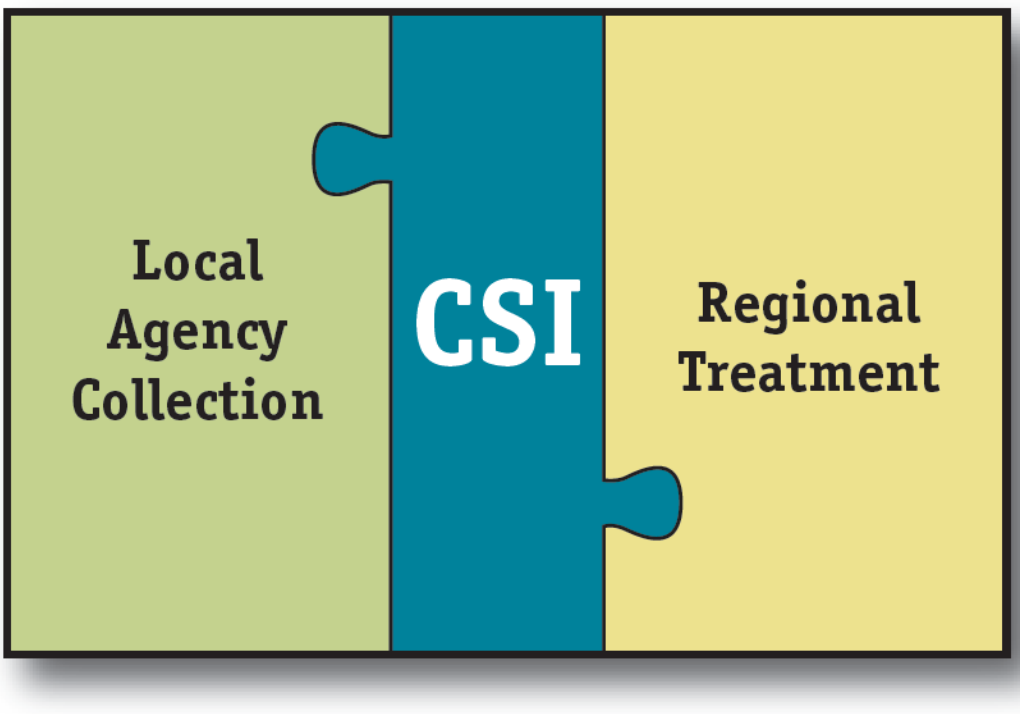
Conveyance System Improvement Program



Program Update

2017

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

For comments or questions, contact:
Steve Tolzman
King County Wastewater Treatment Division
201 S. Jackson St.
KSC-NR-0512
Seattle, WA 98104-3855
206-477-5459
Steve.Tolzman@kingcounty.gov

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

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Chapter 1

Introduction

The purpose of the King County Wastewater Treatment Division (WTD) Conveyance System Improvement (CSI) Program is to identify ways to improve the County's conveyance system to ensure that it has sufficient capacity to respond to regional growth. This *2017 Conveyance System Improvement Program Update* (*2017 Program Update*) implements conveyance policies contained in the Regional Wastewater Services Plan (RWSP), which was adopted by the King County Council in 1999. Specifically, the *2017 Program Update* verifies, adjusts, and identifies new CSI projects needed for increasing capacity in the conveyance system to accommodate future flow from both the growth in population and infiltration and inflow (I/I). Further, it establishes a timeline and estimated costs for these projects based on a set of nine prioritization criteria that address such factors as available capacity as defined by level of service (LOS), available capacity operations and maintenance (O&M) issues, and local agency input.[1]

The *2017 Program Update* follows a previous set of CSI Program updates published in 2004 and 2007. The planning cycle for the next program update, scheduled to be completed in 2027, will begin with decennial flow monitoring (DFM) in 2020.

This chapter outlines the *2017 Program Update* process and scope. Summaries of King County's Strategic Climate Action Plan (SCAP) and Equity and Social Justice (ESJ) Initiative, which are both considerations in all CSI—and WTD—projects, are also included.

1.1 Program Update Process

This *2017 Program Update* is the culmination of the following multistage process:

- Stage 1: Update planning assumptions (see Section 2.4.1)
- Stage 2: Complete a regional needs assessment (RNA) (see Section 3.1.1)[2]
- Stage 3: Develop conceptual projects and planning-level cost estimates[3]
- Stage 4: Prioritize conceptual projects (see Section 3.4)

[1] "Level of service" is the recurrence interval of the flow that an existing facility can convey.
[2] The 2015 *Regional Needs Assessment* can be found at: https://your.kingcounty.gov/dnrp/library/wastewater/csi/2017-update/1505_Final-RNA-web.pdf
[3] *Conceptual Projects to Meet Identified Capacity Needs* can be found at: https://your.kingcounty.gov/dnrp/library/wastewater/csi/2017-update/1705_CSI-conceptual-projects.pdf

1.2 Scope of this Program Update

Conceptual CSI projects and identified needs in this *2017 Program Update* represent upgrades and expansions of conveyance facilities through 2060 in the *separated* portion of the *existing* County service area. The program update does not cover local agency systems. Each agency produces its own plans and capital improvement programs.

Moreover, the level of detail in this update is greater for capacity-related than for condition-related needs and their associated projects. The CSI conceptual projects and identified needs are based on the best available information about system capacity and future growth. However, the timing, scope, and scale of actual CSI projects is subject to change as actual conditions evolve and diverge from projections of growth and capacity demand over time. Conceptual projects do not consider the potential for I/I reduction to address the capacity need. The potential for I/I reduction is made on a project-by-project basis during the predesign phase of project implementation.

Conditions that may change include the physical condition of specific components of the conveyance system that are discovered during project initiation. These conditions may affect the scope or scale of a project. For instance, a project planned as installing a parallel pipe may require a full pipe replacement if the existing pipe is found to be in poor condition. Actual population and employment growth, both in terms of total numbers and density in various portions of the region, may also vary greatly from current projections and can change the scale and timing of planned projects.

1.3 Strategic Climate Action Plan

A 2015 Council-approved update of the King County SCAP established a five-year blueprint for County action to confront climate change, integrating greenhouse gas emissions reduction targets into all areas of County operations and its work in the community. As a result, energy conservation is considered in the planning and design of all WTD capital projects, including CSI projects. When identifying conceptual projects, reducing energy usage is initially weighed against project needs and costs; full consideration takes place in project design.

Although the effects of climate change on the regional wastewater system are still under investigation, climate change is generally regarded as causing more intensive storm events that could increase projections of peak wastewater flows for the system. When precipitation models for the Puget Sound region that account for the effects of climate change become available, they will be incorporated into existing models for projecting peak flows. The updated projections may require revisions to the list of needed CSI projects for the region.

1.4 Equity and Social Justice Initiative

King County's ESJ Initiative, which was enacted by the Council as an ordinance in 2010, directs all County agencies and departments to systematically consider the impacts of policy and funding decisions on disadvantaged and marginalized communities. To assist in these efforts, the King County Office of Equity and Social Justice published a seven-year strategic plan for ongoing and future efforts to foster a fair and just society for all residents.

WTD has been actively working to incorporate ESJ considerations in all aspects of its operations. To this end, a tool was developed to assess demographics in areas where WTD plans to implement capital projects and to assign an ESJ level of effort for each project. The *2017 Program Update* used this tool to conduct equity impact reviews of projects identified as high or medium priority (see Section 4.3).

Chapter 2

CSI Program Overview

This chapter provides a brief overview of the CSI Program, including the County's service area and regional wastewater system and the history of conveyance planning in the region. Relevant RWSP conveyance policies and the CSI Program's underlying 20-year capacity standard are also addressed. Finally, the chapter addresses changes that have occurred in WTD's infrastructure since the *2007 Conveyance System Improvement Program Update* (*2007 Program Update*) that have affected conveyance planning, namely updated planning assumptions and the completion of an I/I demonstration project.

2.1 Wastewater Service Area and System

King County's regional wastewater system serves approximately 1.7 million residents within a 420-square-mile service area encompassing most of King County and smaller portions of Snohomish and Pierce counties. It is a large, integrated wastewater collection, conveyance, and treatment system operated by King County. The system receives wastewater from 34 cities and sewer districts that are "local agencies" that independently operate local wastewater collection systems.

The local agencies own and operate facilities for collecting wastewater from residences and businesses. Their combined facilities include 5,100 miles of collection pipes and numerous pump and regulator stations. King County owns and operates regional facilities necessary for conveying and treating flows from component agency systems.

The following components make up King County's regional wastewater system:

- Three large, regional wastewater treatment plants (West Point Treatment Plant in the City of Seattle, South Treatment Plant in the City of Renton, and Brightwater Treatment Plant near Woodinville)
- Two small wastewater treatment plants (one on Vashon Island and one in the City of Carnation)
- One community septic system (Beulah Park and Cove on Vashon Island)
- Four combined sewer overflow (CSO) treatment facilities (Alki, Carkeek, Mercer/Elliott West, and Henderson/Norfolk—all in the City of Seattle)
- Over 391 miles of sewer pipelines

- Twenty-six regulator stations
- Forty-seven pump stations
- Thirty-eight CSO outfalls

The West Point, South, Brightwater, Carnation, and Vashon treatment plants provide secondary treatment; the wet weather treatment facilities provide CSO treatment (the equivalent to primary treatment). With the exception of Carnation Treatment Plant, which discharges to a wetland adjacent to the Snoqualmie River, all the treatment facilities discharge their treated and disinfected wastewater to Puget Sound.

