of alternative debt structures, the risks, costs, WTD's current and future debt profile, and perceptions of the financial industry need to be carefully considered. It cannot be assumed that these alternative bond structures will be available to finance the capital program without possible interest rate penalties or bond rating implications.

The following sections describe these bond structures, the risks associated with using them, and an analysis of how they could be used to manage rate impacts through 2026 from accelerating the HLKK project.

Description of Alternative Bond Structures

The following describes the three alternative bond structures that could be used to manage rates:

- **Principal-deferred amortization ("interest-only").** The initial year's debt service is reduced by postponing principal payments. Deferring principal is a means of managing rates that is relatively low in cost. It allows the issuer to vary the total debt service in a period. While low in cost, interest-only is a limited rate management tool that can manipulate the debt service stream only up to the principal portion. Once the period of full repayment begins, the debt is fully amortized over the remainder of the bond term, resulting in higher rates than level principal and interest.
- **Capitalized interest**. The amount of the bond issuance increases and the additional proceeds are used to pay interest during the initial years. Although it increases borrowing and total financing costs, this bond structure matches the impact to the facility's online date and produces rate savings until that time.
- **Zero coupon bonds.** This structure delays debt service payments until a future date and yields the maximum ability to manage rates. The ability to avoid all debt service costs in a year allows the flexibility to issue a portion of the total bonds as zeros. Once the period

of repayment is reached, the full principal plus forgone interest is amortized over the remainder of the bond term at high interest rates. The repayment period results in higher rates during this period than level principal and interest. Although this strategy provides significant flexibility in affecting debt service patterns and ability to manage rate patterns, it comes with significant increases in borrowing costs (a 40 to 65 basis point penalty). Implementation of this type of debt structure is limited because bond rating agencies generally do not view it favorably.

Risks of Using Alternative Bond Structures

Some of the risks of using alternative bond structures are as follows:

- **Credit rating.** WTD may be viewed in a less favorable light by rating agencies because of the use of alternative financing structures.

  Ability to issue debt. For the 12 months preceding the issuance of a future parity bond (WTD revenue or King County general obligation bond), the annual income (primarily sewer rate revenue) after operating expenses must be at least 1.25 times the amount required to pay annual debt (parity bond test) for each year during the life of the future parity bond.[6] This requirement can put additional upward pressure on sewer rates compared to level principal and interest.

- **Interest rates.** Alternative bond structures, especially zero coupon bonds, typically carry a significant increase in interest rates, thereby increasing the cost of financing.

Analysis of Rate Management Through Alternative Bond Structures

Table C-8 presents the total debt service for the WTD CIP with the accelerated HLKK schedule assuming the planning-level cost estimate for the project and level principal and interest; compares this debt service with the debt services if principal-deferred, capitalized interest, and zero coupon bond financing structures were used; and indicates the relative effectiveness of each bond structure in managing sewer rates. As described above, the ability to achieve specific rate targets comes with a higher cost. The timeframe shown in the table is 2013–2073, which captures all debt service associated with the accelerated project.

Figures C-8, C-9, and C-10 show the effectiveness from 2014 through 2040 of using principal-deferred bonds, capitalized interest, and zero coupon bonds for keeping sewer rates through 2026 as close as possible to the rates if no alternative financing strategies were used:

- Principal-deferred bonds offer the least ability to manage rates but are the least costly of the alternative structures, with interest rate differentials of 0 to 10 basis points over level principal and interest. The debt service would increase by $137 million (0.70 percent) if this structure were used.
- Capitalizing interest is an effective rate management tool but increases the cost of financing. This approach produces results similar to zero coupon bonds but is less flexible because the period of full amortization coincides with when the facility goes

[6] A parity bond is an issued bond with equal rights to a claim as other bonds already issued.

online. Total debt service would increase by $207 million (1.00 percent) if this structure were used.

