

Reclaimed Water Comprehensive Plan

Purpose and Need Statement

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King County

Department of Natural Resources and Parks
Wastewater Treatment Division

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Summary

The purpose of the Reclaimed Water Comprehensive Plan is to determine if, how, when, where, and by what funding mechanisms over the next 30 years King County’s existing reclaimed water program should expand. Such a plan is needed now to help the county continue to effectively manage its wastewater utility into the future.

The mission of King County’s Wastewater Treatment Division (WTD) is to protect public health and enhance the environment by treating and reclaiming water, recycling solids, and generating energy. Its vision is “Creating Resources from Wastewater.” WTD is required to conduct comprehensive planning under state law and county code. Since the regional wastewater system was established in 1958, comprehensive plans and plan updates have been adopted over time. The timing for updates has been driven by changing environmental regulations (the Secondary Treatment/Combined Sewer Overflow Plan in 1986) and the need to determine how additional conveyance and treatment capacity will be provided (the Regional Wastewater Services Plan in 1999). Another update—the Reclaimed Water Comprehensive Plan—is now being developed in anticipation of potential changes to wastewater discharge regulations and potential impacts of climate change on the region.

“The purpose of the Reclaimed Water Comprehensive Plan is to determine if, how, when, where, and by what funding mechanisms over the next 30 years King County’s existing reclaimed water program should expand. Such a plan is needed now to help the county continue to effectively manage its wastewater utility into

This purpose and needs statement lays a foundation for the Reclaimed Water Comprehensive Plan by describing the drivers that have prompted its development. The key drivers for the plan are as follows:

- **Regional Wastewater System Planning.** In addition to being required by state law and county code to conduct comprehensive wastewater planning, King County is required by state law to consider reclaimed water in wastewater planning. State law and regional policies recognize the importance of reclaimed water for water resource management and encourage the development and use of reclaimed water. The state legislature in 2007 specifically found that the use of reclaimed water should be considered as part of restoration of Puget Sound and as part of strategies to address the impacts of climate change. County policies need to be updated to reflect current and future conditions and to address financing, pricing, and other policy-related issues that have emerged as the county’s existing reclaimed water program has developed over the last decade.
- **Creating Resources from Wastewater.** King County is committed to creating resources from the byproducts of the wastewater treatment process. Currently, WTD recycles 100 percent of the biosolids produced at its South and West Point Treatment Plants. In addition, WTD uses about 70 percent of the digester gas produced at these plants to generate heat, electricity, and natural gas. However, WTD recycles only 1 percent of the average of 200 million gallons of wastewater processed each day at its treatment plants. The Reclaimed Water Comprehensive Plan will explore the potential for increasing the percentage of water reclaimed. Projected population growth and effects of climate

change, low flows in streams, denied water right applications, and other indicators of water resource needs in the region could lead to greater need for reclaimed water to help meet future water demands. King County needs to understand how reclaimed water can help meet needs and be prepared to respond to these needs or be able to notify potential users where it is not able to provide reclaimed water reliably.

- **Protecting Water Quality in Puget Sound.** King County is the largest discharger of treated wastewater to Puget Sound. Wastewater treatment reduces the amount of pollution that enters the Sound but still leaves trace pollutants and nutrients in the effluent. Greater restrictions on discharges and other aspects of wastewater system operation may arise as more becomes known about the health of Puget Sound. If more treatment is required, reclaiming wastewater in conjunction with other wastewater management practices could help provide additional benefits for what could be a substantial investment.

The Reclaimed Water Comprehensive Plan will explore and analyze how reclaimed water could be used to address these and other needs. The information provided in this purpose and need statement forms the basis for future analyses to be conducted during the planning process. Criteria will be used to guide the evaluation of potential reclaimed water uses and in the development of different strategies to serve these uses. Alternatives that may provide similar benefits to the production and use of reclaimed water will be identified and listed, and a process for evaluating these alternatives will be developed for later use after the plan is complete and prior to implementing any projects to expand the region's existing reclaimed water system. Identification and evaluation of these alternatives will help ensure that decisions on whether or not to expand the existing reclaimed water system take into account different approaches to achieving the same benefits that reclaimed water may provide.

1.0 Introduction

King County began to develop its Reclaimed Water Comprehensive Plan in July 2008. This purpose and needs statement lays a foundation for the plan by describing the drivers that have prompted its development. The following sections provide background information and describe how this document is organized.

1.1 Background

The mission of King County's Wastewater Treatment Division (WTD) is to protect public health and enhance the environment by treating and reclaiming water, recycling solids, and generating energy. Its regional wastewater system serves about 1.5 million people within a 420-square-mile service area, including most urban areas of King County and parts of south Snohomish County and northeast Pierce County. The system collects wastewater from 17 cities, 16 local sewer utilities, and 1 Indian tribe and treats an average of approximately 200 million gallons per day.

WTD's vision—Creating Resources from Wastewater—describes WTD's approach to its mission. Wastewater treatment produces three main byproducts: biosolids, digester gas, and effluent. In keeping with its vision, WTD is finding beneficial uses for these byproducts:

- All biosolids produced at WTD treatment plants are recycled as a soil amendment for forestry and agricultural applications and to make compost.
- The West Point and South Treatment Plants recover digester gas to generate heat, electricity, and natural gas. Design is under way for a facility at the Brightwater plant for testing new technologies that generate energy from digester gas.
- WTD has been reclaiming some of the effluent produced at the West Point and South plants for over a decade. The new Carnation plant is beneficially using its effluent for wetland enhancement. Interest in reclaimed water has been increasing in the region, and the county has received requests for reclaimed water in recent years.

King County is currently developing a Reclaimed Water Comprehensive Plan to determine if, how, when, where, and by what funding mechanisms it's reclaimed water program should expand over the next 30 years. The plan will explore the conditions under which the county could make reclaimed water investments in a manner that is integrated into existing plans for the regional wastewater system, and will examine how reclaimed water can help address current and emerging regional challenges. Alternatives that may provide similar benefits to the production and use of reclaimed water will be identified and listed, and a process for evaluating these alternatives will be developed for later use after the plan is complete and prior to implementing any projects to expand the region's existing reclaimed water system. Identification and evaluation of these alternatives will help ensure that decisions to either expand or not expand the existing reclaimed water system take into account different approaches to achieving the same benefits that reclaimed water may provide.

1.2 Organization of This Document

This purpose and need statement establishes the starting point for developing the comprehensive plan by answering two questions:

- Why is WTD developing a Reclaimed Water Comprehensive Plan?
- Why is WTD developing the plan now?

The statement answers these questions in the following sections:

- **Section 2, Regional Wastewater System Planning.** King County is required to conduct comprehensive planning under state law and county code. Planning documents must evaluate alternative ways of providing wastewater services, including opportunities to use reclaimed water. This section describes wastewater planning policies and requirements.
- **Section 3, Creating Resources from Wastewater.** Population growth, increased development, and climate change are expected to adversely affect existing water resources in the Central Puget Sound region (King, Kitsap, Pierce, and Snohomish Counties). Localized water resource problems have come to light over the past decade with regard to instream flows, future water supply limited by availability of water rights, seasonal supply shortages, and the ability to serve intended agricultural land uses with adequate water supply. This section describes King County's vision for Creating Resources from Wastewater, the status of water resources in the region, and challenges and forecasts for meeting future water needs for people and aquatic life. Through the Reclaimed Water Comprehensive Plan, WTD is taking a systematic and systemwide look at if, how, when, where, and by what funding mechanisms its reclaimed water program should expand to help meet future water resource management challenges in the region.
- **Section 4, Protecting Water Quality in Puget Sound.** The county's regional wastewater system is the largest discharger of effluent to Puget Sound. Recent studies indicate that wastewater treatment plants are a major contributor of human-generated nitrogen to the Sound. Increased levels of such nitrogen can reduce the amount of oxygen available for aquatic life in marine water. This section summarizes findings from studies on wastewater discharges to the Sound, how these findings may lead to stricter requirements in discharge permits, and their implications for wastewater management. The Reclaimed Water Comprehensive Plan will evaluate reclaimed water as a wastewater management tool to reduce reliance on Puget Sound for discharge.
- **Section 5, Purpose and Need for Reclaimed Water Planning Now.** King County must start developing the Comprehensive Reclaimed Water Plan now so that it can continue to effectively manage its wastewater utility into the future. The process to develop the Reclaimed Water Comprehensive Plan is dynamic, incorporating findings from each step in the planning process into the next planning steps while answering fundamental questions about the feasibility of expanding the reclaimed water system over time and also following guiding principles and applying criteria to evaluate reclaimed water strategies. This section outlines the need for reclaimed water planning and then describes the process, questions, principles, and criteria.

