

King County Reclaimed Water Comprehensive Plan

Reclaimed Water Strategy Assessment of Regulatory Feasibility

WORKING DRAFT

April 2012



King County

Department of
Natural Resources and Parks
Wastewater Treatment Division

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Prepared for:

King County Wastewater Treatment Division
Department of Natural Resources and Parks

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Table of Contents

Executive Summary	1
Feasibility of Reclaimed Water Uses Proposed for Redmond/Bear Creek Basin Brightwater Centralized Strategy	2
Feasibility of Reclaimed Water Uses Proposed for Renton/Tukwila South Plant Centralized Strategy	4
Feasibility of Reclaimed Water Uses Proposed for Reclaimed Water Skimming or Polishing Decentralized Strategy	5
Anticipated Changes to Regulations	5
1.0. Introduction.....	7
1.1 Description and Location of Strategies.....	7
1.2 Proposed Nonpotable Consumptive and Environmental Enhancement Uses.....	8
1.3 Objectives of this Study	10
1.4 Content and Organization of this Report	10
2.0. Methodology	11
2.1 Regulations Governing Reclaimed Water Use	11
2.2 Regulatory Feasibility Challenges to Implementing Reclaimed Water Strategies	11
2.3 Approaches to Address Challenges	12
2.4 Anticipated Changes to Regulations	12
3.0. Regulations Governing Reclaimed Water Use	13
3.1 Federal, State and Local Regulations Governing Reclaimed Water.....	13
3.2 Water Reclamation and Reuse Standards and Reclaimed Water Act.....	21
3.2.1 Treatment Standards	21
3.2.2 Use Restrictions	22
3.2.3 Environmental Enhancement of Wetlands.....	23

3.2.4	Indirect Potable Reuse for Augmentation of Surface Waters	25
4.0.	Redmond/Bear Creek Basin Brightwater Centralized Strategy	27
4.1	Regulatory Feasibility Challenges to Implementing Strategy	28
4.1.1	Wetlands	28
4.1.2	Irrigation	29
4.2	Approaches to Address Regulatory Challenges.....	30
5.0.	Renton/Tukwila South Plant Centralized Strategy	31
5.1	Regulatory Feasibility Challenges to Implementing Strategy	32
5.1.1	Aquifer Protection Requirements	32
5.1.2	Water Quality Criteria for Wetland Enhancement.....	32
5.2	Approaches to Address Regulatory Challenges.....	33
6.0.	Reclaimed Water Skimming or Polishing Decentralized Strategy	35
6.1	Decentralized Strategies.....	35
6.1.1	Interbay Skimming Decentralized Strategy	35
6.1.2	Duwamish Polishing Decentralized Strategy.....	35
6.1.3	Lower Green River Valley Skimming Decentralized Strategy.....	36
6.2	Regulatory Feasibility Challenges to Implementing Strategies.....	36
6.3	Approaches to Address Regulatory Challenges.....	36
7.0.	Anticipated Changes to Regulations	37
7.1	Federal Regulations	37
7.2	State Regulations	37
7.3	Local Regulations	37
8.0.	References.....	39

Appendix

Appendix A. EPA Guidelines for Water Reuse

Tables

Table 1-1. Reclaimed Water Usage Categories	9
Table 3-1. Regulations Governing Reclaimed Water Use.....	14
Table 3-2. Washington State Reclaimed Water Monitoring and Compliance Requirements	21
Table 4-1. Summary of Reclaimed Water Uses within Local Jurisdictions for Brightwater Strategy	27
Table 5-1. Summary of Reclaimed Water Uses within Local Jurisdictions for South Plant Strategy	31

Figures

Figure 1-1. Reclaimed Water Strategies Recommended for Analysis
Figure 4-1. Wellhead Protection Areas—Brightwater
Figure 4-2. Critical Aquifer Recharge Areas—Brightwater
Figure 5-1. Wellhead Protection Areas—South Plant
Figure 5-2. Critical Aquifer Recharge Areas—South Plant
Figure 5-3. City of Renton Aquifer Protection Areas

Acronyms and Abbreviations

AKART	all known available and reasonable technologies
APA	aquifer protection areas
BOD	biochemical oxygen demand
CFR	Code of Federal Regulations
cm	centimeters
cm/day	centimeters per day
CWA	Clean Water Act
EDCs	endocrine-disrupting compounds
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ETS	Effluent Transfer System
kg	kilograms
LGRV	Lower Green River Valley
MBR	membrane bioreactor
mgd	million gallons per day
NTU	nephelometric turbidity units
PPCPs	pharmaceuticals and personal care product
RCW	Revised Code of Washington
SDWA	Safe Drinking Water Act
TKN	Total Kjeldahl nitrogen
TMDL	total maximum daily load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	total suspended solids
WAC	Washington Administrative Code
WTD	Wastewater Treatment Division

EXECUTIVE SUMMARY

King County is considering supplying reclaimed water for irrigation and other nonpotable consumptive uses and for enhancement and creation of wetlands. This document reports on an evaluation of the regulatory feasibility of implementing these nonpotable consumptive and environmental enhancement uses and identifies anticipated changes to regulations.