The County's conveyance system, which consists of pipes, pump stations, and regulator stations, was constructed over many decades. Older pipes, located in many parts of Seattle, are part of a combined sewer system that collects both stormwater and wastewater. Wastewater pipes in the rest of the region, including some portions of north Seattle, are part of a separated sewer system in which separate pipes carry wastewater and stormwater. The CSI Program update focuses only on the separated conveyance system.

2.2 History of Conveyance System Planning

Because regional wastewater needs are always changing, planning for the regional conveyance system is an ongoing function for WTD. Initial planning began in 1959 when the newly formed Municipality of Metropolitan Seattle (Metro) completed its *Metropolitan Seattle Sewerage and Drainage Survey.* This original plan was largely implemented in the 1960s through the early 1980s.

The plan was updated as a part of the RWSP in 1999. The regional CSI program that was included as part of the RWSP listed projects, based on information available at that time, for repairing or modifying existing conveyance facilities and for constructing new facilities. The program consisted of three components: (1) conveyance facilities needed to serve a proposed new North Treatment Plant (now called Brightwater Treatment Plant), (2) improvements to major conveyance facilities, and (3) improvements to minor pipelines (trunks).

Since adoption of the RWSP, the conveyance planning approach has undergone substantial reorganization, primarily to break down the service area into 10 sub-regional planning basins and to integrate conveyance planning into local agency plans and into other RWSP programs such as I/I control, CSO control, and water recycling. The CSI Program was updated between 2000 and 2003 using this approach and was documented in the *RWSP 2004 Update*, which represented the

first comprehensive review of RWSP policy implementation.[4] Projects were identified through 2030, the RWSP planning horizon.

The program was updated in 2007 because significant new capacity needs were identified during development of the March 2005 RNA conducted for the Regional I/I Control Program.[5,6] The purpose of the RNA was to identify CSI projects and costs that could serve as a baseline for conducting benefit-cost analyses of potential I/I reduction projects. Most recently, a RNA was conducted in 2015 that serves as the basis for capacity needs for this *2017 Program Update* (see Section 3.3).

2.3 RWSP Conveyance Policies & 20-Year Peak Flow Standard

RWSP conveyance policies are codified in the King County Code 28.86.060 and are intended, in part, to guide the planning, design, and construction of CSI projects to accommodate increased flows over a 30-year period (through 2030). The *2017 CSI Program Update* addresses the following key RWSP conveyance policies:

- *Conveyance Policy (CP)-1: To protect public health and water quality, King County shall plan, design, and construct county wastewater facilities to avoid sanitary sewer overflows.*

    1. *The [20]-year peak flow storm shall be used as the design standard for the County's separated wastewater system.*

- *CP-2: King County shall construct the necessary wastewater conveyance facilities, including, but not limited to pipelines, pumps, and regulators, to convey wastewater from component agencies to the treatment plants for treatment and to convey treated effluent to water bodies for discharge. Conveyance facilities shall be constructed during the planning period of the currently adopted RWSP to ensure that all treatment plants can ultimately operate at their rated capacities. No parallel eastside interceptor shall be constructed. No parallel Kenmore interceptor shall be constructed.*

To prevent sanitary sewer overflows, King County adopted a 20-year peak flow capacity standard for regional conveyance facilities in the separated portion of its service area (KCC 28.86.060).[7] To meet this standard, facilities are designed to have capacity to convey peak flows

[4] The *RWSP 2004 Update* can be found at: https://your.kingcounty.gov/dnrp/library/wastewater/wtd/construction/Planning/RWSP/CompReview/04/04_Update.pdf

[5] The *2007 Program Update* can be found at: https://your.kingcounty.gov/dnrp/library/wastewater/csi/ProgramUpdate/0706CSI-Plan.pdf

[6] In general, the peak flow is comprised of 30 to 40 percent base flow and 60 to 70 percent I/I.

[7] The federal Clean Water Act prohibits discharge of pollutants other than where allowed by National Pollutant Discharge Elimination System permits.

of a magnitude that can be expected on an average of once every 20 years (a 20-year return interval). This return interval corresponds to a 5 percent chance that such flows or higher would occur in any given year and a 63 percent chance that such flows would occur in any 20-year period.

For the design of pump stations in the separated system, a 5-year peak flow is used to set the firm pumping capacity (all pumps except the largest pump are operating).

2.4 Significant Changes Since the *2007 Program Update*

There have been a number of changes in King County's treatment and conveyance system infrastructure since the *2007 Program Update* was published. Most notably, two new treatment plants were brought online: the Brightwater Treatment System, which includes the Brightwater Treatment Plant, became fully operational in 2012, and the Carnation Treatment Plant and conveyance system became operational in 2008. Additionally, CSI planning assumptions were updated and an I/I demonstration project was completed.

2.4.1 Updated Planning Assumptions

Flow modeling is used to forecast future demands in the separated portion of the regional wastewater system and the average wet weather flow at regional treatment plants. Input to the models includes information obtained from local agency sewer comprehensive plans, population and employment growth forecasts, measured flow and rainfall data, existing land uses, topography, water consumption data, and assumptions about future conditions ("planning assumptions"). The flow models are calibrated, typically every 10 years, based on the latest U.S. Census data and extensive flow monitoring. Current-year flows are used as the baseline to project future flows. The baseline year for previous modeling was 2000; the baseline year for current modeling is 2010.

The planning assumptions were developed and applied during preparation of the RWSP. They are reviewed and updated as part of RWSP comprehensive reviews ("updates"), CSI Program plan updates, and development of the Regional I/I Control Program. WTD works with the Engineering and Planning (E&P) Subcommittee of the Metropolitan Water Pollution Abatement and Advisory Committee (MWPAAC) to develop and update the planning assumptions.

In 2003, as part of the *2004 RWSP Update*, WTD used eight planning assumptions to forecast flows from 2000 baseline conditions. These assumptions were reviewed and updated to provide wastewater flow projections for the RWSP 2014 comprehensive review and 2017 CSI plan update. The updated planning assumptions, including the methodologies used to update each

assumption, are described in detail in the 2014 *Updated Planning Assumptions for Wastewater Flow Forecasting*.[8]

The main influences that led to updates in the flow projections are a geographic information system (GIS)-based analysis to determine which areas are served by sewers, flow monitoring data collected during the WTD DFM project, and Puget Sound Regional Council's (PSRC's) 2013 Land Use Forecast:

- A GIS data layer of sewered areas in the regional wastewater service area was developed in 2000 to 2001 using King County Tax Assessor Parcel Data, environmentally sensitive area data, and input from local agencies that contract with WTD for wastewater conveyance and treatment service. This data layer was updated in 2010 to 2011 using the same method.
- The DFM project began in 2009. A total of 235 flow meters were installed in the separated portion of WTD's service area. Flow data were collected over two wet seasons from September 2009 to May 2011. The project resulted in the most comprehensive set of wastewater flow monitoring data collected by WTD since 2001 and 2002.
- The PSRC 2013 Land Use Forecast, based on 2010 U.S. Census data, forecasts future development based on how the market responds to growth in population and employment based on development capacities established in comprehensive plans for local jurisdictions.[9]

2.4.2 Completion of I/I Demonstration Project

In 2012, WTD and the Skyway Water and Sewer District partnered to repair and replace sewer mains, side sewers, laterals, and manholes in a residential sewer service basin near the southwest end of Lake Washington as part of a demonstration project of the Regional I/I Control Program. The goal of this demonstration project was to reduce I/I to the sewer system, increasing the unused capacity of the wastewater conveyance system and eliminating the need for a planned wastewater storage facility downstream.

A key objective of the demonstration project was to evaluate the effectiveness of sewer rehabilitation. Rainfall and flow data were evaluated to determine if rehabilitation reduced I/I enough to allow for delaying, reducing the size of, or eliminating the Bryn Mawr Storage Project identified in the *2007 Program Update*. I/I reduction was quantified by comparing model results based on flow data collected before and after construction of the demonstration project (i.e., pre-rehabilitation and post-rehabilitation).

[8] The 2014 *Updated Planning Assumptions for Wastewater Flow Forecasting* can be found at: http://your.kingcounty.gov/dnrp/library/wastewater/wtd/construction/Planning/RWSP/CompReview/13/1407_UpdatedPlanningAssumptions2014.pdf

[9] Forecasts can be found in the 2014 *PSRC Population and Employment Forecast Summary* at: https://your.kingcounty.gov/dnrp/library/wastewater/csi/2015update/1408_PSRC-Forecast-WTD-Model-Basin-Summary.pdf

The reduction effectiveness of the Skyway I/I Reduction Demonstration Project was below the expected 60 percent removal. Overall, the results of the project suggest that the benefits of rehabilitation work are most apparent in the local system where the work is performed and that downstream translation of I/I reduction is more difficult to achieve.[10]

Although the Skyway I/I Reduction Demonstration Project determined that the Bryn Mawr Storage Project is still necessary, it also determined that the latter project can be delayed. Further, the rehabilitation work of the demonstration project may have led to a reduction in required storage volume despite the slightly higher peak flow rate due to a change in shape of the hydrograph (narrowing of the peak flow portion of the curve). These encouraging results were achieved with a capital cost to King County of less than $2 million.

The County will continue with flow monitoring in Skyway and elsewhere and will consider future I/I reduction projects where they may be of value.