2.0 Regional Wastewater System Planning

The following subsections describe the policies and regulations guiding King County's comprehensive wastewater planning, including reclaimed water planning, and how the county is meeting these policies and regulations.

2.1 Comprehensive Wastewater Planning

The Growth Management Act (Chapter 36.70A RCW) requires counties to develop growth management plans to ensure that facilities and services necessary to sustain urban growth are in place when needed. WTD is responsible for developing and implementing plans to provide sufficient capacity in the regional wastewater system to meet projected growth; comply with federal and state requirements related to the planning, design, construction, operation, and maintenance of its wastewater treatment system; and implement applicable local, state, and federal policies. Under Chapter 90.48 RCW, WTD is required to develop wastewater plans that consider reclaimed water.

Since the formation of the regional wastewater system in 1958, comprehensive planning has formed the cornerstone for ensuring that the system meets its responsibilities and is prepared to address emerging issues in the future. The Comprehensive Water Pollution Abatement Plan was adopted by WTD's predecessor, the Municipality of Metropolitan Seattle (Metro) Council, in 1959. This plan has been implemented in stages and updated over time. The most recent update is the Regional Wastewater Services Plan (RWSP), adopted by the King County Council in 1999 and approved by the Washington State Department of Ecology (Ecology) as a General Sewer Plan in September 2001 in accordance with RCW 90.48.110 and WAC 173-240-010.

The RWSP outlines a number of important projects, programs, and policies for King County to implement through 2030 to continue to protect public health and water quality and to ensure sufficient wastewater conveyance and treatment capacity to meet future needs. It includes over \$500 million in planning-level cost estimates for expanding conveyance and treatment capacity between 2012 and 2030, including approximately \$400 million for 24 conveyance system improvement projects¹ and \$109 million to expand the South Treatment Plant by 20 million gallons per day (mgd) in 2029.² Figure 1 shows completed and planned RWSP treatment, conveyance, and combined sewer overflow capital projects.

2.2 Reclaimed Water Planning as a Part of Wastewater Planning

Washington State laws and rules, King County policies, and Puget Sound Regional Council recommendations call for examination of the use of reclaimed water in King County's wastewater planning. In addition, there is a desire in the region to evaluate needs and uses for reclaimed water and to create a vision for beneficial use of this resource that allows for efficient operation of the regional wastewater system (Reclaimed Water Technical Committee, 2007).

¹ 2007 Conveyance System Improvement Program Update (<http://www.kingcounty.gov/environment/wastewater/CSI/ProgramUpdate.aspx>).

² RWSP 1998 preliminary planning-level cost estimate for expansion of South plant adjusted for inflation (3 percent per year), as reported in the 2007 RWSP Annual Report (<http://www.kingcounty.gov/environment/wtd/Construction/planning/rwsp/Library/AnnualReport.aspx>).

Washington State laws encourage the development and use of reclaimed water, require consideration of reclaimed water in wastewater planning, and recognize the importance of reclaimed water as a strategy for water resource management statewide (Chapters 90.46, 90.48, and 90.82 RCW). In 2007, through amendments to the Reclaimed Water Act (Chapter 90.46 RCW), the state legislature reaffirmed the state's commitment to reclaimed water and recognized the importance of the benefits of its use, including the following:

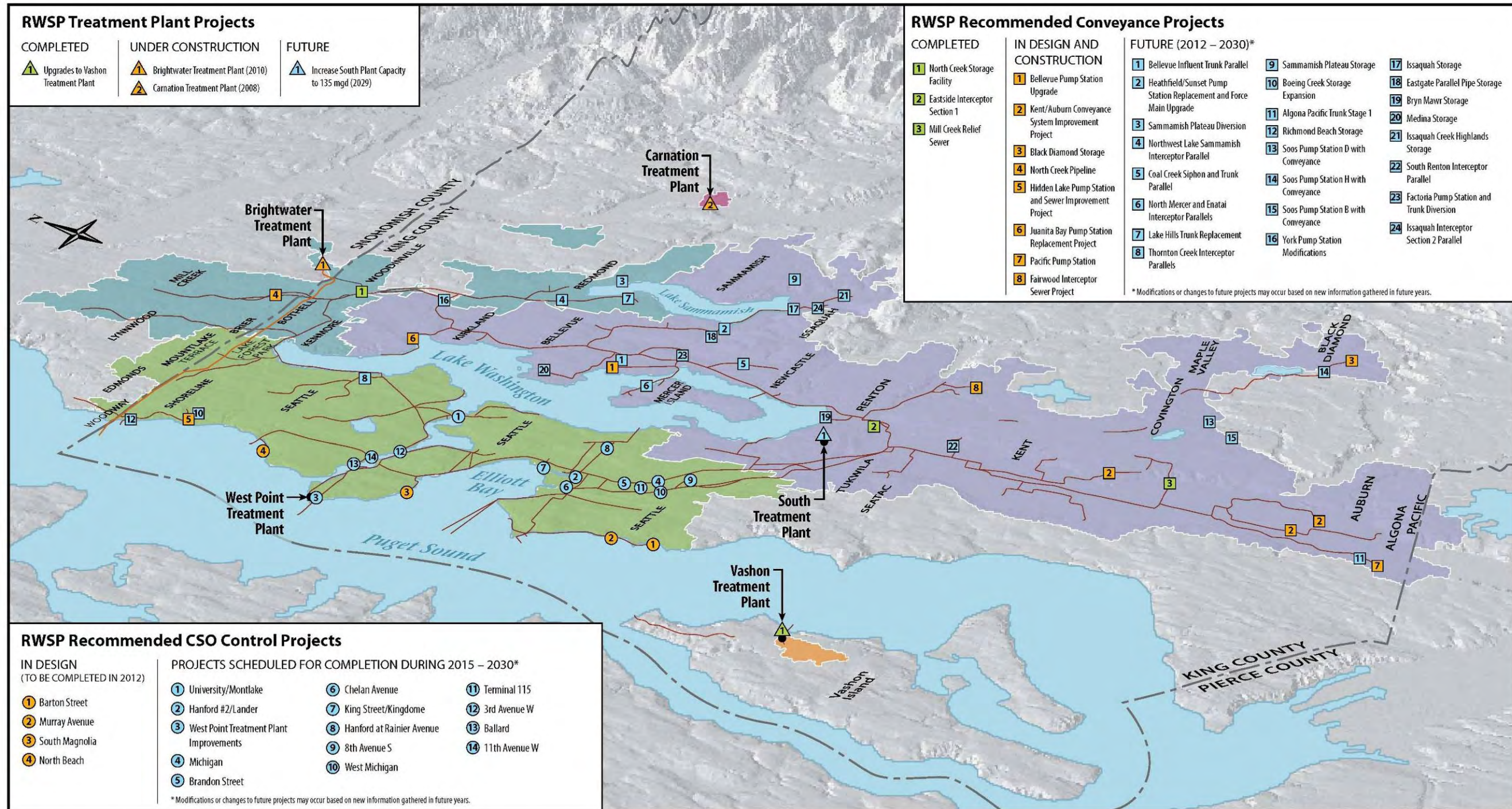
- Consistent, reliable water supply as Washington faces climate change challenges
- Reduced discharge of treated wastewater into Puget Sound
- More water in rivers and streams for salmon recovery

State law (RCW 90.48.112) requires wastewater planning to include consideration of opportunities to use reclaimed water. Rules adopted by Ecology (WAC 173-240-60) require wastewater planning documents to evaluate alternative ways of providing wastewater services. Water supply plans, either prepared by individual water systems or collectively by regional water providers, need to include evaluation and coordination with wastewater utilities of potential opportunities for the use of reclaimed water (RCW 90.46.120(3), as amended by the Legislature in 2009 in SSB 5504). New rules for reclaimed water facilities are being drafted and must be adopted by Ecology by December 31, 2010 (RCW 90.46.015).