The evaluation was done to support the development of a Reclaimed Water Comprehensive Plan for King County's Wastewater Treatment Division (WTD). The purpose of the Reclaimed Water Comprehensive Plan is to determine if, how, when, where, and by what funding mechanisms King County's existing reclaimed water program should expand over the next 30 years, through 2040 and beyond.

The work documented in this report was conducted as part of Step 4 of the reclaimed water planning process as amended and approved by the King County Council in May 2011. The report presents the methodology and results of efforts to further define three reclaimed water strategies under consideration by King County.

The strategies were developed for planning and evaluation purposes only and are not intended to necessarily represent any future reclaimed water improvement projects or any implied preference or commitment on the part of any interested parties or potential end users.

Each strategy approved and developed for further analysis represents a concept for producing and supplying reclaimed water to serve potential uses identified during the reclaimed water planning process. The uses include both nonpotable consumptive uses (irrigation, commercial, industrial) and environmental enhancement uses (wetland enhancement and associated indirect groundwater recharge and/or streamflow augmentation). The following are brief descriptions of the strategies:

- **Redmond/Bear Creek Basin Brightwater Centralized Strategy.** Reclaimed water would be produced through the membrane bioreactor (MBR) process at the Brightwater Treatment Plant for distribution to two areas—one in the immediate vicinity of the plant and one farther south above Lake Sammamish—via new pipelines connected to the South Segment of the Brightwater reclaimed water pipeline.
- **Renton/Tukwila South Plant Centralized Strategy.** Reclaimed water would be produced through expansion of the South Treatment Plant's tertiary sand filtration system for distribution to an area just south of Lake Washington via extension of an existing pipeline that delivers reclaimed water to the City of Tukwila.
- **Reclaimed Water Skimming or Polishing Decentralized Strategy.**¹ This strategy represents opportunities for smaller-scale reclaimed water implementation. Infrastructure was constrained to a single treatment plant of up to 0.5 million gallons per day (mgd) capacity and up to 1 mile of reclaimed water pipeline. Three potential areas and configurations were identified to help define the decentralized strategy:

¹ A skimming plant removes some of the raw wastewater from pipelines that carry the wastewater to regional plants for treatment and then treats the wastewater to reclaimed water quality for local distribution. A polishing plant removes some secondary-treated effluent from pipelines exiting regional treatment plants and treats the effluent to reclaimed water quality standards.

- An MBR skimming plant located in the Interbay area of Seattle would produce reclaimed water from untreated wastewater in adjacent conveyance pipelines for distribution near the plant via a new pipeline.
- A sand filtration polishing plant located in Seattle on the west side of the Duwamish River would produce reclaimed water from flows in the Effluent Transfer System (ETS) pipeline that carries South Treatment Plant secondary effluent for discharge at Alki Point in West Seattle. The reclaimed water would be distributed to nearby uses via a new pipeline.
- An MBR skimming plant located in the lower Green River Valley in south King County would produce reclaimed water from untreated wastewater in adjacent conveyance pipelines for distribution near the plant via a new pipeline.

All of the strategies propose supplying Class A reclaimed water for nonpotable consumptive or environmental enhancement use types. Class A reclaimed water is the highest standard of reclaimed water in Washington state. According to the Revised Code of Washington (RCW) 90.46, wastewater that has been cleaned to the Washington State Departments of Ecology and Health Class A standards can be used for many purposes and is thereafter considered reclaimed water and not wastewater.

This report assesses the regulatory feasibility of implementing the nonpotable consumptive and environmental enhancement uses of reclaimed water associated with the three reclaimed water strategies. This document refers to rules, standards, and guidelines generally as “regulations,” some of which have been promulgated as rules or laws while others have not. All of them are criteria that regulatory agencies would use to evaluate and approve the reclaimed water strategies. Information is presented and compiled to aid in addressing the following questions regarding the reclaimed water strategies approved for further analysis during Step 4 of the planning process:

- What regulations apply to the reclaimed water use strategies?
- Are the potential uses in the reclaimed water strategies allowed under current regulations? Are there any regulatory feasibility issues?
- What methods or approaches could be used to address known/anticipated challenges to regulatory feasibility of the strategies?
- Could anticipated changes to existing regulations affect the regulatory feasibility of the strategies?

Feasibility of Reclaimed Water Uses Proposed for Redmond/Bear Creek Basin Brightwater Centralized Strategy

The Washington State Water Reclamation and Reuse Standards, state surface and groundwater water quality protection and anti-degradation requirements, and City of Redmond wellhead protection requirements would present regulatory feasibility challenges for certain applications under the Redmond/Bear Creek Basin Brightwater Centralized Strategy.

The regulatory feasibility challenges related to wetlands are as follows:

- The wetlands in the vicinity of Crystal Lake, Cottage Lake, and the lake-fringe wetlands along Lake Sammamish may be Category I wetlands (King County 2012b). Enhancement of these wetlands with reclaimed water would not be allowed under state standards (Ecology and Health 1997) unless a net environmental benefit could be demonstrated and no existing significant wetland functions would be decreased.
- The daily loading rate of total phosphorus and total nitrogen contemplated for the Cottage Lake wetlands and total phosphorus loading for the Sammamish Slough wetlands would be above the average annual rate specified in the Washington State Water Reclamation and Reuse Standards.
- The Cottage Lake Phosphorus TMDL and Bear-Evans Creek TMDL for temperature and dissolved oxygen could preclude the addition of additional nutrients contained in reclaimed water into the watershed.
- Groundwater protection could also be an issue for the Crystal Lake wetland enhancement use and could trigger Snohomish Critical Area requirements for critical aquifer recharge areas.