The effort to formulate conceptual projects for this *2017 Program Update* did not include consideration of I/I control as a means to address capacity needs. An I/I analysis will be conducted as part of design flow criteria development as projects are implemented and will be informed by the following:

- Assumptions developed by the Regional I/I Control Program, including high and low ranges of I/I reductions
- Lessons learned from I/I program demonstration projects

Possible outcomes of the evaluation include a recommendation as to whether I/I reduction should be considered as a project alternative during predesign and/or further evaluated through a sewer system evaluation survey.

[10] Complete results of the Skyway I/I Reduction Demonstration Project can be found at: https://www.kingcounty.gov/~/media/services/environment/wastewater/i-i/docs/Reports/1403_II_SkywayEvalReport.ashx?la=en

Chapter 3

Planned CSI Projects

This chapter describes the processes used to identify service area capacity needs and identifies conceptual and prioritized projects. A summary comparing the 2017 and 2007 program updates is also presented.

3.1 Identifying Needs and Projects

3.1.1 Needs Assessment Process

The process for identifying capacity needs consists of three main steps:

1. **Estimate current flows.** The MOUSE model was developed and calibrated to measured flows in model basins of the separated portion of the regional conveyance system. This calibrated model is used to simulate the base wastewater flow and hydrologic responses throughout a long-term simulation to estimate the current 20-year peak flow condition in WTD's separated system conveyance facilities. The simulation establishes a baseline that represents how the system currently performs under peak flow conditions. The year that flow monitoring data were collected and used for model calibration serves as the current, or baseline, condition for estimating peak flow conditions. The baseline year for this effort is 2010.
2. **Estimate future peak flows.** Peak flows are estimated by decade through 2060 for the regional conveyance system using existing and future projections of sewered area, population, employment, and I/I projections.
3. **Determine capacity exceedance and LOS.** Capacity constraints are identified based on when 20-year peak flows exceed the capacity of existing regional conveyance facilities:
    - For facilities that currently exceed the 20-year peak flow capacity standard, their LOS and the portion of the 20-year peak flow they cannot convey are estimated.
    - For facilities where capacity will be exceeded in the future, the year that the capacity is exceeded and the portion of the 20-year peak flow that cannot be conveyed through the existing system are identified.

Model basins were delineated to help quantify flow contributed by local sewer systems to various portions of the King County conveyance system. One hundred and fifty model basins in the separated part of the service area were delineated during the 2009 to 2011 flow monitoring effort. The average basin size is 1,164 acres.

3.1.2 Service Area Capacity Needs

Figure 3-1 shows the locations of identified conveyance capacity needs through 2060, including pipelines and pump stations, and the CSI projects in progress to address some of these needs.

Table 3-1 lists the needs in the order of the decade that the 20-year peak flow is or will be exceeded (earliest decade first) and by the estimated LOS for facilities whose capacity was exceeded before 2010 (lowest LOS first). It was assumed that LOS for facilities where capacity was not exceeded before 2010 is greater than 20 (i.e., meets the 20-year peak flow standard). Table 3-1 also indicates whether or not a need had been identified in the *2007 Program Update*. Because of improved flow monitoring data that include larger storms, some facilities shown as exceeding the standard before 2010 may not have been identified in the *2007 Program Update*.

The 77 conveyance facilities that fall below the 20-year peak design standard, especially those with an LOS of less than 10, were the focus of the process to identify and prioritize CSI projects to increase capacity to meet the standard. The breakdown of these facilities according to their LOS is as follows:

- Sixteen facilities have an LOS below 5, which means there is a one in five chance that an overflow will occur in any given year. CSI projects are underway to address eight of these needs. One of the 16 needs was not identified in the *2007 Program Update*.
- Thirteen facilities have an LOS of 5 to 10. Projects are underway to address two of these needs. Three of the needs were not identified in the *2007 Program Update*.
- Eleven facilities have an LOS of 10 to 20. No projects are in progress to address these needs. Two of the needs were not identified in the *2007 Program Update*.

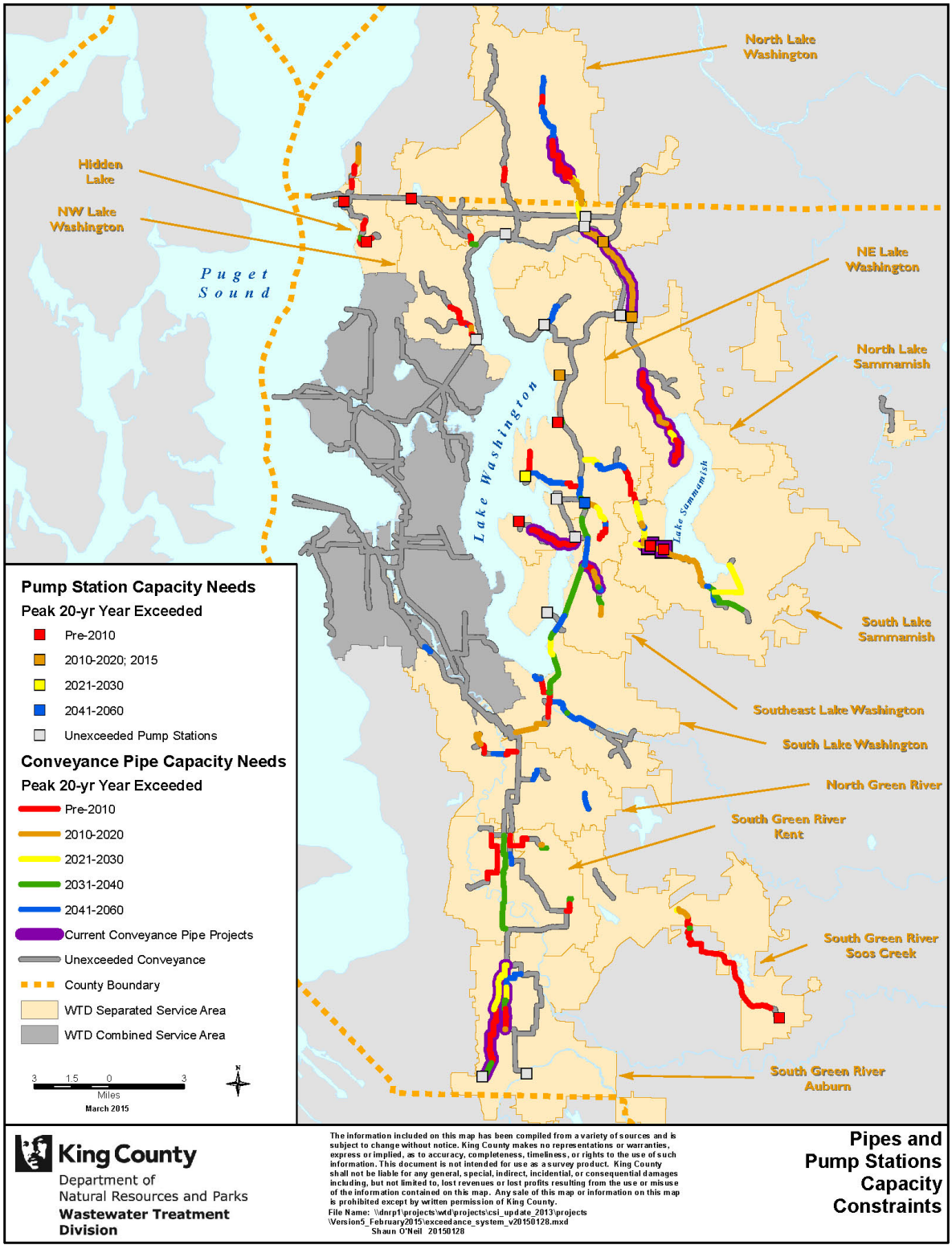

Figure 3-1. Locations of Identified Conveyance Capacity Needs in Separated Sewer Service Area

Table 3-1. Identified Conveyance System Capacity Needs Organized by Decade Exceeded and Estimated Level of Service

Need	CSI Planning Area	Decade Capacity Exceeded	Estimated Level of Service in 2010 (years)	Identified in *2007 CSI Update*	Capital Project in Progress to Address Need
Medina Trunk	NE Lake Washington	pre-2010	<5	Yes	Not in 6-year CIP
Auburn-West Interceptor	South Green River/Auburn	pre-2010	<5	Yes	Kent – Auburn Conveyance System Improvements Project Phase B
Auburn-West Valley Interceptor	South Green River/Auburn	pre-2010	<5	Yes	Kent – Auburn Conveyance System Improvements Project Phase B
Algona-Pacific Trunk	South Green River/Auburn	pre-2010	<5	Yes	Kent – Auburn Conveyance System Improvements Project Phase B
Richmond Beach Pump Station	Hidden Lake	pre-2010	<5	Yes	Not in 6-year CIP
Thornton Creek Trunk	NW Lake Washington	pre-2010	<5	Yes	Not in 6-year CIP
Richmond Beach-Edmonds Interceptor	Hidden Lake	pre-2010	<5	Yes	Not in 6-year CIP
Tukwila Freeway Crossing	North Green River	pre-2010	<5	No	Not in 6-year CIP
Kent-Cascade Relief Interceptor	South Green River/Kent	pre-2010	<5	Yes	Not in 6-year CIP
Enatai Interceptor	NE Lake Washington	pre-2010	<5	Yes	North Mercer and Enatai Sewer Upgrades
North Mercer Island Interceptor	NE Lake Washington	pre-2010	<5	Yes	North Mercer and Enatai Sewer Upgrades
Garrison Creek Interceptor	South Green River/Kent	pre-2010	<5	Yes	Not in 6-year CIP
Coal Creek Trunk	SE Lake Washington	pre-2010	<5	Yes	Coal Creek Siphon and Trunk Parallel
Heathfield Pump Station/Force Mains	South Lake Sammamish	pre-2010	<5	Yes	Sunset and Heathfield Pump Station and Force Main Upgrades
Sunset Pump Station/Force Mains	South Lake Sammamish	pre-2010	<5	Yes	Sunset and Heathfield Pump Station and Force Main Upgrades
ULID #1 Contract #4 – Kent	South Green River/Kent	pre-2010	<5	Yes	Not in 6-year CIP
Lake Hills Trunk	North Lake Sammamish	pre-2010	5–10	Yes	Lake Hills Trunk and NW Lake Sammamish Sewer Upgrade
Boeing Creek Trunk	Hidden Lake	pre-2010	5–10	Yes	Not in 6-year CIP
Lake Ballinger Pump Station	North Lake Washington	pre-2010	5–10	No	Not in 6-year CIP
NW Lake Sammamish Interceptor	North Lake Sammamish	pre-2010	5–10	Yes	Lake Hills Trunk and NW Lake Sammamish Sewer Upgrade
North Creek Trunk Extension–North	North Lake Washington	pre-2010	5–10	Yes	Not in 6-year CIP
North Creek Trunk Extension–	North Lake Washington	pre-2010	5–10	Yes	Not in 6-year CIP