The King County Comprehensive Plan, updated in October 2008, notes the important role that reclaimed water can play in protecting and conserving the quality and quantity of groundwater and salmon habitats. In addition, the RWSP calls for the county to actively pursue the use of reclaimed water to help preserve water supplies in the region, enhance or maintain fish runs, and preserve environmental and aesthetic values. RWSP reclaimed water policies (1) encourage the county to work with local water purveyors to evaluate opportunities to use reclaimed water in their service areas and (2) encourage the county to explore ways to increase the use of reclaimed water at its existing and future wastewater treatment facilities. RWSP conveyance policies call for integrating reclaimed water planning into conveyance planning and evaluating whether reclaimed water facilities could meet identified conveyance needs. These policies continue to provide important guidance to the existing program. However, they need to be updated to reflect current and future conditions and to address financing, pricing, and other policy-related issues that have emerged as the county's existing reclaimed water program has developed over the last decade.

The Puget Sound Regional Council's Vision 2040 recognizes the use of reclaimed water for irrigation and groundwater recharge as a way to improve ecosystem conditions and calls for the increased use of reclaimed water to reduce wastewater generation and ensure water availability.

The Reclaimed Water Comprehensive Plan will consider the role of reclaimed water as a wastewater management tool and a water resource for the region as part of the operation of the wastewater system over the next 30 years. The plan will examine if, how, when, where, and by what funding mechanisms to expand WTD's current reclaimed water program. It will take a proactive look at the whole wastewater system under possible future scenarios, seeking ways to optimize existing facilities, coordinate and integrate with other plans and projects, and solicit and integrate input from interested parties.



- Brightwater Service Area
- West Service Area
- South Service Area
- Carnation Service Area
- Vashon Service Area
- Existing Wastewater Pipeline
- Brightwater Conveyance


King County
 Department of Natural Resources and Parks
 Wastewater Treatment Division

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**Regional Wastewater Services
 Plan Projects and Service Areas
 (1999-2030) As Revised December 2006**

Figure 1. Regional Wastewater Services Plan Projects

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3.0 Creating Resources from Wastewater

Safe and environmentally responsible wastewater treatment has been and continues to be a part of WTD's mission. Since the formation of the regional wastewater system in 1958, advances in treatment and other technologies have allowed Metro and then King County to go one step further—to recycle byproducts of the treatment process in ways that benefit ratepayers, users of the recycled products, and the environment. In the early 2000s, WTD decided that it was time to update its vision after nearly 45 years of operating as a clean water agency. In building on this legacy and looking to the next 50 years, a clear goal emerged: to adopt sustainability practices that allow for returning the wastewater WTD treats as a beneficial resource to the environment and the community. The updated vision—Creating Resources from Wastewater—puts reclaiming, reusing, and recycling the byproducts of wastewater treatment in the forefront of the division's goals and activities without losing sight of its core mission to protect human health and the environment.

WTD's recycling efforts focus on three byproducts: biosolids, digester gas, and reclaimed water. Currently, WTD recycles 100 percent of the biosolids produced at its South and West Point Treatment Plants. The approximately 110,000 wet tons of high quality Class B biosolids produced each year is used as a soil amendment for forestry and agricultural applications and to make compost. In addition, WTD currently uses about 70 percent of the digester gas produced at these plants to generate heat, electricity, and natural gas. This percentage will increase after the cogeneration pump at West Point is replaced in 2012. Design is under way for a facility at the Brightwater plant for testing new technologies for generating energy from digester gas. Effluent—the third and largest byproduct of the treatment process—is mostly untapped as a resource. WTD treatment plants process an average of 200 mgd of wastewater. Only 1 percent of this wastewater volume is recycled—some for nonpotable uses at the West Point and South plants and some for limited nonpotable applications near South plant. The remaining 99 percent is discharged as secondary effluent to Puget Sound.

RWSP policy requires WTD to look for ways to reclaim more water from existing and new treatment plants. In keeping with this policy and with its new vision, WTD is expanding the offsite uses near South plant, beneficially using water from the new Carnation plant for enhancing a nearby wetland, and constructing the reclaimed water backbone pipeline south of the Brightwater plant. Each of these efforts represents an important step in achieving the goal to reuse more treated wastewater. Now, through the Reclaimed Water Comprehensive Plan, WTD is undertaking a systematic and systemwide look at if, how, when, where, and by what funding mechanisms its reclaimed water program should expand beyond the existing program to take advantage of opportunities for converting greater volumes of treated wastewater from a waste product into a resource.

Reclaimed water is a tool, along with other options, to help address water resource needs in the region. Western Washington has traditionally been considered rich in water resources, but these resources are not unlimited. The U.S. Geological Survey (USGS) estimated that in 2005, a total of 227.88 mgd of water was withdrawn from King County groundwater and surface water sources (USGS, 2005). Water supply planners predict that the region will have, on an average annual basis, enough supply on a regional scale in the foreseeable future. The importance of better water resource management, however, is anticipated to grow as challenges such as

meeting the needs of a greater population and responding to potential impacts from climate change put further strain on water resources and their ability to meet human and environmental needs, including economic development and fish recovery (Ecology, 2002; Ecology, 2004; Ecology, 2007; Forum, 2009; PSRC, 2008; Vano et al., in press; Waldo, 2003).

Water resource challenges, such as the following, are already facing the region:

- Flows may be too low in some streams to support uses such as salmon spawning (Tributary Streamflow Technical Committee, 2006).
- There are almost 200 pending applications for new water rights or for changing existing water rights (Ecology Water Right Administration Tracking System, 2009). This creates a challenge given that much of the region's water is already allocated, which makes new water rights increasingly difficult to obtain (Ecology, 2009).
- A recent land use survey estimates that approximately 6,000–9,000 more acres in King County could be farmed (or farmed more productively) if water were available (Evans, 2009).

These and other unmet needs, discussed in the following subsections, could result in conflicts and further demands on already stressed water resources. The Reclaimed Water Comprehensive Plan will analyze how reclaimed water can be considered as one potential water resource to satisfy unmet needs.

3.1 Status of Regional Water Resources

Water is essential to life in the region. It sustains the natural environment, supports homes and businesses, and is fundamental to commerce and economic health. Water resources in the region come from freshwater supplied from surface water and groundwater sources. Surface water is water that travels or is collected above ground, including streams, rivers, lakes, and wetlands. Groundwater is water that enters the ground and is stored in soil pore spaces and underground geological water systems called aquifers. Where streams and aquifers meet, water moves from one to the other, depending on the geology of the area. This interconnection between surface water and groundwater is referred to as hydraulic continuity.

Freshwater resources are used for agricultural, industrial, household, recreational, and environmental purposes. For many years, inventories and assessments of groundwater and freshwater resources have been done for the region. Decisions and actions based on such inventories and assessments have been made to determine how water should be managed for these purposes.

The State of Washington has divided the state into 62 Water Resource Inventory Areas (WRIAs) to delineate major watersheds (WAC 173-500-040; Chapter 90.54 RCW).³ King County includes all or portions of WRIAs 7, 8, 9, 10, and 15.⁴ These watersheds provide major regional sources of water supply, smaller subregional or individual supplies, and rivers and streams that support

³ A watershed is an area that drains into a river, lake, or other water body.