The regulatory feasibility challenge related to City of Redmond Wellhead protection requirements is as follows. City of Redmond wellhead protection regulations (RZC 21.64.050) limit the regulatory feasibility of the reclaimed water use strategies within specific parts of Redmond, prohibiting irrigation with reclaimed water within wellhead protection Zones 1 and 2². The strategies include using reclaimed water for one agricultural irrigation use and two non-agricultural irrigation uses within Zone 1 and 2 wellhead protection areas. In addition, two commercial/industrial uses are within Zone 1 wellhead protection areas. These reclaimed water uses being considered in Redmond within the Zone 1 and 2 wellhead protection areas are not allowed under Redmond City Code.

Approval of the wetland environmental enhancement uses at Crystal Lake, Cottage Lake, and Lake Sammamish lake-fringe wetlands as currently envisioned within the Brightwater strategy would require a demonstration of net environmental benefit.

Studies necessary to demonstrate net environmental benefit from the proposed wetland enhancement use would likely include efforts to:

- identify the wetland category and conduct wetland delineation
- identify existing beneficial uses of the wetland
- determine the hydrologic regime and monthly water budget
- conduct downstream water quality modeling

If net environmental benefit could not be demonstrated, modifications may be necessary to the wetland enhancement uses; for example, nutrient-loading rates could be reduced by decreasing

² Wellhead Protection Zone 1 represents the land area overlying the 6-month time-of-travel zone of any public water source well owned by the City. Wellhead Protection Zone 2 represents the land area that overlies the 1-year time-of-travel zone of any public water source well owned by the City, excluding the land area contained within Wellhead Protection Zone 1.

the rate of reclaimed water application or incorporating a higher level of treatment in the production of reclaimed water.

Feasibility of Reclaimed Water Uses Proposed for Renton/Tukwila South Plant Centralized Strategy

The requirements that protect the Cedar Valley Aquifer from contamination may present challenges to implementing the Renton/Tukwila South Plant Centralized Strategy for those wetland enhancement and irrigation reclaimed water uses located within the City of Renton. The created beneficial use wetland and several non-agricultural irrigation uses are within City of Renton Zone 1 and 2 Aquifer Protection Areas (APAs), as defined by Critical Areas Ordinance 5137. The ordinance specifies nitrate application requirements, which limit total annual application rates of nitrate to 8 pounds of nitrogen per thousand square feet. This application limit may apply to reclaimed water uses within these zones. This may represent a substantial limitation to the uses being considered.

In addition, the TP and TKN concentrations in the reclaimed water produced by the South plant are higher than the water quality criteria specified in the Washington State Water Reclamation and Reuse Standards for use of reclaimed water in wetland enhancement. Analysis of the effects of the reclaimed water strategies on wetlands indicates that the nutrient concentrations in reclaimed water would result in mass loading rates³ that are higher than limits specified in the standard (King County 2012b).

The key issue to be resolved to determine regulatory feasibility of reclaimed water uses within Zone 1 and 2 APAs would be to ascertain how the nitrogen contained in reclaimed water would be treated under the City's restrictions regarding nitrate-containing materials. Once this technical question were resolved, it would also be necessary to demonstrate that no degradation of the aquifer would occur as a result of using reclaimed water for wetland enhancement.

Ecology may make an exception to the water quality criteria and annual average mass loading rates if net environmental benefit could be demonstrated. Studies necessary to demonstrate net environmental benefit from the proposed wetland enhancement use would likely include efforts to:

- identify the wetland category and conduct wetland delineation
- identify existing beneficial uses of the wetland
- determine the hydrologic regime and monthly water budget
- conduct downstream water quality modeling

If net environmental benefit could not be demonstrated, using South plant reclaimed water for a constructed beneficial use wetland would not be allowed unless there were additional nutrient removal from South plant reclaimed water.

³ Mass loading on an average annual basis is expressed as kilograms per hectare per day (kg/ha/day).

Feasibility of Reclaimed Water Uses Proposed for Reclaimed Water Skimming or Polishing Decentralized Strategy

No strategy-specific regulatory feasibility challenges were identified.

Anticipated Changes to Regulations

Changes to reclaimed water regulations are either being drafted or might reasonably be expected at federal, state, and local levels. At the federal level, EPA guidelines may become more restrictive, requiring additional water quality criteria for certain pathogens as well as pollutants such as agricultural and industrial chemicals, pharmaceuticals and personal care products, and endocrine-disrupting compounds. Washington state is developing administrative rules that would revise, update, and codify the Washington State Water Reclamation and Reuse Standards (Ecology and Health 1997), though the content of these new rules is unknown. Also at the state level, new requirements could become effective as new TMDLs are developed to address water quality issues in waters listed as impaired under Section 303(d) of the Clean Water Act. At the local level, more jurisdictions are likely to regulate reclaimed water uses as the availability of reclaimed water becomes more widespread.

1.0. INTRODUCTION

King County is considering supplying reclaimed water for irrigation and other nonpotable consumptive uses and for enhancement and creation of wetlands. This document reports on an evaluation of the regulatory feasibility of implementing these nonpotable consumptive and environmental enhancement uses and identifies anticipated changes to regulations.