Need	CSI Planning Area	Decade Capacity Exceeded	Estimated Level of Service in 2010 (years)	Identified in *2007 CSI Update*	Capital Project in Progress to Address Need
South					
ULID #1 Contract #5 – Kent	South Green River/Kent	pre-2010	5–10	Yes	Not in 6-year CIP
Medina Siphon	NE Lake Washington	pre-2010	5–10	No	Not in 6-year CIP
Yarrow Bay Pump Station	NE Lake Washington	pre-2010	5–10	No	Not in 6-year CIP
Black Diamond Pump Station	South Green River/Soos	pre-2010	5–10	Yes	Not in 6-year CIP
ULID 250 – Kent	South Green River/Kent	pre-2010	5–10	Yes	Not in 6-year CIP
Factoria Trunk	NE Lake Washington	pre-2010	5–10	Yes	Not in 6-year CIP
Tukwila Interceptor	North Green River	pre-2010	10–20	Yes	Not in 6-year CIP
Hidden Lake Pump Station	Hidden Lake	pre-2010	10–20	Yes	Not in 6-year CIP
Black Diamond Trunk	South Green River/Soos	pre-2010	10–20	Yes	Not in 6-year CIP
Hidden Lake Force Main	Hidden Lake	pre-2010	10–20	Yes	Not in 6-year CIP
North Lake City Trunk	NW Lake Washington	pre-2010	10–20	Yes	Not in 6-year CIP
Swamp Creek Trunk Extension	North Lake Washington	pre-2010	10–20	Yes	Not in 6-year CIP
Lake Hills Interceptor	NE Lake Washington	pre-2010	10–20	Yes	Not in 6-year CIP
North Mercer Pump Station	NE Lake Washington	pre-2010	10–20	No	Not in 6-year CIP
Eastside Interceptor Section 1	South Lake Washington	pre-2010	10–20	Yes	Not in 6-year CIP
McAleer Trunk	North Lake Washington	pre-2010	10–20	No	Not in 6-year CIP
Bryn Mawr Trunk	South Lake Washington	pre-2010	10–20	Yes	Not in 6-year CIP
Issaquah Interceptor Section 1	South Lake Sammamish	2011–2020	>20	Yes	Not in 6-year CIP
Lakeland Hills Trunk	South Green River/Auburn	2011–2020	>20	Yes	Not in 6-year CIP
Kirkland Pump Station	NE Lake Washington	2011–2020	>20	Yes	Not in 6-year CIP
Eastgate Trunk	South Lake Sammamish	2011–2020	>20	Yes	Not in 6-year CIP
Cedar River Interceptor Section 2	South Lake Washington	2011–2020	>20	No	Not in 6-year CIP
Sammamish Valley Interceptor	North Lake Washington	2011–2020	>20	Yes	North Lake Sammamish Diversion
Woodinville Pump Station	North Lake Washington	2011–2020	>20	Yes	North Lake Sammamish Diversion
Bothell-Woodinville Interceptor	North Lake Washington	2011–2020	>20	Yes	North Lake Sammamish Diversion
Hollywood Pump Station	North Lake Washington	2011–2020	>20	Yes	North Lake Sammamish Diversion

Need	CSI Planning Area	Decade Capacity Exceeded	Estimated Level of Service in 2010 (years)	Identified in *2007 CSI Update*	Capital Project in Progress to Address Need
SE Lake Sammamish Interceptor	South Lake Sammamish	2021–2030	>20	Yes	Not in 6-year CIP
West Valley Interceptor	South Green River/Auburn	2021–2030	>20	Yes	Kent – Auburn Conveyance System Improvements Project
Eastside Interceptor Section 3	South Lake Washington	2021–2030	>20	Yes	Not in 6-year CIP
Medina Pump Station	NE Lake Washington	2021–2030	>20	No	Not in 6-year CIP
Eastside Interceptor Section 2	South Lake Washington	2031–2040	>20	Yes	Not in 6-year CIP
Auburn Interceptor Section 3	South Green River/Kent	2031–2040	>20	Yes	Not in 6-year CIP
Eastside Interceptor Section 11	NE Lake Washington	2031–2040	>20	No	Not in 6-year CIP
Issaquah Interceptor Section 2	South Lake Sammamish	2031–2040	>20	Yes	Not in 6-year CIP
Yarrow Bay Force Main	NE Lake Washington	2031–2040	>20	No	Not in 6-year CIP
Eastside Interceptor Sections 5, 6, & 7	SE Lake Washington	2031–2040	>20	No	Not in 6-year CIP
Eastside Interceptor Section 10	NE Lake Washington	2031–2040	>20	No	Not in 6-year CIP
Eastside Interceptor Section 9	NE Lake Washington	2031–2040	>20	No	Not in 6-year CIP
Issaquah Creek Interceptor	South Lake Sammamish	2031–2040	>20	Yes	Not in 6-year CIP
Eastside Interceptor Section 4	SE Lake Washington	2031–2040	>20	Yes	Not in 6-year CIP
Auburn Interceptor Section 1	South Green River/Kent	2031–2040	>20	Yes	Not in 6-year CIP
Auburn Interceptor Section 2	South Green River/Kent	2031–2040	>20	Yes	Not in 6-year CIP
Rainier Vista Interceptor	North Green River	2041–2050	>20	No	Not in 6-year CIP
Medina Force Main	NE Lake Washington	2041–2050	>20	Yes	Not in 6-year CIP
South Renton Trunk	North Green River	2041–2050	>20	Yes	Not in 6-year CIP
Wilburton Pump Station	NE Lake Washington	2041–2050	>20	Yes	Not in 6-year CIP
Cedar River Interceptor Section 1	South Lake Washington	2041–2050	>20	No	Not in 6-year CIP
South 277th Interceptor	South Green River/Kent	2041–2050	>20	No	Not in 6-year CIP
North Soos Creek Trunk	North Green River	2051–2060	>20	No	Not in 6-year CIP
Juanita Creek Trunk	NE Lake Washington	2051–2060	>20	No	Not in 6-year CIP
Eastside Interceptor Section 8	NE Lake Washington	2051–2060	>20	No	Not in 6-year CIP
Eastside Interceptor Section 12	NE Lake Washington	2051–2060	>20	No	Not in 6-year CIP

3.2 Developing Conceptual Projects

The process for developing a list of conceptual projects is an iterative one in which early project lists are reviewed and revised to incorporate local information and cost-saving measures. Key process activities, which are described further in this section, are as follows:

- Review the list of projects in the *2007 Program Update*.
- Assess whether to replace or parallel an existing pipeline or rebuild or upgrade a pump station that has an identified capacity constraint.
- Size each project to convey the projected 20-year peak flow in 2060.
- Determine possible routes for new pipelines.
- Develop initial project cost estimates.
- Evaluate whether diversion or storage projects would provide cost-effective alternatives to parallel pipelines.
- Consider whether construction of a project in phases could potentially spread the cost of addressing the need over a period of decades and result in near-term cost savings.
- Revise project alternatives, as needed, to reflect information from local sewer agencies.
- Refine cost estimates.

The process depended on whether or not conveyance facilities with identified needs can convey a 20-year peak flow without surcharging and/or overflowing under current conditions (2010). Facilities that can currently convey the peak flow were assigned an LOS of greater than 20. Two options were considered for these facilities:

- If the need was identified in the *2007 Program Update*, the conceptual project developed for the need in 2007 will be carried forward.
- If the need was not identified in the *2007 Program Update*, the pipeline or pump station will be replaced or upgraded.

Facilities that cannot currently convey the peak flow were assigned an LOS of 20 or less; for example, an LOS of 5 means there is a one in five chance that an overflow will occur in any given year. For these facilities, the condition, age, and composition of pipes were considered in order to decide whether to parallel or replace them. Replacement projects were developed for pipes greater than 50 years old and in poor condition. It was assumed that paralleling would occur in areas with relatively new pipes made of durable materials like reinforced concrete or metal, with enough room available, and with few pipes in the corridor.