⁴ The portion of WRIA 15 in King County is Vashon Island. This watershed is outside of the reclaimed water planning area and is not discussed further in this purpose and need statement.

multiple species of plants and animals. The watersheds drain to Puget Sound, contributing to estuarine and nearshore habitat and to the quantity and quality of water in the Sound.

The nature and magnitude of contributions to Puget Sound from these watersheds are changing. According to an assessment of water quantity in the Puget Sound region published in 2008, the total annual flow into the Sound from rivers and streams has decreased by 13 percent between 1948 and 2003, and during the critical period from June through September of each year, the flows have decreased by 18 percent (PSP, 2008b). During the same timeframe, freshwater inflows from melting snowpack have started an average of 12 days earlier and high (flood) and low (drought) flow events have generally increased. These hydrologic changes have affected nearshore habitat and water circulation patterns.

A number of studies have been undertaken to assess the status of surface water and groundwater resources in and around King County. Some of these studies are discussed below.

3.1.1 Surface Water Resources

In the last 25 years, several studies have been conducted on summer low flow in rivers and streams in the Central Puget Sound region (Ecology, 1995a; Ecology, 1995b; Ecology, 1995c; KCDNR, 2001; Konrad and Booth, 2002; Lombard and Somers, 2004; National Marine Fisheries Service, 2006; NHC, 2005; PSP, 2008b; Tributary Streamflow Technical Committee, 2006). Each of these studies generally concludes that water resources in the region are currently stressed and/or likely to be stressed in the future.

Lombard and Somers (2004) summarized existing information on human-reduced summer low flows and effects on salmon populations in streams in the Central Puget Sound region. The rivers and streams that the authors identified are those with “obvious” low-flow problems—those for which sufficient records were available (Figure 2). The authors note that other streams may also have low-flow problems but that there are insufficient records of current and historical flows to make such a determination for these streams.

The largest rivers in King County where good records are available are showing evidence of trends of increasing number of days that the required instream flow is not met (Ecology, 1995a, 1995b, and 1995c).⁵ In addition, data from some stations, such as the USGS gauge on the Green River near Auburn, indicate that flows do not meet required instream flows on average a large percentage of the time during August and September (Figure 3). The National Marine Fisheries Service believes there is an urgent and inescapable need to address summer low-flow in rivers to recover Puget Sound Chinook salmon (National Marine Fisheries Service, 2006).

⁵ The regulatory “minimum” flow established by Ecology in the 1980s under the Washington Administrative Code (WAC) to protect and preserve instream resources and values, such as fish, wildlife, and recreation.

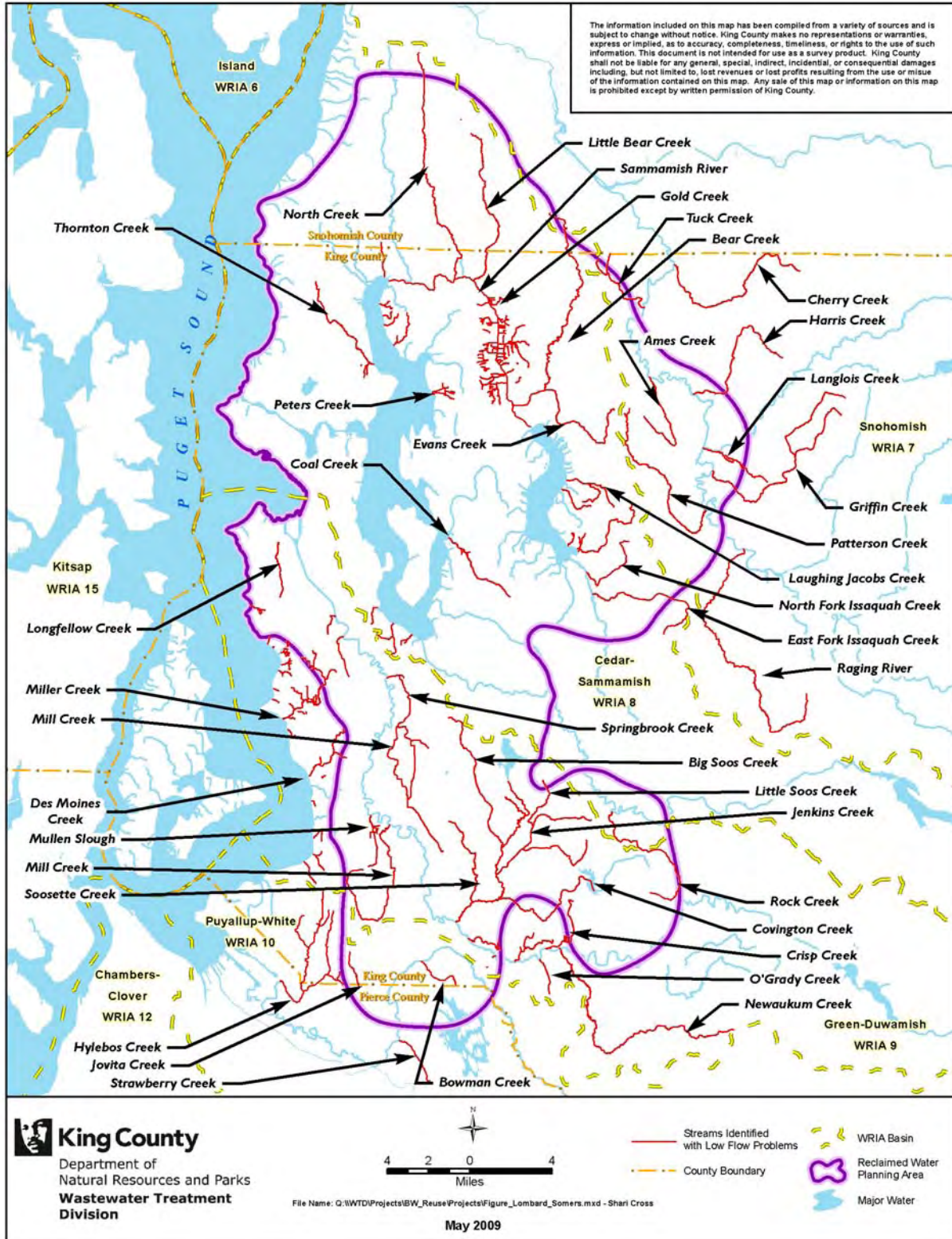


Figure 2. Rivers and Streams in Central Puget Sound Identified with Low-Flow Problems (Lombard and Somers, 2004)

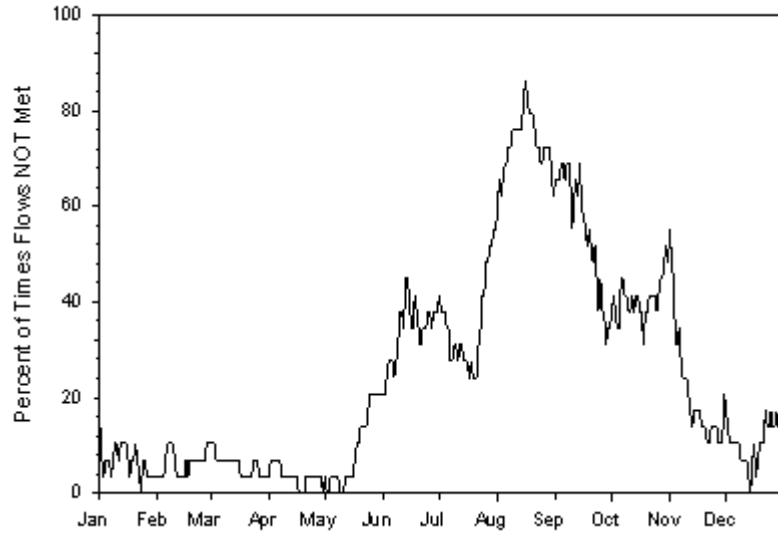


Figure 3. Average Percent of Time per Month the Green River, as Measured at USGS Gauge 12113000 near Auburn, Did Not Meet Instream Flow, 1980–2008

All the major rivers and streams in the region provide valuable habitat for anadromous fish (salmon and steelhead), several of which are listed as either threatened or endangered under the Endangered Species Act. WRIs 7, 8, 9, and 10 have been identified as among the state’s 16 “critical basins” for fisheries purposes by the Washington State Department of Fish and Wildlife (WSJNRC, 1999). In 2002, the Washington State Conservation Commission produced individual watershed reports on habitat factors that were limiting salmon and steelhead recovery in the four watersheds. A statement common to each report is, “The key identified concerns related to water quantity...are instream water withdrawals, altered hydrology associated with increased impervious surfaces, and altered hydrology from increased rain-on-snow runoff” (Washington State Conservation Commission, 2002).