The evaluation was done to support the development of a Reclaimed Water Comprehensive Plan for King County's Wastewater Treatment Division (WTD). The purpose of the Reclaimed Water Comprehensive Plan is to determine if, how, when, where, and by what funding mechanisms King County's existing reclaimed water program should expand over the next 30 years, through 2040 and beyond.

The work documented in this report was conducted as part of Step 4 of the reclaimed water planning process as amended and approved by the King County Council in May 2011. The report presents the methodology and results of efforts to further define three reclaimed water strategies developed and approved earlier, during Step 3.⁴

Throughout the development, definition, and analysis of the strategies, WTD applied King County Council-approved evaluation criteria to assess how each strategy addresses the three drivers for the Reclaimed Water Comprehensive Plan—regional wastewater system planning, creating resources from wastewater, and protecting Puget Sound water quality.

The strategies were developed for planning and evaluation purposes only and are not intended to necessarily represent any future reclaimed water improvement projects or any implied preference or commitment on the part of any interested parties or potential end users.

This introduction briefly describes the reclaimed water strategies, identifies the reclaimed water uses proposed by the strategies, and then outlines the objectives of this evaluation.

1.1 Description and Location of Strategies

Each reclaimed water strategy represents a concept for producing and supplying reclaimed water to serve potential uses identified during the reclaimed water planning process. The uses include both nonpotable consumptive uses (irrigation, commercial, industrial) and environmental enhancement uses (wetland enhancement and associated indirect groundwater recharge and/or streamflow augmentation). The following are brief descriptions of the strategies:

- **Redmond/Bear Creek Basin Brightwater Centralized Strategy.** Reclaimed water would be produced through the membrane bioreactor (MBR) process at the Brightwater Treatment Plant for distribution to two areas—one in the immediate vicinity of the plant and one farther south above Lake Sammamish—via new pipelines connected to the South Segment of the Brightwater reclaimed water pipeline.

⁴ More information on the reclaimed water comprehensive planning process is available at <http://www.kingcounty.gov/environment/wastewater/RWCompPlan.aspx>. More information on prior reclaimed water strategy development and identification is available at http://your.kingcounty.gov/dnrp/library/wastewater/rw/CompPlan/1012_RWCPStrategyReport.pdf.

- **Renton/Tukwila South Plant Centralized Strategy.** Reclaimed water would be produced through expansion of the South Treatment Plant’s tertiary sand filtration system for distribution to an area just south of Lake Washington via extension of an existing pipeline that delivers reclaimed water to the City of Tukwila.
- **Reclaimed Water Skimming or Polishing Decentralized Strategy.**⁵ This strategy represents opportunities for smaller-scale reclaimed water implementation. Infrastructure was constrained to a single treatment plant of up to 0.5 mgd capacity and up to 1 mile of reclaimed water pipeline. Three potential areas and configurations were identified to help define the decentralized strategy:
 - An MBR skimming plant located in the Interbay area of Seattle would produce reclaimed water from untreated wastewater in adjacent conveyance pipelines for distribution near the plant via a new pipeline.
 - A sand filtration polishing plant located in Seattle on the west side of the Duwamish River would produce reclaimed water from flows in the Effluent Transfer System (ETS) pipeline that carries South Treatment Plant secondary effluent for discharge at Alki Point in West Seattle. The reclaimed water would be distributed to nearby uses via a new pipeline.
 - An MBR skimming plant located in the lower Green River Valley in south King County would produce reclaimed water from untreated wastewater in adjacent conveyance pipelines for distribution near the plant via a new pipeline.

The locations of the strategies are shown in Figure 1-1.

1.2 Proposed Nonpotable Consumptive and Environmental Enhancement Uses

Reclaimed water is an important wastewater management tool that can also be used as a beneficial resource. King County is proposing to use Class A reclaimed water for agricultural irrigation, non-agricultural irrigation (i.e., landscape irrigation), commercial and industrial uses, and environmental enhancement. Potential uses of reclaimed water are documented according to category, use type, estimated annual reclaimed water usage volume, and seasonality of use. The use categories for King County’s reclaimed water strategies are listed in Table 1-1.

⁵ A skimming plant removes some of the raw wastewater from pipelines that carry the wastewater to regional plants for treatment and then treats the wastewater to reclaimed water quality for local distribution. A polishing plant removes some secondary-treated effluent from pipelines exiting regional treatment plants and treats the effluent to reclaimed water quality standards.

Table 1-1. Reclaimed Water Usage Categories

Categories	Use Type	Seasonal
Agricultural	Irrigation	Yes
Athletic Field	Irrigation	Yes
Cemetery	Irrigation	Yes
Commercial	Varies	Varies ¹
Golf Course	Irrigation	Yes
Industrial	Varies	Varies ¹
Nursery	Irrigation	No ²
Other	Varies	Varies ¹
Park	Irrigation	Yes
School	Irrigation	Yes
Wetland Enhancement	Environmental	Potentially ³

Source: King County 2008

¹ A portion of the use type for the commercial, industrial, and “other” categories may be seasonal irrigation use.

² Irrigation use is treated as seasonal for all categories, except nursery.