- For the zero coupon analysis, approximately $346 million of zero coupon bonds are issued between 2017 and 2026. Issuing zero coupon bonds entails a significant interest rate differential of 100 to 150 basis points yet is powerful in managing rates. Total debt service would increase by $281 million (1.40 percent) if this structure were used.

Table C-8. Comparison of Total Debt Service of the Accelerated HLKK Project Using Standard and Alternative Bond Structures (2013–2073, with inflation)

	Rate Management Effectiveness	Debt Service ($ x 1 million)	Difference from Level Principal and Interest	
			Level ($ x 1 million)	%
Level Principal and Interest	N/A	$20,274	0	0
Principal-deferred	Low	$20,410	$137	0.70
Capitalized interest	Medium	$20,480	$207	1.00
Zero coupon	High	$20,555	$281	1.40

Note: Rate management effectiveness is a general assessment of the ability to achieve specific rate targets.

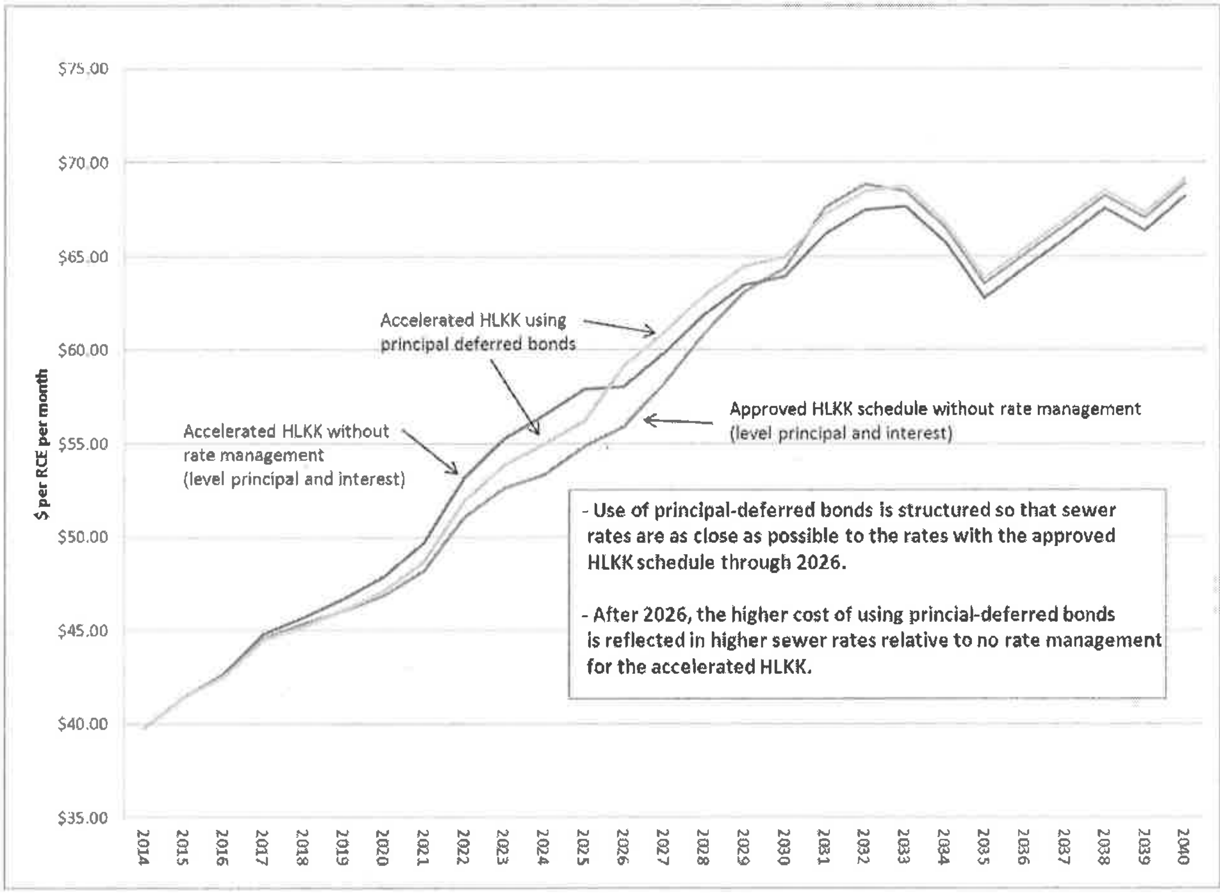

Figure C-8. Example of Managing Sewer Rates with Principal-Deferred Bonds (2014–2040, with inflation)