3.1.2 Groundwater Resources

Aquifer conditions are not well understood in many areas of King County. Studies that have attempted to assess these conditions have produced mixed results. One study indicated that some aquifers in east King County have declining water levels (Turney et al., 1995). More recent King County studies, however, found these aquifers to have stable water levels (KCDNRP, 2005a; KCDNRP, 2005b). An aquifer in south King County was found to have declining water levels (CWD et al., 1995). A study conducted by USGS in southwestern King County noted that some wells showed declining water levels over time (Woodward et al., 1995). Since this 1995 study, one aquifer in southwestern King County has shown an increasing water level (Bowman, 2009). Other aquifers, such as those in the Redmond-Bear Creek Groundwater Management Area, have been documented as having no significant declines (KCDNRP, 2005a).⁶

⁶ King County has five groundwater management areas that were proposed and designated in 1986–1987 under the provisions of Chapter 173-100 WAC.

It is likely that the shallower aquifers would be most affected by groundwater withdrawals. However, because of rising development and demand, increased pumping of deeper aquifers may be depleting water supplies. More detailed and comprehensive assessments are needed to better understand both the condition of aquifers in the region and the effects of increasing withdrawals and climate change.

3.2 Meeting Water Supply Needs in the Future

Water can be supplied to users either through self-supply or delivery from a third party such as a public utility. The method for obtaining water is withdrawal from a surface water or groundwater resource. Surface water withdrawals require placing a water intake pipe into a stream, river, or lake. Groundwater withdrawals require drilling a well and pumping water from it. Both surface water and groundwater withdrawals in Washington State are regulated through a water appropriation and permitting system. Third-party water providers are typically required to engage in planning processes to ensure that future water needs can be met. Local governments in growing areas of the state are also required to develop plans to address necessary public services to meet growth needs, including water supply.

3.2.1 Water Appropriation and Permitting

A water right permit from the state is generally required before withdrawing water from surface sources and before withdrawing a large amount of groundwater. Two indicators of the current water supply challenge in the region are (1) the number of applications for new water rights or for changing existing water rights on file with Ecology and (2) the number of legal restrictions on future withdrawal of water.

As of January 2009, there were 191 applications pending for new water rights or for changing existing water rights in WRIs 7, 8, 9, and 10 (Table 1). These four WRIs have been identified by the state as “over-appropriated,” meaning that more water rights have been issued than can be satisfied by the physical supply of water available (WSJNRC, 1999). Instream flow levels have been set by state rules for 11 rivers and streams in the four WRIs, and junior water rights cannot be used if flow falls below these levels. No new water rights are available for 38 rivers and streams in these WRIs. These conditions make it difficult or impossible for Ecology to appropriate additional water by issuing new water rights.

For domestic and small municipal water suppliers, groundwater is preferred over surface water because it has fewer water quality concerns and usually does not require the expensive treatment that is required for surface water supplies. Generally, a water right is required for groundwater wells that withdraw more than 5,000 gallons per day (gpd). Groundwater wells that withdraw less than 5,000 gpd do not require a permit if the planned uses fall within those authorized in state law. Wells that are considered under this exception to the general water right requirement are commonly referred to as “exempt wells.”

Table 1. Flow Restriction Rules and Pending Water Right Applications for Surface Waters in Water Resource Inventory Areas (WRIAs) 7, 8, 9, and 10

WRIA	Number of Rivers or Streams with Flow Restriction Rules		Number of Pending Water Right Applications ³
	Instream Flow ¹	Closed ²	
WRIA 7—Snohomish basin (WAC 173-507)	7	7	59
WRIA 8—Cedar-Sammamish basin (WAC 173-508)	1 (mainstem Cedar River)	12	93
WRIA 9—Green-Duwamish basin (WAC 173-509)	1 (mainstem Green River)	5	37
WRIA 10—Puyallup-White basin (WAC 173-510)	2	14	2

¹ Regulated streamflows are set to protect and preserve instream resources and values, such as fish, wildlife, and recreation. Junior water right holders cannot use water right when flow is below instream flow level.

² No new water rights are available.

³ Includes application for water right and change of water right in Ecology's Water Right Administration Tracking system, as of January 2009.

The availability of new groundwater rights to meet increasing demands is limited because of the state's need to consider hydraulic continuity between surface water and groundwater rights. Of nearly 600 water right decisions for proposed groundwater uses issued by Ecology in late 1995 and early 1996, over 200 were denied. Many of these denials were in WRIAs 7, 8, and 9. The basis for the denials was the unavailability of water, frequently because the withdrawals were expected to affect streams where "minimum" flows have been established. Some of the denials were appealed in court. In 2000, the Supreme Court affirmed Ecology's decisions to deny the water rights mainly on the basis of the hydraulic continuity between the groundwater and nearby streams (Postema et al. v. The Pollution Control Hearings Board et al., 2000). The denied water rights have heightened awareness and concern over how future water needs will be met.

Because of the lack of availability of surface water and groundwater rights to meet water supply needs, exempt wells have increasingly been turned to as the source of supply for new developments. A water well report or well log must be filed with Ecology prior to drilling an exempt well. According to logs that were filed, the number of exempt wells in King County has risen steadily in the past decades. An average of 287 new wells have been drilled each year since 1975. (Figure 4 shows the number of new wells drilled between 2000 and 2008.) Ecology does not require that the amount of water withdrawn from exempt wells be metered or reported. Moreover, the effects of these withdrawals on streamflows with hydraulic continuity with groundwater are neither regulated by the state nor quantified (Caldwell, 1998).