The size for each new parallel or replacement pipe was then determined by projecting the 20-year peak flow in 2060 to be conveyed through the pipe. After the pipes were sized, possible pipeline routes were developed based on GIS data, aerial photographs, and elevations of existing conveyance facilities. Factors considered in developing possible routes included stream crossings, major street and culvert crossings, wetlands, public rights-of-way, topography, water

bodies, and high water tables. Stream and wetland crossings were avoided, if possible; major street crossings were minimized; and public rights-of-way were preferred to private properties.

Flow diversion and storage were evaluated if paralleling was infeasible or to determine if these options were more-cost effective than paralleling all or part of a the length of a pipeline where capacity is needed. Sometimes an iterative process was used to find the optimal combination of storage, diversion, and downstream paralleling costs.

Storage and diversion considerations were as follows:

- **Storage.** Storage facilities, such as tanks or online or offline pipes and tunnels, store flow in excess of capacity and release the flow when downstream capacity becomes available for conveyance to a treatment plant. The downstream benefits of storage were analyzed using the MOUSE hydraulic model to determine if building storage capacity rather than paralleling the pipe could provide needed capacity. A storage curve was developed to determine how much storage would be required. If the modeling indicated that storage was feasible and if the estimated cost of storage was less than increasing capacity in the downstream system, storage was assumed. Possible locations and types of storage facilities were identified. It is usually better if flow enters and exits a storage facility via gravity to avoid the need for pumps and associated electrical and mechanical equipment; large pipes are also typically less expensive than tanks for underground storage.
- **Diversion.** Diversion involves construction of a new pipeline to divert upstream flow to existing WTD facilities. Analysis of the feasibility of diversion took into consideration proximity to existing conveyance facilities, infrastructure and environmental constraints, and possible impacts to downstream facilities. If the analysis indicated that diversion was feasible and if the estimated cost of diversion was less than increasing capacity in the downstream system, diversion was assumed.

The methodology for estimating conceptual CSI project costs produces an order of magnitude, planning-level estimate for each project using only a rudimentary scope defined in the form of a need. General assumptions are made and documented throughout the process. The process and supporting tools/techniques align with AACE International standards and total cost management (TCM) practices for development of a conceptual Class 5 estimate. Class 5 estimates are considered to have an accuracy range of -50 percent to +100 percent.[11] The level of project definition is minimal or near a zero percent level of engineering development.

The list of proposed projects and cost estimates were modified based on information from local sewer agency representatives on local conditions, including topographic or permitting issues, and on plans for future road and utility projects that may provide the opportunity for coordination with CSI projects.

[11] AACE International Recommended Practice No. 18R-97: *Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries* can be found at: http://www.costengineering.eu/Downloads/articles/AACE_CLASSIFICATION_SYSTEM.pdf.

In accordance with conveyance policies, WTD will (1) conduct additional flow monitoring and modeling to verify or update the flow projections, (2) analyze the feasibility of including reclaimed water conveyance and access, and (3) assess the feasibility of reducing I/I as a means to reduce, delay, or eliminate the need for a project before initiating any of the identified conceptual projects.

3.3 Conceptual Projects

The 2015 RNA determined that the capacities of 77 components or sections of King County's separated sewer system are below or will fall below the 20-year peak flow design standard (KCC 28.86.060) sometime in the 50-year planning period (2010 to 2060). Over half of the facilities (40) do not currently meet the standard. As a result, 41 conceptual CSI projects were developed to address the capacity needs of conveyance facilities in the separated sewer portion of the regional wastewater system. Ten conceptual projects are located in the Northeast Lake Washington Planning Area and six in the Hidden Lake Planning Area.

Table 3-2 lists the total planning-level project and the construction-only cost estimates for the conceptual projects. Total project costs include allied costs such as project design, permitting, and property acquisition. Figure 3-2 shows the locations of the projects in each of the planning areas.

Table 3-2. Estimated Project and Construction Costs for Conceptual Projects

Planning Area	Project Name	Estimated Total Project Cost (M 2016$)	Estimated Construction Cost (M 2016$)
North Lake Washington	North Creek Trunk Storage and Replacement	85.4	43.6
	Swamp Creek Trunk Extension Replacement	17.4	8.4
	McAleer Trunk Replacement	5.1	2.5
	Lake Ballinger Storage	82.9	43.6
Hidden Lake	Richmond Beach Pump Station Upgrade	46.8	24.6
	Richmond Beach Force Main Parallel	11.7	5.7
	Richmond Beach – Edmonds Interceptor Parallel	13.9	6.7
	Boeing Creek Trunk Replacement and Parallel	9.7	4.7
	Hidden Lake Pump Station Upgrade	10.9	5.3
	Hidden Lake Force Main Replacement	6.9	3.4
Northwest Lake Washington	Thornton Creek Trunk Replacement and Realignment	34.6	18.1
	North Lake City Trunk Replacement and Realignment	44.8	23.5
Northeast Lake Washington	Medina Trunk Replacement	14.2	6.9
	Medina Siphon Replacement	13.8	6.7

Planning Area	Project Name	Estimated Total Project Cost (M 2016$)	Estimated Construction Cost (M 2016$)
	Factoria Trunk Diversion	20.5	9.6
	Lake Hills Interceptor Replacement	70.4	37.0
	North Mercer Pump Station Upgrade	18.2	9.2
	Yarrow Bay Pump Station Replacement	18.8	9.5
	Sweyolocken Pump Station Upgrade	29.8	15.0
	Kirkland Pump Station Upgrade	22.7	11.5
	Medina Pump Station Upgrade	22.2	11.2
	Eastside Interceptor Section 8 Storage	112.1	57.9
North Lake Sammamish	No conceptual projects	–	–
Southeast Lake Washington	No conceptual projects	–	–
South Lake Sammamish	Sammamish Plateau Diversion Phase 2	218.9	113.0
	Eastgate Trunk Replacement	8.1	3.9
	Issaquah Interceptor Section 2 Replacement	3.7	1.8
	Issaquah Creek Highlands Storage	8.6	3.7
South Lake Washington	Eastside Interceptor Section 1 Replacement	207.4	108.0
	Bryn Mawr Trunk Storage	50.0	26.3
	Cedar River Interceptor Section 2 Replacement	8.3	4.0
	Cedar River Interceptor Section 1 Replacement and Parallel	16.2	8.2
North Green River	Tukwila Freeway Crossing Replacement	24.2	12.2
	Tukwila Interceptor Replacement	30.3	15.3
	South Renton Trunk Replacement	10.6	5.1
	Rainier Vista Interceptor South Replacement	5.0	2.4
	North Soos Creek Trunk Replacement	9.1	4.4
South Green River – Kent	Garrison Creek Interceptor Replacement, Realignment, and Diversion	55.7	29.3
	Auburn Interceptor Sections 1, 2, and 3 Replacement	270.3	142.1
	South 227th Interceptor Replacement	9.4	4.6
	West Hill Trunk Diversion	10.0	.4.9
South Green River – Soos Creek	Black Diamond Pump Station Upgrade	4.5	2.2
	Black Diamond Trunk Storage and Replacement	82.6	43.4
South Green River – Auburn	No conceptual projects	–	–