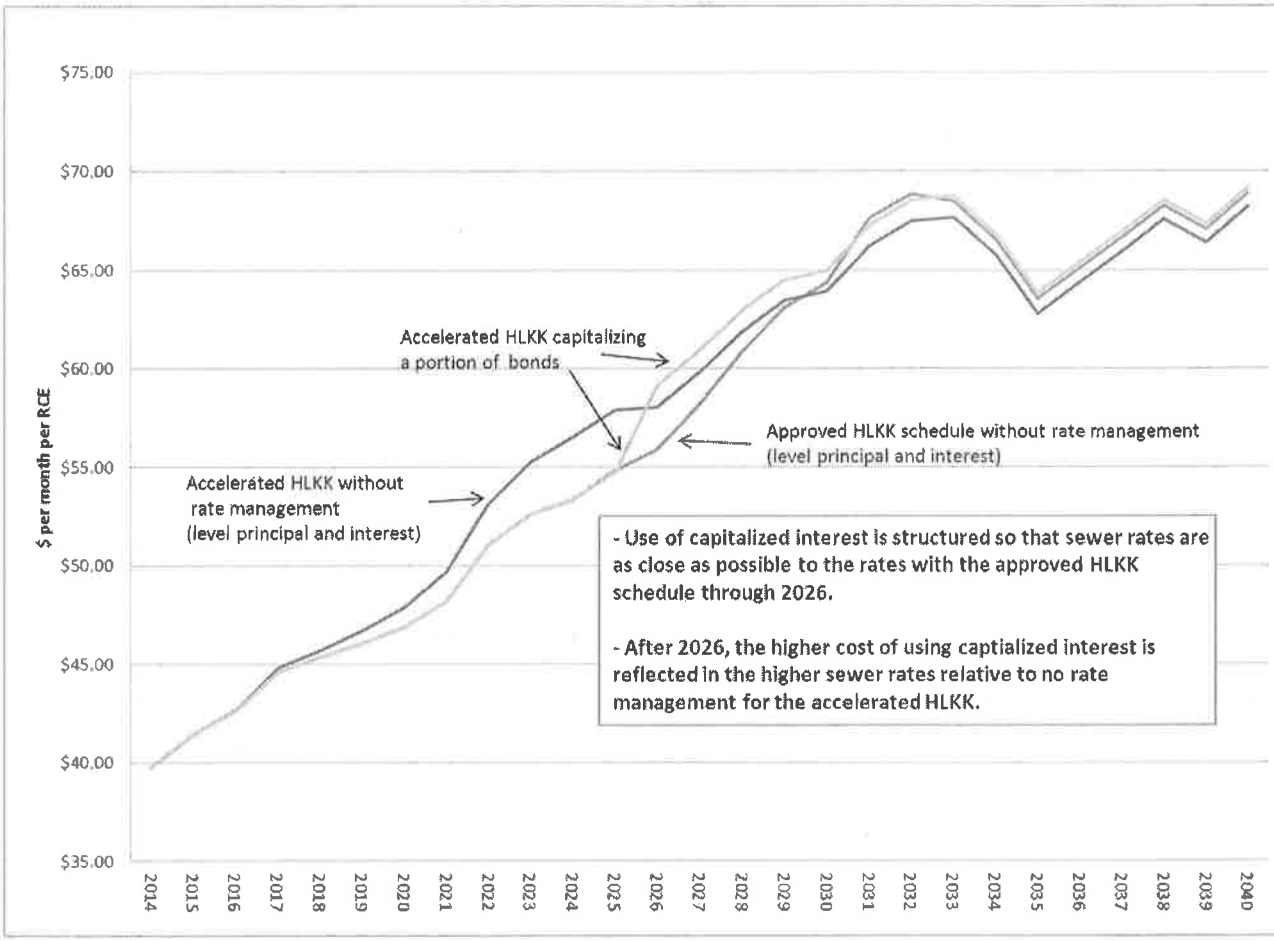

Figure C-9. Example of Managing Sewer Rates with Capitalized Interest (2014–2040, with inflation)