³ Two application scenarios were evaluated for potential wetland enhancement flows: year-round application, and 7-8 month/year flow application during the spring, summer, and fall. Daily application rates would be consistent for both scenarios, and would be expected to coincide with all other use periods to form one component of peak demand. In terms of conceptual infrastructure sizing the two application scenarios thus become functionally equivalent and do not drive differing infrastructure capacity needs.

The specific non-potable consumptive uses proposed for each strategy are presented in Chapters 4-6.

King County has identified environmental enhancement uses for the Redmond/Bear Creek Basin Brightwater Centralized Strategy and the Renton/Tukwila South Plant Centralized Strategy. Four potential Areas of Interest (AOIs) are being considered for wetland enhancement, as listed below. The first three of the AOIs are part of the Brightwater strategy and the fourth is part of the South plant strategy:

- Crystal Lake, an approximately 130-acre wetland adjacent to the north shore of Crystal Lake in Snohomish County.
- Cottage Lake, an approximately 129-acre wetland in the Cold Creek Natural Area west of Cottage Lake in King County.
- Sammamish River/Lake Sammamish, an approximately 154-acre area in Marymoor Park with two potential subareas: Area A, 54 acres of wetlands west of the Sammamish River, and Area B, 100 acres of wetlands at the north end of Lake Sammamish.
- Cedar River, an approximately 30-acre area located on a terrace along the south side of the Cedar River in Renton approximately 1.9 miles from the Cedar River discharge to Lake Washington. This area is being considered as a potential location for creation of a 16-acre wetland using reclaimed water.

1.3 Objectives of this Study

This report assesses the regulatory feasibility of implementing the nonpotable consumptive and environmental enhancement uses of reclaimed water associated with King County’s three reclaimed water strategies. Other reports analyze effects of using reclaimed water for non-potable consumptive and environmental enhancement uses (King County 2012a, 2012b).

This report refers to rules, standards, and guidelines generally as “regulations,” some of which have been promulgated as rules or laws while others have not. All of them are criteria that regulatory agencies would use to evaluate and approve the reclaimed water strategies. Information in this report is presented and compiled to aid in addressing the following questions regarding the reclaimed water strategies approved for further analysis during Step 4 of the planning process:

- What regulations apply to the reclaimed water use strategies?
- Are the potential uses in the reclaimed water strategies allowed under current regulations? Are there any regulatory feasibility issues?
- What methods or approaches could be used to address known/anticipated challenges to regulatory feasibility of the strategies?
- Could anticipated changes to existing regulations affect the regulatory feasibility of the strategies?

1.4 Content and Organization of this Report

The next chapter describes the methods used in this evaluation, followed by chapters that summarize reclaimed water requirements and evaluate the regulatory feasibility of the three reclaimed water strategies. This report ends with a discussion of foreseeable regulatory changes that could affect feasibility of the reclaimed water strategies in the future.

2.0. METHODOLOGY

This study evaluates the regulatory feasibility of King County’s reclaimed water strategies given current federal, state, and local rules, standards, and guidelines. This document refers to these rules, standards, and guidelines generally as “regulations,” some of which have been promulgated as rules or laws while others have not. All of them are criteria that regulatory agencies would use to evaluate and approve the reclaimed water strategies. The primary goal of this evaluation is to identify regulations governing reclaimed water use that could limit the regulatory feasibility of King County’s proposed reclaimed water strategies.

The steps in this evaluation were to determine which regulations are pertinent to the reclaimed water strategies, assess each strategy in light of applicable regulations, and identify anticipated future changes to regulations. Each of these steps is elaborated on below.

2.1 Regulations Governing Reclaimed Water Use

Federal, state, and local regulations on water-related topics were reviewed to identify the requirements that would govern the uses of reclaimed proposed for King County’s reclaimed water strategies. Regulations were reviewed to determine:

- Applicability, either directly to reclaimed water uses or indirectly through provisions to protect other resources (e.g., surface water quality, groundwater quality, drinking water)
- Type of regulation (e.g., treatment standards, use restrictions, monitoring and reporting requirements)

The review of local regulations involved first identifying the local jurisdictions where potential reclaimed water uses are envisioned. Based on the potential uses considered within each jurisdiction, local critical area regulations (regulations pertaining to groundwater, wellhead protection and flood hazard) were reviewed to identify requirements relevant to reclaimed water use strategies.

The results of this regulatory review are presented in Table 3-1 of Chapter 3. In addition to this review, Chapter 3 also includes more detailed information on Washington state treatment standards and use requirements that could limit regulatory feasibility of the proposed reclaimed water uses.

2.2 Regulatory Feasibility Challenges to Implementing Reclaimed Water Strategies

The regulations that were identified as potentially limiting the feasibility of reclaimed water use as currently envisioned in the three reclaimed water strategies were reviewed in further detail to identify regulatory challenges based on the following potential situations:

- Proposed use not allowed by existing regulations
- Proposed use is based on existing regulations

- Proposed use is not allowed unless specific conditions are met (e.g., studies are required to justify an exception to a regulation)

These situations are identified and discussed for each strategy in Chapters 4-6.