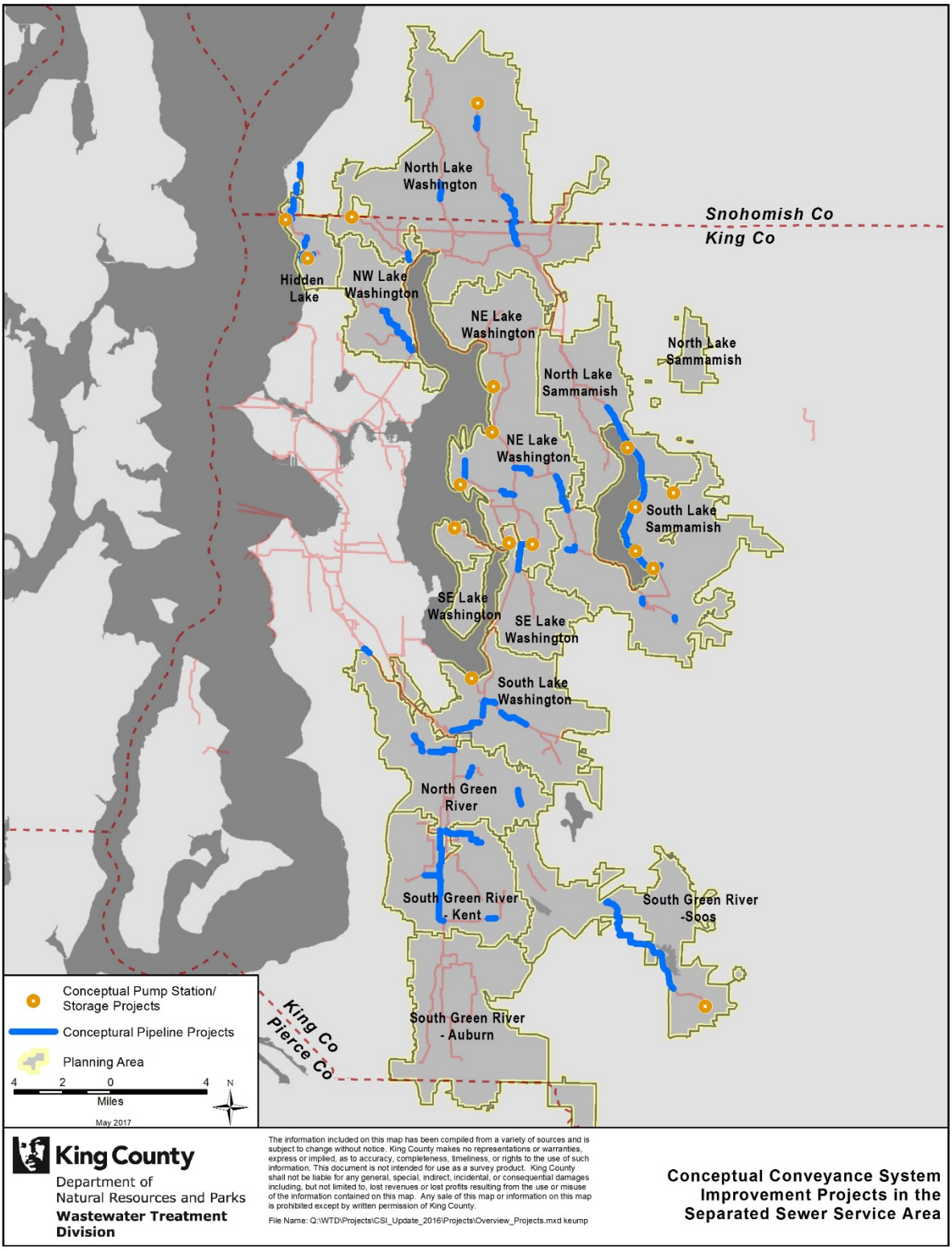

Figure 3-2. Locations of Planned Conceptual Conveyance System Improvement Projects in the Separated Sewer Service Area

3.4 Prioritizing Projects

Prioritization of CSI projects is primarily based on LOS. The estimates were then sorted following the criteria below to determine prioritization based on LOS:

- High priority = 2010 LOS < 5 or 2030 LOS < 2
- Medium priority = LOS between 5 and 10 in 2010 or between 2 and 5 in 2030
- Low priority = LOS >10 in 2010 or > 5 in 2030

The following are other factors considered during project prioritization:

- **Evaluation of risk of overflow versus surcharge.** Wastewater modeling was done to assess the potential for overflow versus pipe surcharge without causing an overflow.
- **O&M issues.** Asset management and operations information was collected on conveyance system components where the 20-year peak flow was exceeded prior to 2010.
- **Community and local agency input.** Input was sought on project prioritization through MWPAAC and the E&P Subcommittee and through individual meetings with cities and sewer districts.
- **Coincident benefits.** Working through MWPAAC and the E&P Subcommittee, departments of transportation at various levels of government throughout the region were contacted to discuss partnering with transportation or other capital projects. At this point, no projects with coincident benefits have been identified.

Table 3-3 presents the results of the application of prioritization criteria to planned conveyance projects.

3.5 Prioritized Projects

Table 3-3 and Figure 3-3 present priority-level assignments for conceptual CSI projects. The priority-level assignments are the result of applying the factors presented in Section 3.4 above. This resulted in eight high-, 10 medium-, and 23 low-priority projects.

Table 3-3. Results of Application of Prioritization Criteria to Planned Conveyance Projects (Yellow = High Priority; Green = Medium Priority; White = Low Priority)

Project Name	Sewered Area Growth 2010–2030 (%)	Sewered Population Growth 2010–2030 (%)	20-yr Peak Flow (mgd)		Peak 20-yr Flow Increase 2010–2030 (%)	Level of Service (years)		O&M Issues
			2010	2030		2010	2030	
North Creek Trunk Storage and Replacement (2 Phases)	30.8	24.0	23.6	29.4	24.9	6–10	2–5	Y
Swamp Creek Trunk Extension Replacement	38.5	39.6	15.3	20.3	32.8	11–20	2–5	N
Lake Ballinger Storage	1.4	35.5	16.9	19.4	14.7	11–20	2–5	N/A[2]
McAleer Creek Trunk Replacement	2.4	35.0	18.0	21.8	21.3	11–20	6–10	N
Hidden Lake Planning Area								
Richmond Beach Pump Station Upgrade	2.7	32.6	15.9	18.2	14.1	<2	< 2	Y
Richmond Beach Force Main Parallel	2.7	32.6	15.9	18.2	14.1	6–10	2–5	UNK[3]
Richmond Beach – Edmonds Interceptor Parallel	4.5	33.0	16.9	19.4	14.8	<2	< 2	N
Boeing Creek Trunk Replacement and Parallel	2.7	32.6	8.0	9.3	15.3	2–5	< 2	N
Hidden Lake Pump Station Upgrade	1.5	42.6	8.4	9.5	13.8	6–10	2–5	N
Hidden Lake Force Main Replacement	1.5	42.6	8.4	9.5	13.8	6–10	2–5	UNK[3]
Northwest Lake Washington Planning Area								
Thornton Creek Trunk Replacement and Diversion	0.5	17.2	60.1	68.2	13.4	<2	< 2	N
North Lake City Trunk Replacement, Realignment, and Rehabilitation	0.3	18.6	42.1	47.8	13.5	11–20	6–10	Y
Medina Trunk Replacement	1.9	16.6	6.4	7.3	14.1	6–10	2–5	N
Medina Siphon Replacement	1.9	16.6	6.7	8.0	19.2	6–10	2–5	UNK[3]
Factoria Trunk Diversion	10.9	10.8	5.7	6.6	15.6	6–10	2–5	N
Lake Hills Interceptor Replacement	23.7	31.9	39.3	50.2	27.7	11–20	2–5	Y
North Mercer Pump Station Upgrade	0.8	17.8	7.8	8.9	13.4	11–20	6–10	N
Kirkland Pump Station Upgrade	0.4	27.5	8.8	10.0	13.7	>20	11–20	N
Medina Pump Station Upgrade	1.9	16.6	9.2	10.4	14.1	>20	>20	Y
Yarrow Bay Pump Station Replacement	0.9	32.8	5.9	6.7	14.2	2–5	2–5	Y
Sweyolocken Pump Station Upgrade	1.4	43.6	17.9	20.7	15.8	>20	>20	N
Eastside Interceptor Section 8 Storage	13.0	34.0	147.0	176.0	19.8	>20	>20	N
South Lake Sammamish Planning Area								
Sammamish Plateau Diversion Phase 2	71.8	49.6	21.1	29.6	40.1	>20	11–20	N/A[4]

Project Name	Sewered Area Growth 2010–2030 (%)	Sewered Population Growth 2010–2030 (%)	20-yr Peak Flow (mgd)		Peak 20-yr Flow Increase 2010–2030 (%)	Level of Service (years)		O&M Issues
			2010	2030		2010	2030	
Eastgate Trunk Replacement	31.8	36.3	22.4	31.7	41.5	>20	6–10	Y
Issaquah Interceptor Section 2 Replacement	34.7	47.3	4.1	5.5	32.7	>20	>20	N
Issaquah Highlands Storage	21.3	41.7	4.3	5.2	21.2	>20	>20	N
South Lake Washington Planning Area								
Eastside Interceptor Section 1 Replacement	13.9	31.8	196.1	234.2	19.4	11–20	6–10[5]	N
Bryn Mawr Trunk Storage	2.6	17.8	13.3	15.2	13.8	11–20	11–20	N
Cedar River Interceptor Section 2 Replacement	29.8	31.7	26.0	31.7	21.5	>20	11–20	N
Cedar River Interceptor Section 1 Replacement	29.4	31.8	27.3	33.2	21.6	>20	>20	N
North Green River Planning Area								
Tukwila Freeway Crossing Replacement	10.1	33.1	9.4	10.8	14.4	2–5	<2	N
Tukwila Interceptor Replacement	15.6	62.1	11.7	14.3	21.6	>20	11–20	N
South Renton Trunk Replacement	12.5	19.0	5.6	6.6	17.9	>20	>20	N
Rainier Vista Interceptor South Replacement	8.8	32.2	7.7	9.1	17.4	>20	>20	N
North Soos Creek Trunk Replacement	35.9	54.9	2.7	3.5	30.8	>20	>20	N
South Green River – Kent								
Garrison Creek Interceptor Replacement, Realignment, and Diversion	18.7	40.0	8.2	10.0	21.6	2–5	2–5	Y
Auburn Interceptor Sections 1, 2, and 3 Replacement	44.8	36.1	50.7	71.4	41.0	>20	>20	Y
South 277th Interceptor Replacement	N/A	#N/A	20.9	30.3	45.2	>20	>20	N
West Hill Trunk Diversion	16.4	19.2	9.7	11.4	17.4	11–20	6–10	N
South Green River – Soos Creek								
Black Diamond Pump Station Upgrade	<10	<10	0.4	0.9	108.0	>20	>20	Y
Black Diamond Trunk Storage and Replacement (2 Phases)	214.6	156.0	1.9	3.9	108.0	11–20	<2	N

1. P1 = Total Cost Estimate for Phase 1, P2 = Total Cost Estimate for Phase 2.
2. Storage Project would not result in opportunity to coordinate with O&M needs; therefore, O&M needs are not applicable.
3. No facility condition information was available because of lack of access to inspect facility.
4. Proposed project to address need would install pipe in area where no WTD asset currently exists; therefore, O&M needs are not applicable.
5. After Eastside Interceptor Section 8 Storage is online in 2030, capacity increases to 11–20 years.