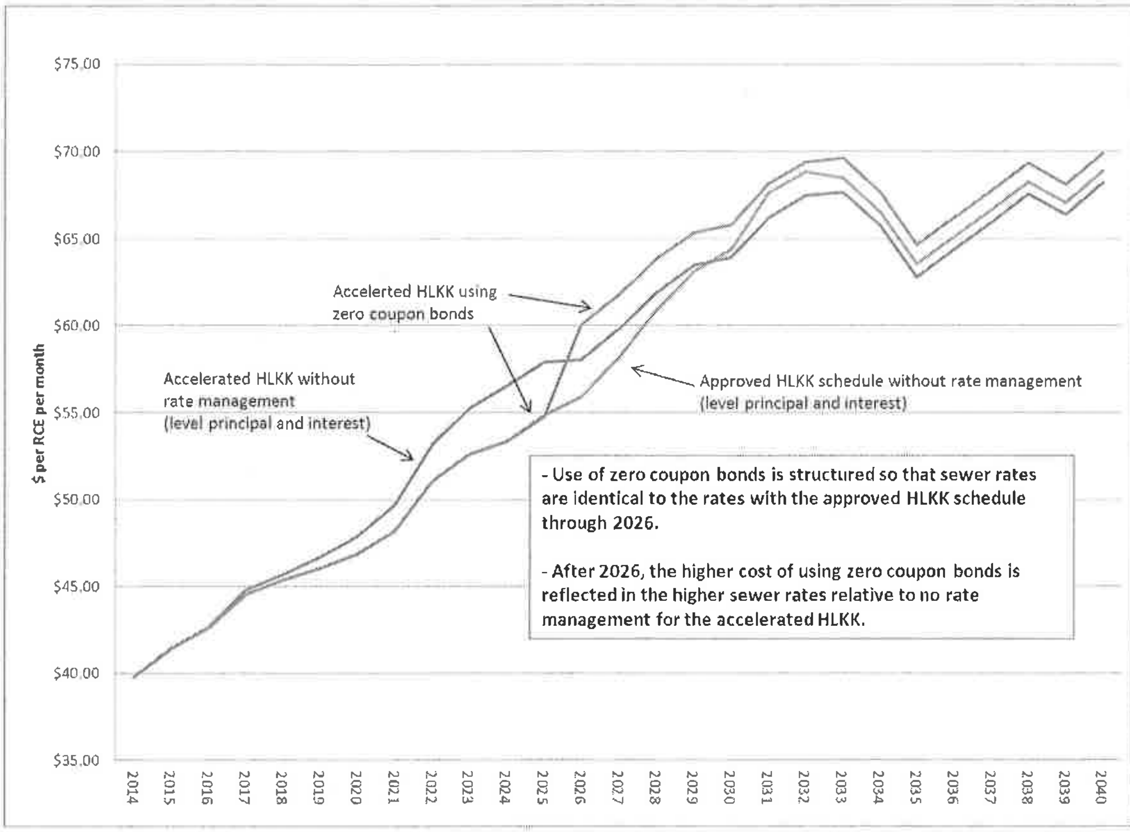

Figure C-10. Example of Managing Sewer Rates with Zero Coupon Bonds (2014–2040, with inflation)