To determine regulatory feasibility of the reclaimed water strategies regarding drinking water and groundwater resources, GIS data were used to identify the locations of wellhead protection areas, critical aquifer recharge areas, and the locations of sole source aquifers within the vicinity of the reclaimed water strategies. The following shapefiles were used:

- Wellhead protection areas: 6-month, 1-year, 5-year, and 10-year time of travel wellhead protection area (King County 2011b)
- Critical aquifer recharge areas: cara_area from King County geodatabase (King County 2011b)
- Sole source aquifer (U.S. Environmental Protection Agency n.d.)

Analysis of regulatory feasibility related to surface water quality involved review of Washington State Department of Ecology (Ecology) 303(d) listings of impaired waters and Total Maximum Daily Loads (TMDLs) for waterbodies that could potentially receive reclaimed water flows from wetland enhancement uses. TMDL allocations could preclude these uses or limit the amount and rate of reclaimed water and its associated nutrient and chemical constituents that could be applied within a watershed, particularly for wetland enhancement that results in surface water flow augmentation. Parameters of concern related to each TMDL or 303(d) listing were checked to see whether they could be affected positively or negatively by application of reclaimed water. Waterbodies reviewed in this analysis included Crystal Lake, Cottage Lake, Evans Creek, Lake Sammamish, Sammamish River, and the lowest reaches of the Cedar River.

2.3 Approaches to Address Challenges

Approaches to address the regulatory feasibility challenges of each strategy were identified based on a review of the regulations to identify potential exemptions as well as the types of studies or analyses required to satisfy requirements for granting exemptions. As relevant, approaches specific to each strategy are presented in Chapters 4-6.

2.4 Anticipated Changes to Regulations

Potential changes to regulations were identified through literature review, discussions with King County staff, and on-line resources available on state and federal websites. Ecology 303(d) listings for waterbodies adjacent to or downstream of potential wetland enhancement reclaimed water uses were reviewed to identify the potential for developing TMDLs sometime in the future, which could place restrictions on reclaimed water uses. Specifically, 303(d) listings for nutrients, dissolved oxygen, and biological oxygen demand were reviewed. The results of this review are presented in Chapter 7.

3.0. REGULATIONS GOVERNING RECLAIMED WATER USE

This chapter presents regulations governing reclaimed water that would be applicable to King County’s proposed reclaimed water strategies. The first section of this chapter provides an overview of the applicable federal, state, and local regulations. The section that follows provides further detail on treatment standards and use restrictions stipulated in the Washington State Water Reclamation and Reuse Standards (Ecology and Health 1997) and the Reclaimed Water Act (RCW 90.46).

3.1 Federal, State and Local Regulations Governing Reclaimed Water

Table 3-1 presents a summary of the regulations that govern or could govern the reclaimed water uses included in the King County reclaimed water strategies. The table is organized by federal, state, and local regulations; it provides a brief synopsis of each regulation and identifies its general applicability to reclaimed water use. Regulations from the following entities are included:

- Federal—Clean Water Act, Safe Drinking Water Act, US EPA Guidelines for Water Reuse
- Washington State—Revised Code of Washington (RCW) Reclaimed Water Act, Water Pollution Control, Water Resources Act, and Growth Management; Washington Administrative Code (WAC) water quality standards for groundwaters and surface waters; and the Washington State Water Reclamation and Reuse Standards
- Local—King County Critical Areas; Snohomish County Critical Aquifer Recharge Areas; and Cities of Redmond, Renton, Seattle, Tukwila, and Woodinville

1 **Table 3-1. Regulations Governing Reclaimed Water Use**

Regulation	Citation/ Reference	Description	Governs Reclaimed Water Use	Type of Requirement			
				Treatment Standards	Use Restrictions	Engineering Controls	Monitoring/ Reporting
FEDERAL							
Clean Water Act	Part 131	Provides for establishment of Water Quality Standards including requirements for states to establish anti-degradation policies (40 Code of Federal Regulations [CFR] 131.12) to protect and maintain existing uses.	Yes, indirectly	-	Yes	-	-
	Section 303(d) - TMDL and Impaired Waters Rule	Requires states, territories, and authorized tribes to develop a list of impaired waters that do not meet water quality standards and to establish a TMDL of pollutants that these waterbodies can receive. <i>(Administered by Washington State Department of Ecology [Ecology])</i>	Yes, indirectly	-	Yes	-	-
	Section 402 National Pollutant Discharge Elimination System (NPDES) Permit Program	Controls water pollution by regulating point sources (direct conveyances) of pollution to waters of the United States, including discharges from municipal facilities. <i>(Administered by Ecology)</i>	Yes, indirectly	-	-	-	-
Safe Drinking Water Act (SDWA)	Section 1424(e) Sole Source Aquifer Program ⁶	Provides the EPA with the authority to review projects receiving federal financial assistance to determine their potential for contaminating designated sole source aquifer. <i>(Administered by Washington State Department of Health [Health])</i>	Yes, indirectly	-	Yes	-	-
U.S. Environmental	Guidelines for Water	Not intended to be used as definitive water reclamation and	Yes, guidance	Yes ⁸	Yes	Yes	Yes

⁶ For more information see < <http://www.epa.gov/region4/water/groundwater/r4ssa.html>>.