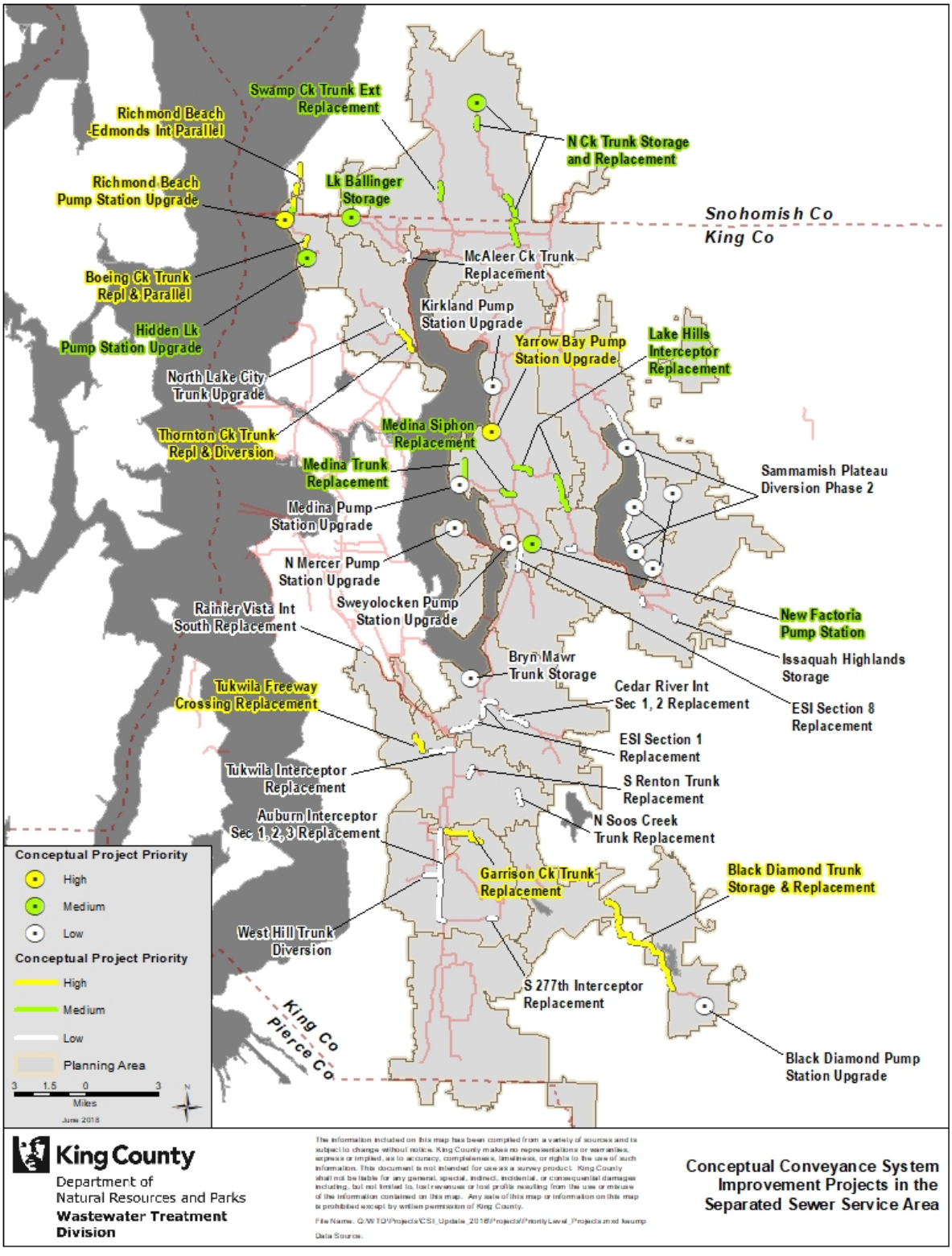

Figure 3-3. Priority Assignments for Conceptual Conveyance System Improvement Projects

3.6 Comparison of 2007 and 2017 CSI Program Updates

This section provides an overview comparison of the 2007 and 2017 CSI Program Updates that identifies which projects have been completed, which project are in construction, which projects have been modified, and which projects are new. Table 3-4 shows whether conceptual projects in this *2017 Program Update* were also included in the *2007 Program Update*. It also presents cost estimates for projects that appear in the *2017 Program Update*. Table 4-1 also presents a breakdown of estimated costs for planned projects in the *2017 Program Update*. Cost information for the 2007 CSI projects can be found in Chapter 6 of the *2007 Program Update*.

Table 3-4. Comparison of 2017 and 2007 Conveyance System Improvement Program Updates

2017 Project Name	In *2007 Program Update*	2007 Project Name	2017 Estimated Total Project Cost (M 2016$)	Comments
North Lake Washington Planning Area				
North Creek Trunk Storage and Replacement (2 Phases)	Yes	Same as 2017	P1=25.6/P2=51.7[1]	
Swamp Creek Trunk Extension Replacement	Yes	Same as 2017	15.3	
Lake Ballinger Storage	No	Same as 2017	74.9	
McAleer Creek Trunk Replacement	No	Same as 2017	3.85	
Hidden Lake Planning Area				
Richmond Beach Pump Station Upgrade	Yes	Richmond Beach Storage	29.8	
Richmond Beach Force Main Parallel	Yes	Richmond Beach Storage	11.1	
Richmond Beach – Edmonds Interceptor Parallel	Yes	Richmond Beach Storage	12.4	
Boeing Creek Trunk Replacement and Parallel	Yes	Boeing Creek Storage Expansion	8.35	
Hidden Lake Pump Station Upgrade	No	Same as 2017	8.96	
Hidden Lake Force Main Replacement	No	Same as 2017	5.61	
Northwest Lake Washington Planning Area				
Thornton Creek Trunk Replacement and Diversion	Yes	Same as 2017	33.9	
North Lake City Trunk Replacement, Realignment, and Rehabilitation	No	Same as 2017	44.1	
Northeast Lake Washington Planning Area				
Bellevue Influent Trunk Parallel	Yes	Same as 2017	N/A	Project completed.
North Mercer and Enatai Interceptor Parallels	Yes	North Mercer and Enatai Interceptor Parallels	N/A	Project in implementation.
Juanita Bay Pump Station Force Main Upgrade		Same as 2017		
Medina Trunk Replacement	Yes	Medina Storage	12.2	Increased peak flow

2017 Project Name	In *2007 Program Update*	2007 Project Name	2017 Estimated Total Project Cost (M 2016$)	Comments
				projection precludes use of storage.
Medina Siphon Replacement	Yes	Same as 2017	11.8	
Factoria Trunk Diversion (change name in conceptual projects report)	Yes	Factoria Pump Station and Trunk Diversion	15.4	
Lake Hills Interceptor Replacement	No	Same as 2017	62.1	
North Mercer Pump Station Upgrade	Yes	Same as 2017	7.68	
Kirkland Pump Station Upgrade	No	Same as 2017	10.8	
Medina Pump Station Upgrade	No	Same as 2017	10.6	
Yarrow Bay Pump Station Replacement	No	Same as 2017	16.3	
Sweyolocken Pump Station Upgrade	No	Same as 2017	9.37	
Eastside Interceptor Section 8 Storage	No	Same as 2017	101	
South Lake Sammamish Planning Area				
Sammamish Plateau Diversion Phase 2	Yes	Same as 2017	194	
Eastgate Trunk Replacement	Yes	Same as 2017	7.06	
Issaquah Interceptor Section 2 Replacement	Yes	Same as 2017	3.42	
Issaquah Highlands Storage	Yes	Same as 2017	6.22	
South Lake Washington Planning Area				
Eastside Interceptor Section 1 Replacement	No	Same as 2017	195	
Bryn Mawr Trunk Storage	Yes	Same as 2017	20.5	
Cedar River Interceptor Section 2 Replacement	No	Same as 2017	7.74	
Cedar River Interceptor Section 1 Replacement	No	Same as 2017	15.9	
North Green River Planning Area				
Tukwila Freeway Crossing Replacement	No	Same as 2017	22.8	
Tukwila Interceptor Replacement	No	Same as 2017	27.2	
South Renton Trunk Replacement	Yes	Same as 2017	8.63	
Rainier Vista Interceptor South Replacement	No	Same as 2017	3.73	
North Soos Creek Trunk Replacement	No	Same as 2017	5.95	

2017 Project Name	In *2007 Program Update*	2007 Project Name	2017 Estimated Total Project Cost (M 2016$)	Comments
South Green River – Kent				
Garrison Creek Interceptor Replacement, Realignment, and Diversion	Yes	Same as 2017	49.2	
Auburn Interceptor Sections 1, 2, and 3 Replacement	Yes	Same as 2017	255	
South 277th Interceptor Replacement	No	Same as 2017	7.43	
West Hill Trunk Diversion	No	Same as 2017	6.63	
South Green River – Soos Creek				
Black Diamond Pump Station Upgrade	Yes	Same as 2017	1.37	
Black Diamond Trunk Storage and Replacement (2 Phases)	Yes	Same as 2017	P1=22.2/P2=60.3[1]	

P1 = Total Cost Estimate for Phase 1, P2 = Total Cost Estimate for Phase 2.

Chapter 4

CSI Program Next Steps

This chapter describes the process for initiating CSI projects, gives an estimated timeline for implementing the identified projects, and presents the process and outcome of a preliminary review of the level of effort required to address ESJ considerations in areas where priority projects will be undertaken.