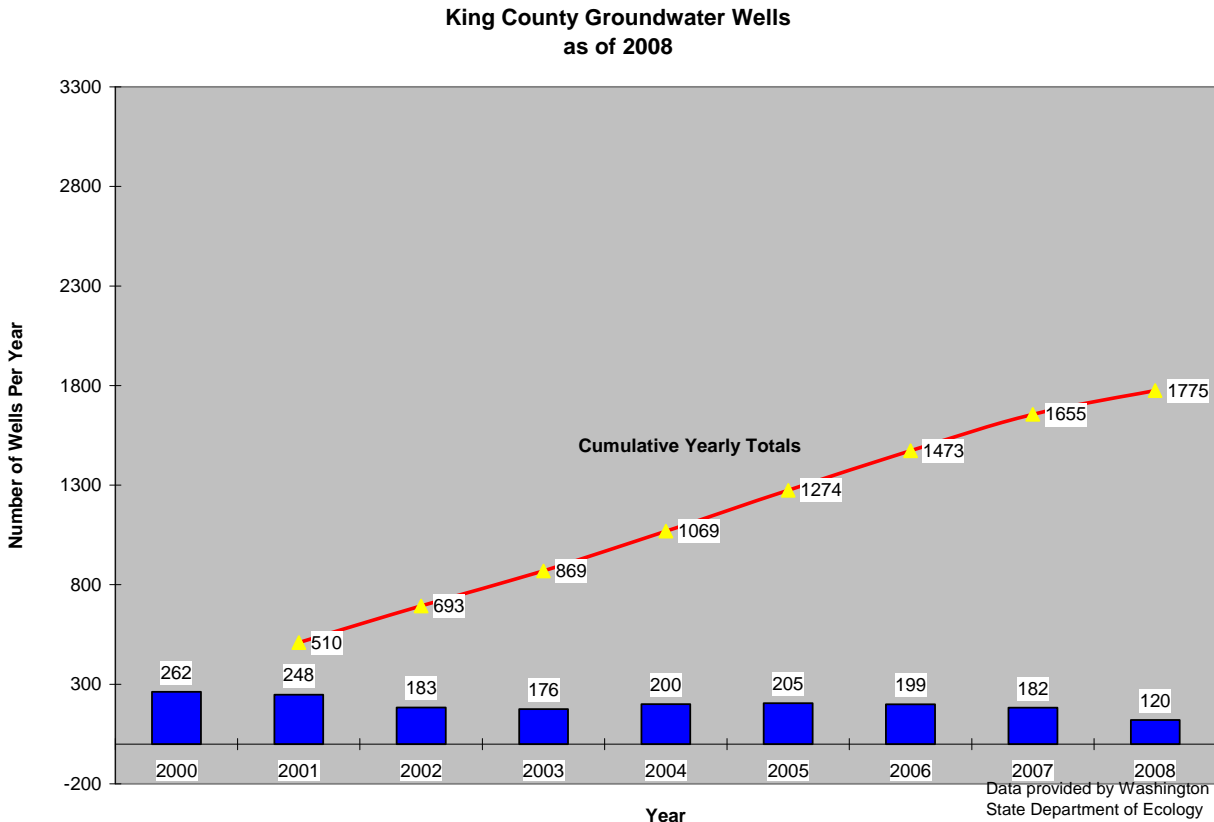


Figure 4. Number of New Exempt Groundwater Wells in King County, 2000–2008

3.2.2 Population Growth and Climate Change

The greater Central Puget Sound region is predicted to grow by approximately 1.4 million by 2040. King County expects to receive the largest share of this growth (PSRC, 2008). While water conservation efforts, particularly for large municipal systems, have tempered per capita water demands to date, many water utilities are projecting increasing water demands over the next 20 years commensurate with population growth.

Climate change is also likely to affect water resources and supplies. The Pacific Northwest is projected to experience higher average air temperatures, a general shift from snow to rain in the mountains, earlier spring runoff, more frequent and severe droughts, and more frequent large storms as a result of climate change (Washington Economic Steering Committee et al., 2006). These conditions will likely lead to increased irrigation demand during an extended growing season and to other altered demand patterns (Washington Economic Steering Committee et al., 2006). Managing water supply systems to provide sufficient water throughout the summer may become more challenging (Vano et al., in press).

Climate change is expected to significantly impact Washington’s hydrologic resources over the next century. The hydrology of the Pacific Northwest is particularly sensitive to changes in climate because of the role of mountain snowpack on the region’s rivers (McGuire Elsner et al., in press). The studies conducted on summer low flows in rivers and streams, discussed earlier, have generally concluded that water resources in the region are stressed and/or likely to be

stressed in the future (Ecology, 1995a; Ecology, 1995b; Ecology, 1995c; KCDNR, 2001; Konrad and Booth, 2002; Lombard and Somers, 2004; NHC, 2005; PSP, 2008b; Tributary Streamflow Technical Committee, 2006). In the most recent statewide assessment of potential impacts to streamflows from climate change, the University of Washington Climate Impacts Group forecast a reduction in flows to Puget Sound streams, along with increasing water temperatures and shifts in timing of peak flows, to the degree that these changes will constitute significant threats to the continued existence of several salmon species in King County waters (Vano et al., in press).

3.3 Water Supply Forecasts

The Central Puget Sound Water Suppliers Forum (Forum) recently prepared a draft of the 2008 *Central Puget Sound Regional Water Supply Outlook* (Outlook 2008).⁷ The purpose of Outlook 2008 was to inventory and assess municipal water supply sources that might be used to meet future water supply needs in King, Pierce, and Snohomish Counties. The draft report states that there is sufficient water collectively among the participants, assuming planned supply projects are implemented, to meet regional demand through 2060 (Forum, 2009). The assumptions include continued reductions in demand through utility water conservation programs, construction of facilities for delivery of water, no changes to the reliability of existing sources of supply (similar precipitation and snowpack patterns), no increased restrictions on withdrawals to accommodate instream flow needs, and agreements on sharing supplies.

It is important to note that the demand forecast in Outlook 2008 is not meant to be interpreted as a local or utility demand forecast. Utility forecast models are more specific, are calibrated to local conditions, and can address planning issues not apparent at a regional level (Forum, 2009). Individual public water systems over a certain size are required to engage in water supply planning (RCW 43.20 and 70.119A). Water supply plans are typically written to analyze supply and demand needs for periods of 6 and 20 years. Supply and demand forecasts consider a variety of factors including population growth and climate change. The plans consider reclaimed water as a supply alternative.

The two regional water providers in King County, Seattle Public Utilities (SPU) and Cascade Water Alliance (CWA), have prepared water supply plans that include utility demand forecasts. Potable water demand forecasts by SPU, whose system supplies water to approximately 70 percent of the county's population, indicate that new water supply sources will not be needed until sometime after 2060 (SPU, 2007). Potable water demand forecasts by CWA, whose system supplies water to approximately 20 percent of the county's population, indicate that water supply is sufficient in most years to meet population growth. In some years during the planning period, additional steps may need to be taken to ensure a balance between supply and demand (Cascade Water Alliance, 2005).

Demand forecasts for cities and water districts in King County indicate that some water suppliers may need additional water supply to meet increased demands of population growth within their water supply planning period (City of Auburn, 2001; King County Water District No. 111, 2007; Sammamish Plateau Water and Sewer District, 2001). These are examples of where reclaimed

⁷ The Forum was formed in July 1998 as an organization for King, Pierce, and Snohomish Counties to promote discussion and develop a shared input into state and regional water supply strategies and programs.

water could meet nonpotable water needs as a means of reducing demands on potable water supplies in these areas.

4.0 Protecting Water Quality in Puget Sound

Puget Sound is a deep glacially carved, fjord-like estuary that connects to the Strait of Juan de Fuca through Admiralty Inlet and Deception Pass. It extends approximately 140 miles in a north-south direction, reaches a maximum depth of 930 feet off of Point Jefferson, contains approximately 1,331 miles of shoreline, and is characterized by a series of relatively deep underwater valleys and ridges (called basins) and submerged hills (called sills). Puget Sound provides commercial, environmental, and recreational resources for the region.

The health of the Puget Sound ecosystem is in decline. Evidence of this decline includes 21 species listed as threatened or endangered, more than 1,000 rivers and lakes tributary to Puget Sound listed as impaired for one or more water quality parameters, and the existence of low oxygen “dead zones” in Hood Canal and South Sound (PSP, 2008c). Recognizing that Puget Sound is in serious decline, the Washington State Legislature created the Puget Sound Partnership (PSP) in 2007. PSP published a *2020 Action Agenda* in December 2008 that outlines actions to restore the health of Puget Sound by 2020 (PSP, 2008c).

An array of contaminants from a variety of sources and transport mechanisms add a mix of pollutants that affects Puget Sound water quality. Wastewater is one of these sources. PSP identified pollutants from wastewater treatment plants as a threat to the health of Puget Sound and recommended strategies in its Action Plan to reduce wastewater discharges to this water body (PSP, 2008a). Studies have been conducted to evaluate the impacts of wastewater treatment plant discharges to Puget Sound. The studies have included analysis of the discharge volumes and the pollutant loading from wastewater treatment facilities. These studies and their implications are discussed below.

4.1 Wastewater Discharge Volumes to Puget Sound

Based on average daily flow calculated for 2006 and 2007 for wastewater treatment facilities that discharge to Puget Sound, the total discharge volume from these plants was 475 mgd (Envirovision et al., 2008). Almost half of this discharge volume was from King County’s two regional treatment plants—West Point Treatment Plant in Seattle and South Treatment Plant in Renton. The total average daily discharge from these two plants during the two-year period was 200 mgd (Figure 5).