Regulation	Citation/ Reference	Description	Governs Reclaimed Water Use	Type of Requirement			
				Treatment Standards	Use Restrictions	Engineering Controls	Monitoring/ Reporting
Protection Agency	Reuse ⁷	reuse criteria; they do not impose legally-binding requirements on EPA, states, local or tribal governments, or members of the public.	only				
WASHINGTON STATE							
Reclaimed Water Act	RCW 90.46	Establishes shared regulatory authority for production and use of Reclaimed Water between Ecology and Health.					
	RCW 90.46.130	Requires no impairment of downstream water rights for any facilities that discharge treated wastewater into fresh waterbodies and would alter discharge volumes through water reclamation and reuse.					
	RCW 90.46.080 through 100	Discharging reclaimed water to constructed wetlands (beneficial use or treatment wetlands), streamflow augmentation or groundwater recharge by surface percolation must be incorporated within a locally adopted and State approved sewer or water comprehensive plan ⁹ .					
Water Pollution	RCW 90.48	Statutory mandate to protect and maintain water quality of state	Yes,	No	No	Yes	No

⁸ See Appendix A for details.

⁷ EPA guidelines are found in Section 4.2, of the document entitled EPA Guidelines for Water Reuse (U.S. Environmental Protection Agency 2004)

⁹ These planning documents may also be referred to as general sewer plans (WAC 173-240-050), facilities plans (40 CFR 35.2030), or water system plans and project reports (WAC 246-290).

Regulation	Citation/ Reference	Description	Governs Reclaimed Water Use	Type of Requirement			
				Treatment Standards	Use Restrictions	Engineering Controls	Monitoring/ Reporting
Control		waters for beneficial uses and requires use of all known available and reasonable technologies (AKART) to prevent and control pollution.	indirectly				
	RCW 90.48.112	Requires that water system plans include consideration of opportunities for use of reclaimed water and a description of how water reclamation and reuse would be coordinated. ¹⁰	Yes, directly	No	No	No	No
Water Resources Act	RCW 90.54	Requires protection of the natural quality of water resources using AKART; allows degradation only if overriding public interests clearly will be served.	Yes, indirectly	No	No	Yes	No
Growth management	RCW 36.70A.030(5) ¹¹	Critical aquifer recharge areas are the geographic areas that have “critical recharging effects on aquifers used for potable water.”	Yes, indirectly	No	Yes	No	No
Water quality standards for groundwaters	WAC 173-200-030 – anti-degradation policy	Protects existing and future beneficial uses. Does not allow degradation of groundwater quality that would interfere with or become injurious to beneficial uses. Allows reduction in groundwater quality if overriding consideration of the public interest will be served.	Yes, Indirectly	No	Yes	No	No
Water quality standards for	WAC 173-201A Part	Defines Washington’s anti-degradation policy for surface water	Yes,	No	Yes	No	No

¹⁰ RCW 90.46.120 contains a similar requirement that local water supply plans consider water reclamation and reuse.

¹¹ Critical aquifer recharge areas serve to replenish the groundwater supplies, but can also allow for introduction of contaminants into the upper most unconfined aquifer (King County 2004).

Regulation	Citation/ Reference	Description	Governs Reclaimed Water Use	Type of Requirement			
				Treatment Standards	Use Restrictions	Engineering Controls	Monitoring/ Reporting
surface waters	Ill – Anti-degradation	resources.	Indirectly				
Washington State Water Reclamation and Reuse Standards (1997).	N/A	Shared responsibility of Ecology and Health. Address all potential reclaimed water uses (Section 1) and specific standards for wetlands (Section 2). See Section 4.1 for additional details on treatment standards and use restrictions relevant to uses proposed by King County.	Yes, directly	Yes	Yes	Yes	Yes
LOCAL							
King County - Critical Areas	29 Title 21A.24.311 – 316	Addresses critical aquifer recharge areas that are susceptible to contamination. Requirements are silent on specific requirements related to reclaimed water use.	Yes, Indirectly	No	Yes	No	No
	29 Title 21A.24.230 – 250	Addresses flood hazard areas and zero rise flood fringe which prohibit development proposals and alterations so that they shall not reduce the effective base flood storage volume of the floodplain.	Yes, Indirectly	No	Yes	No	No
Snohomish County - Critical Aquifer Recharge Areas	SCC 30.62C.340 – Uses and development activities subject to special conditions ¹²	Requires AKART to protect critical aquifer recharge areas. Reclaimed water for groundwater recharge is a use or development activity that would be subject to special conditions.	Yes, directly	No	Yes	Yes	No
City of Redmond	RZC 21.64.050 - Critical Aquifer Recharge Areas	Protects critical aquifer recharge areas and regulates activities that have a potential to degrade the	Yes, directly	No	Yes	No	No

¹² Includes sole source aquifers; Group A wellhead protection areas and areas sensitive to groundwater contamination.