4.1 Project Implementation

CSI capital projects are initiated in a multistep process that includes the following:

- Problem definition
- Project design
- Project construction

4.1.1 Problem Definition

Problem definition advances a project from comprehensive planning to individual project planning, design, and construction. The purpose of problem definition is to (1) define the objective or the problem to be solved by the project and (2) provide context that includes existing conditions, constraints, and other project requirements to be met. Problem definition is led by WTD's Comprehensive Planning Unit. It is prepared for the Project Management Unit project manager who will oversee the capital project.

The intent of problem definition is to provide complete, accurate, and timely information to projects in order to improve efficiency. To accomplish this, problem definition strategy is to determine future design flows, provide information on existing asset capacity and conditions, and provide policy/initiative direction before predesign. Products of problem definition include the initial project charter, a flow design criteria memo, and a reference document list.

4.1.2 Project Design

Project design consists of two phases: preliminary design and final design. The preliminary design phase includes the process of developing two to four best apparent alternatives, selecting a preferred alternative, presenting the alternative for approval, developing the preferred

alternative, and then setting the baselines to proceed to final design. Primary activities during the final design phase are to complete, sequentially, 60, 90, and 100 percent plans and specifications; obtain permits and rights-of-way; and procure the necessary construction and construction management services contracts.

4.1.3 Project Construction

Project construction is the primary activity of project implementation. During this stage, WTD's Construction Management Unit and Project Controls Unit take on key tasks of managing construction contracts until final acceptance of the project. These tasks include arranging pre-construction meetings with the contractor, issuing notice-to-proceed letters, communicating and negotiating with construction contractors, and processing change orders. Construction Management Unit staff are also responsible for site inspection and acceptance of contractor work and issuing notices of substantial completion and final acceptance. Project construction is followed by project closeout.

4.2 Project Implementation Timeline

Table 4-1 presents the estimated timeline for implementing CSI projects.

Table 4-1. Estimated Timeline for Implementing Conveyance System Improvement Projects (Yellow = High Priority; Green = Medium Priority; White = Low Priority)

Project Name	Year the 20–yr Peak Capacity is Exceeded	Estimated Timeframe for Project Initiation	Estimated Timeframe for Project Completion	Estimated Total Project Cost (M 2016$)
Richmond Beach Pump Station Upgrade	Before 2010	2020–2030	2028–2040	46.8
Richmond Beach – Edmonds Interceptor Parallel	Before 2010	2020–2030	2028–2040	13.8
Boeing Creek Trunk Replacement and Parallel	Before 2010	2020–2030	2028–2040	9.7
Thornton Creek Trunk Replacement and Diversion	Before 2010	2020–2030	2028–2040	34.6
Yarrow Bay Pump Station Replacement	Before 2010	2020–2030	2028–2040	18.8
Tukwila Freeway Crossing Replacement	Before 2010	2020–2030	2028–2040	24.2
Garrison Creek Interceptor Replacement, Realignment, and Diversion	Before 2010	2020–2030	2028–2040	55.7
Black Diamond Trunk Storage and Replacement (Phase 1)	Before 2010	2020–2030	2028–2040	22.2
North Creek Trunk Storage and Replacement (Phase 1)	Before 2010	2030–2040	2040–2050	27.7
Swamp Creek Trunk Extension Replacement	Before 2010	2030–2040	2040–2050	17.4
Lake Ballinger Storage	Before 2010	2030–2040	2040–2050	82.9
Richmond Beach Force Main Parallel	Before 2010	2030–2040	2040–2050	11.7
Hidden Lake Pump Station Upgrade	Before 2010	2030–2040	2040–2050	10.9
Hidden Lake Force Main Replacement	Before 2010	2030–2040	2040–2050	6.9
Medina Trunk Replacement	Before 2010	2030–2040	2040–2050	14.2
Medina Siphon Replacement	Before 2010	2030–2040	2040–2050	13.8
Factoria Trunk Diversion	Before 2010	2030–2040	2040–2050	20.5
Lake Hills Interceptor Replacement	Before 2010	2030–2040	2040–2050	70.4
North Creek Trunk Storage and Replacement (Phase 2)	2030	2040–2060	2050–2070	57.7
McAleer Creek Trunk Replacement	Before 2010	2040–2060	2050–2070	5.1
North Lake City Trunk Replacement, Realignment, and Rehabilitation	Before 2010	2040–2060	2050–2070	44.8

Project Name	Year the 20–yr Peak Capacity is Exceeded	Estimated Timeframe for Project Initiation	Estimated Timeframe for Project Completion	Estimated Total Project Cost (M 2016$)
North Mercer Pump Station Upgrade	Before 2010	2040–2060	2050–2070	18.2
Kirkland Pump Station Upgrade	2019	2040–2060	2050–2070	22.7
Medina Pump Station Upgrade	2030	2040–2060	2050–2070	22.2
Sweyolocken Pump Station Upgrade	2033	2040–2060	2050–2070	29.8
Eastside Interceptor Section 8 Storage	2039	2040–2060	2050–2070	112.1
Sammamish Plateau Diversion Phase 2	2027	2040–2060	2050–2070	218.9
Eastgate Trunk Replacement	2025	2040–2060	2050–2070	8.1
Issaquah Interceptor Section 2 Replacement	2053	2040–2060	2050–2070	3.7
Issaquah Creek Highlands Storage	2038	2040–2060	2050–2070	8.6
Eastside Interceptor Section 1 Replacement	Before 2010	2040–2060	2050–2070	207.4
Bryn Mawr Trunk Storage	Before 2010	2040–2060	2050–2070	50.0
Cedar River Interceptor Section 2 Replacement	2020	2040–2060	2050–2070	8.3
Cedar River Interceptor Section 1 Replacement	2034	2040–2060	2050–2070	16.2
Tukwila Interceptor Replacement	Before 2010	2040–2060	2050–2070	30.3
South Renton Trunk Replacement	2047	2040–2060	2050–2070	10.6
Rainier Vista Interceptor South Replacement	2042	2040–2060	2050–2070	5.0
North Soos Creek Trunk Replacement	2051	2040–2060	2050–2070	9.1
Auburn Interceptor Sections 1, 2, and 3 Replacement	2030	2040–2060	2050–2070	270.3
South 277th Interceptor Replacement	2050	2040–2060	2050–2070	9.4
West Hill Trunk Diversion	Before 2010	2040–2060	2050–2070	10.0
Black Diamond Trunk Storage and Replacement (Phase 2)	2030	2040–2060	2050–2070	60.3
Black Diamond Pump Station Upgrade	Before 2010	2040–2060	2050–2070	4.5

4.3 Equity Impact Reviews

A preliminary equity impact review was conducted as part of the 2017 Program Update to evaluate the level of ESJ effort required for each medium- and high-priority CSI project. Results will be updated as projects move through future stages, including project definition, design, and implementation.

4.3.1 Review Process

The equity impact review included three elements:

- Reach—people and places that will be affected by the project
- Intensity—effects, impacts, and/or outcomes the project will have on people and places
- Duration—how long the project will have an effect (short, medium, and long term)

The review focused on the location of projects (reach) because of the conceptual nature of the proposed projects. This analysis only assessed reach. Because the *2017 Program Update* is a long-range programmatic plan, there is not adequate infrastructure for the planned projects to assess intensity and duration.

Reach

Areas where high- and medium-priority projects will be constructed were evaluated for their social and demographic characteristics, including income, poverty, race, age, disability, language, and education. Each characteristic was considered at the census-tract level in relation to the King County averages to identify equity considerations.

Project areas were placed in the following categories based on the number of equity considerations identified:

- Two or less equity considerations
- Three or four equity considerations; requires documentation of determinants of equity in the project area[12]
- Five or more equity considerations; requires preparation of an ESJ plan

When considerations were different among census tracts within the whole project area, the majority of each characteristic was used. If there was an even split between the census tracts, the tract with the larger population was used. For example, the Lake Hills Interceptor Replacement Project spans four census tracts. Two of these tracts have a higher percentage of individuals with disabilities than the county average and two tracts do not. The total population, or the even split of the higher population census tracts, was used to determine whether the majority of individuals

[12] Information on the King County ESJ strategic plan, including determinants of equity, is available at: http://kingcounty.gov/elected/executive/equity-social-justice/vision.aspx.

were above or below the county average. In this case, an additional 2,273 individuals were above the county average and, therefore, disability is an equity consideration for the Lake Hills Project.

4.3.2 Review Outcomes

An ESJ review of priority CSI project reaches determined the following:

- Three priority CSI projects had five or more equity considerations:
    - Lake Ballinger Storage
    - Tukwila Freeway Crossing Replacement
    - Garrison Creek Interceptor Replacement, Realignment, and Diversion
- Four priority CSI projects had three or four equity considerations:
    - Hidden Lake Pump Station Upgrade
    - Medina Siphon Replacement
    - Factoria Trunk Diversion
    - Lake Hills Interceptor Replacement
- Eleven projects had two or less equity considerations:
    - North Creek Trunk Storage and Replacement (two phases)
    - Swamp Creek Trunk Extension Replacement
    - Richmond Beach Pump Station Upgrade
    - Richmond Beach Force Main Parallel
    - Richmond Beach – Edmonds Interceptor Parallel
    - Boeing Creek Trunk Replacement and Parallel
    - Hidden Lake Force Main Replacement
    - Thornton Creek Trunk Replacement and Diversion
    - Medina Trunk Replacement
    - Yarrow Bay Pump Station Replacement
    - Black Diamond Trunk Storage and Replacement (two phases)

These outcomes will inform early CSI project planning so that project teams are aware of potential ESJ considerations.