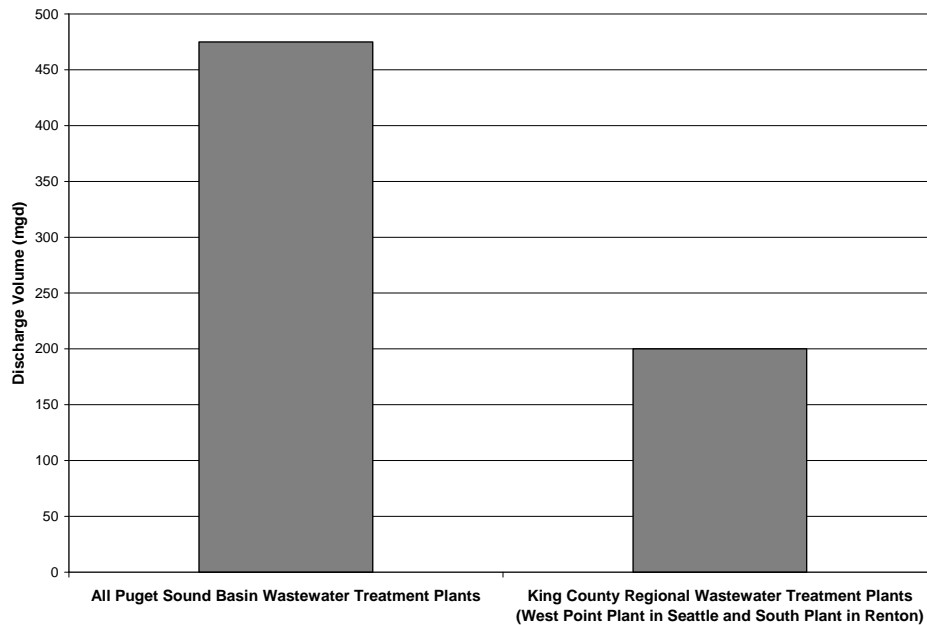


Figure 5. Average Daily Discharge Volumes from Wastewater Treatment Plants Discharging to Puget Sound, 2006–2007

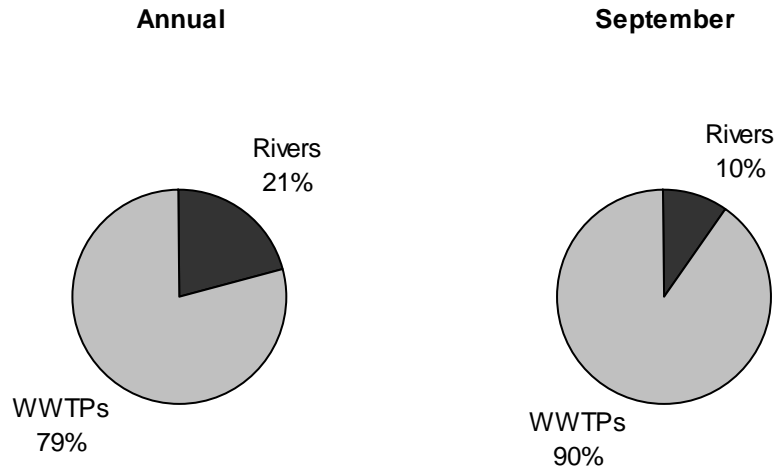
4.2 Wastewater Pollutant Loadings to Puget Sound

Indicators of the decline in Puget Sound water quality are high bacteria levels, harmful algae blooms, low dissolved oxygen levels, and elevated temperatures, toxic organic chemicals, and metals. Concerns about these pollutants have led to investigations as to their sources, including wastewater contributions of nutrients and toxic pollutants, and evaluation of treatment alternatives.

4.2.1 Nutrients

Nutrients are chemicals that are needed by plants and animals for growth. Some areas of Puget Sound have decreased levels of dissolved oxygen because of excess nutrients and other factors (PSP, 2008a). Marine life needs dissolved oxygen to survive. Dissolved oxygen levels decrease when excess nitrogen stimulates algae growth. When the algae die off and decay, oxygen is consumed in the process (Ecology, 2008a).

Nitrogen is one nutrient that can impact marine waters. One study found that each year, wastewater treatment plants contribute 79 percent and rivers contribute 21 percent of the nitrogen load from human sources to Puget Sound south of the City of Edmonds (Ecology, 2008b). Nitrogen loads in late summer are particularly important because this is when dissolved oxygen levels are lowest. The same study found that in September 2007, wastewater treatment plants contributed over 90 percent of the nitrogen load from human sources to Central and South Puget Sound (Figure 6). These human-generated loads are in addition to the much higher natural loads of nitrogen that enter Puget Sound from ocean water.



Source: Ecology, 2008.

Figure 6. Annual and Late Summer (September 2007) Contributions of Nitrogen Load from Rivers and Wastewater Treatment Plants that Discharge Directly to Puget Sound

To assist in determining the relative effect of three nutrient sources (wastewater, stormwater, and natural ocean flux) on Puget Sound, Ecology is conducting two additional studies (1) Puget Sound Dissolved Oxygen Modeling Study and (2) Technical and Economic Evaluation of Nitrogen and Phosphorus Removal at Municipal Wastewater Treatment Facilities.

The modeling study, scheduled to be completed in 2010, seeks to answer the following questions:

- Are current nitrogen loads from point and nonpoint sources significantly impacting water quality?
- If so, what reductions are necessary to reduce human impacts in sensitive areas to acceptable levels?

The nitrogen and phosphorus removal study, scheduled to be completed in 2009, has the following objectives:

- Evaluate a range of nutrient removal technologies.
- Evaluate the use of broadly imposed standard treatment requirements as an alternative to, or a component of, stream-reach and watershed-specific Total Maximum Daily Loads (TMDLs) and other watershed planning efforts.
- Evaluate the relationship of advanced nutrient removal technologies to treatment technologies and cost associated with producing reclaimed water.

4.2.2 Toxic Pollutants

Toxic pollutants include metals, petroleum products, and trace organic chemicals. Ecology is working in collaboration with the PSP and other state and federal agencies to conduct a three-phase study of scientific data related to toxic chemicals that will inform actions to restore Puget

Sound. An assessment of the relative loading of 12 chemicals conducted during the second phase of the study concluded that contributions of toxic chemicals from wastewater dischargers were small relative to the total loadings from all major sources (including atmospheric deposition and stormwater runoff) (Envirovision et al., 2008). The third phase, scheduled for completion in 2010, is looking at wastewater loadings in more depth.

4.3 Possible Implications for Future Wastewater Management

Two major permits or approvals are required to discharge treated wastewater to Puget Sound:

- National Pollutant Discharge Elimination System (NPDES) permits are issued by Ecology. NPDES is a national program under the Federal Clean Water Act that requires a permit to discharge pollutants from a point source into U.S. waterways.⁸
- Aquatic Land Leases are issued by the Washington State Department of Natural Resources (DNR). Lands under Puget Sound are owned by the citizens of the state and are held in trust by DNR for navigation, fishing, commerce, and recreation. An Aquatic Lands Easement must be obtained from DNR in order to build and operate outfalls on state-managed lands.

The results of recent research, objectives of ongoing studies, and Washington State initiatives to restore the health of Puget Sound, discussed above, have led to increasing recommendations and calls for more stringent NPDES discharge requirements and elimination of discharges to Puget Sound.

NPDES provisions in the federal Clean Water Act encourage elimination of pollutant discharges (River Network, 1999). If the studies that are under way indicate that particular outfalls are contributing to water quality impairments in Puget Sound, it is possible that more stringent discharge standards for nutrient (nitrogen) and toxic pollutants could be imposed when NPDES permits are renewed. According to a report issued in 2008 on toxic loadings to Puget Sound, Ecology is also being encouraged to place more emphasis on controlling releases of toxic chemicals from geographic areas with the greatest density of dischargers and on those holding permits who discharge to ecologically sensitive and/or valuable areas of Puget Sound (Envirovision et al., 2008).

In addition, DNR is placing more emphasis on reducing discharges to receiving waters and on water reuse. In issuing an Aquatic Lands Easement for King County's new Brightwater outfall, DNR stated that it acknowledges "that it is the State's goal to reduce the reliance on the receiving waters of Washington State for the disposal of waste effluent, stormwater and other discharges, and to promote water re-use" (DNR Outfall Easement No. 51-076776). To accomplish this goal, DNR has included language in the easement that requires a written report with each NPDES permit renewal or every five years, whichever is sooner, that documents progress toward implementation of reasonably practical disposal alternatives, such as reclaimed water, that abate the effect of discharge.

⁸ A point source originates from a single, identifiable point, such as a wastewater treatment plant outfall. Nonpoint sources cannot be traced to single sources but rather to rainfall, snowmelt, or irrigation water that runs over land or through the ground and into rivers, lakes, and coastal waters or into groundwater.

The LOTT Wastewater Alliance recently had to respond to more stringent requirements regarding discharge to Puget Sound. LOTT is composed of four members: Lacey, Olympia, Tumwater, and Thurston County, Washington. Because of TMDL issues in Budd Inlet on Puget Sound, LOTT was required to either produce cleaner effluent or move its discharge to someplace other than Budd Inlet. LOTT determined that producing and distributing reclaimed water was a viable alternative, and it is currently producing 3 mgd of Class A reclaimed water at two reclamation plants.

Planned improvements to King County's regional wastewater system identified in the RWSP assume that the practice of effluent discharge to Puget Sound will continue unchanged into the future. The expected increase in wastewater effluent discharge requirements, however, creates a need for WTD to investigate methods to reduce pollutant loading and/or discharge volumes. Reclaimed water can be a wastewater management tool that can reduce effluent discharges to Puget Sound or can serve as a secondary benefit if higher levels of treatment are required. Treating wastewater to a higher level so that it is no longer classified as a waste product can substantially increase the options for using it for other purposes. A reduction in effluent discharge translates into a reduction in pollutant loadings, especially nutrients, to Puget Sound (PSP, 2008a).

5.0 Purpose and Need for Reclaimed Water Planning Now

WTD is preparing a Reclaimed Water Comprehensive Plan now to meet planning mandates and as a part of its ongoing examination of alternatives for meeting future regulations, responding to changing conditions, and fulfilling its mission and vision.

The county expects that population in the region will continue to grow and that water quality regulations may become more stringent. In addition, the public is steadily becoming more attuned to water quality and other environmental issues. These types of changes may require shifts in the way WTD does its business. For example, starting in the 1970s in response to changing regulations and mandates, the county found cost-effective, beneficial alternatives to disposing of biosolids in Puget Sound. A shift in water quality regulations and/or mandates could require the county to find beneficial alternatives to disposing of effluent. WTD's constituents—ratepayers, local agencies, and others—rely on WTD to plan for and adapt to changes and to continually find ways to improve the efficiency of its operations.

Because it takes approximately 10 years to plan, design, and construct wastewater treatment facilities, reclaimed water should be examined in a comprehensive manner now in order to (1) identify potential reclaimed water uses, (2) evaluate the role that reclaimed water may have in meeting future needs so that wastewater facility decisions do not foreclose opportunities to implement reclaimed water projects, and (3) avoid costly retrofits to the planned conveyance and treatment capacity improvements should conditions and regulations change. In addition, early planning can help others in the region, including local water and wastewater agencies, better understand the array of options available to meet future water management needs.

The following subsections describe what will be accomplished in the plan and how it will be accomplished.

5.1 What the Plan Will and Will Not Do

The Reclaimed Water Comprehensive Plan will explore if, how, when, where, and by what funding mechanisms King County's existing reclaimed water program should expand in the next 30 years. The plan will evaluate reclaimed water as a means to reduce reliance on discharging to Puget Sound, to enhance the environment through water resource augmentation, and to further prepare the region for addressing the uncertainty of population growth and climate change. It will take a broad look at potential reclaimed water uses and evaluate strategies for serving these uses.

The plan will serve as a planning tool, among other tools, for managing wastewater resources and will provide a cohesive platform for making future reclaimed water decisions in the context of wastewater management as a whole. It will *not* be a water supply plan, but will provide water purveyors with information on where and when reclaimed water could be an alternative supply option to be considered.

The plan will attempt to answer the following questions:

- What are the potential uses for reclaimed water now and over the next 30 years?
- What are the potential volumes of reclaimed water that would be needed to serve the potential uses for reclaimed water?
- What are the different ways that King County's regional wastewater system could produce and deliver the volumes needed to serve potential uses for reclaimed water?
- What are the costs and benefits associated with producing and distributing reclaimed water to serve potential uses?
- What are the environmental impacts associated with producing and providing reclaimed water to serve potential uses?
- If it is recommended that the existing reclaimed water program should be expanded, what are the ways that future reclaimed water investments could be financed and paid for?
- What policies are needed to guide future reclaimed water decisions and investments?

5.2 The Planning Process: Guiding Principles and Evaluation Criteria

The process for developing the Reclaimed Water Comprehensive plan carries no preconceived outcomes, actions, or projects. It is a dynamic process, involving check-in points to assess next steps based on results of previous steps. Principles and evaluation criteria, listed below, have been established to help guide the development of the plan.

5.2.1 Guiding Principles

The planning process will be guided by the following principles:

- Position WTD to respond to changing conditions and new regulations
- Mitigate long-term impacts
- Maximize existing investments

- Consider reclaimed water in capital projects planning (RCW 90.48.112)
- Recommend options that can provide the greatest value, considering costs and cost allocation to benefited parties, the environment, and the community
- Provide meaningful participation in the planning process for customers, other governments, tribes, and the public
- Seek support from the broadest possible group of interested parties

5.2.2 Evaluation Criteria (Updated June 2010)

Evaluation criteria will be used to assess how serving potential uses for reclaimed water addresses the drivers for this planning process. The results of applying these criteria, along with results of conducting technical, environmental, and economic analyses, will provide important information in the decision-making process to determine if, how, when, where, and by what funding mechanisms King County's existing reclaimed water program should expand.

Based on input received through discussions with interested parties, the King County Executive transmitted evaluation criteria to the King County Council in December 2009. On May 3, 2010, the King County Council approved the evaluation criteria through Motion 13211. The council-approved evaluation criteria is listed below.

Regional Wastewater System Planning

The purpose of these criteria is to evaluate how serving potential uses for reclaimed water fits into future improvements and operations of the regional wastewater system:

1. Ability to maintain the efficient and safe operations of the regional wastewater system
2. Ability to cost-effectively incorporate a reclaimed water strategy into future King County regional wastewater treatment and/or conveyance improvements
3. Ability to meet regulatory requirements, such as NPDES, including those reasonably anticipated
4. Ability to obtain funding from benefited parties

Creating Resources from Wastewater

The purpose of these criteria is to evaluate how serving potential uses for reclaimed water meets the wastewater treatment division's vision of creating resources from wastewater:

1. The extent to which the volume of treated effluent produced can be reasonably expected to beneficially and cost-effectively be reused as reclaimed water

2. The extent to which there are institutional barriers, such as existing laws, policies and agreements that may constrain ability to provide reclaimed water
3. The extent to which surface water or wetlands or groundwater conditions and habitat could be improved by the use of reclaimed water, such as improved low-flow conditions in streams, lower stream temperatures, or other enhancements
4. The sustainability of uses of reclaimed water with a benefit/cost analysis

Protecting Water Quality in Puget Sound

The purpose of these criteria is to evaluate how serving potential uses for reclaimed water reduces reliance on Puget Sound for the discharge of effluent:

1. The extent to which pollutants from the county's regional wastewater system are reduced through production and use of reclaimed water
2. The extent to which a higher level of treatment reduces pollutant loadings in Puget Sound

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