Regulation	Citation/ Reference	Description	Governs Reclaimed Water Use	Type of Requirement			
				Treatment Standards	Use Restrictions	Engineering Controls	Monitoring/ Reporting
		quality of groundwater produced by supply wells. RZC 21.64.050 (C)(1)(p) prohibits irrigation with gray or reclaimed water and “other activities” which the City determines would pose a significant contamination hazard to the City’s groundwater supply within wellhead protection zones 1 and 2 ¹³ .					
City of Renton	Ordinance 5137	Includes protection of critical aquifer recharge areas, flood hazard areas, and geologic hazards.	Yes, directly & indirectly	No	Yes	Yes	Yes
	Section II, H - Aquifer Protection	Nitrate application rate limited to 0.5 pound per thousand square feet (0.5 lb/1000 ft ²) and 8 pounds of nitrogen per thousand square feet (8.0 lb/1000 ft ²) per year in Zone 1 and 2 aquifer protection areas (APAs); see Appendix A. Also includes pipeline requirements and fill quality standards in Zone 1 and 2. Also Includes pipeline requirements if there is a potential risk of contamination and fill quality standards within Zones 1 and 2.					
	Section II, J – Geologic Hazards	Apply to sites containing or within 50 feet of steep slopes, landslide hazards, erosion hazards, seismic hazards, and/or coal mine hazards. For projects requiring a development permit, a geotechnical assessment is required to	Yes, indirectly	No	No	Yes	No

¹³ Wellhead Protection Zone 1 represents the land area overlying the six-month time-of-travel zone of any public water source well owned by the City and Wellhead Protection Zone 2 represents the land area that overlies the one-year time-of-travel zone of any public water source well owned by the City, excluding the land area contained within Wellhead Protection Zone 1.

Regulation	Citation/ Reference	Description	Governs Reclaimed Water Use	Type of Requirement			
				Treatment Standards	Use Restrictions	Engineering Controls	Monitoring/ Reporting
		demonstrate the proposal will not increase the threat of the geological hazard to adjacent properties.					
City of Seattle - Regulations for Environmentally Critical Areas	Chapter 25.09	Does not include wellhead protection or critical aquifer recharge requirements.	No	-	-	-	-
City of Tukwila - Environmentally sensitive areas	Code 18.45	Does not include wellhead protection or critical aquifer recharge areas.	No	-	-	-	-
	RZC 21.64.040 Frequently Flooded Areas	Developed to achieve no net loss of structure, value, and functions of natural systems within frequently flooded areas and to employ no net impact floodplain management. Silent on flow augmentation.	Yes, Indirectly	No	Yes	No	No
City of Woodinville	Chapter 21.24.190 to 200 - Critical area requirements	Protects critical aquifer recharge areas and prohibits specific activities within critical aquifer recharges areas. Requirements are silent on reclaimed water use.	Yes, Indirectly	No	Yes	No	No
	Chapter 21.24. 210 – 260 – Flood Hazard	Addresses flood hazard areas and zero rise flood fringe which prohibit development proposals and alterations so that they shall not reduce the effective base flood storage volume of the floodplain.	Yes, Indirectly	No	Yes	No	No

Note: Additional Washington state requirements apply to groundwater recharge; however, since direct groundwater recharge is not part of the three reclaimed water use strategies approved by King County it is not discussed in this document.

3.2 Water Reclamation and Reuse Standards and Reclaimed Water Act

This section presents reclaimed water treatment standards and use restrictions stipulated in the Washington State Water Reclamation and Reuse Standards (Ecology and Health 1997) and the Reclaimed Water Act (RCW 90.46). The sections below address treatment standards, restrictions that apply to all or specific uses, criteria that apply to wetland enhancement, and requirements for projects that will augment stream flows.

3.2.1 Treatment Standards

Table 3-2 summarizes Washington state compliance requirements to meet state treatment standards for reclaimed water (Ecology and Health 1997: Section 1, Table 2 and Section 2, Table 2). In addition to the treatment standards listed below, a chlorine residual of at least 0.5 mg/L is required in the reclaimed water during conveyance from the reclamation plant to the use area, unless waived by Ecology and Health (Ecology and Health 1997: Article 9, Section 5).

The water quality criteria specified in Table 3-2 must be met for all wetland categories (U.S. Environmental Protection Agency 2004, Ecology and Health 1997), unless natural conditions in the wetland are of a lower quality than these criteria—then the natural conditions are considered the water quality criteria (Washington Administrative Code [WAC] 173-201A-070, Ecology and Health 2007).

Certain nutrient-loading rates in King County reclaimed water would not meet the Ecology standards. The standards allow for a waiver on nutrient limits if degradation of existing downstream water uses would not occur and net environmental benefit can be demonstrated. If a waiver were not granted, then reclaimed water nutrient levels would need to be reduced.

Table 3-2. Washington State Reclaimed Water Monitoring and Compliance Requirements¹

Parameter	Sample Type and Frequency	Compliance Requirement (All Uses)	Compliance Requirement (Wetland Enhancement)
Biochemical Oxygen Demand (BOD)	24-hour composite, collected at least weekly	Shall not exceed 30 mg/L determined monthly, based on the arithmetic mean of all samples collected during the month.	Shall not exceed 20 mg/L on an average annual basis.
Total Suspended Solids (TSS)	24-hour composite, collected at least daily ²	Shall not exceed 30 mg/L, determined monthly based on the arithmetic mean of all samples collected during the month.	Shall not exceed 20 mg/L on an average annual basis ³ .
Total Coliforms	Grab, collected at least daily	Compliance determined daily, based on the median value determined from the bacteriological results of the last 7 days for which analyses have been completed.	Same.

Parameter	Sample Type and Frequency	Compliance Requirement (All Uses)	Compliance Requirement (Wetland Enhancement)
Turbidity	Continuous recording turbidimeter	Filtered wastewater shall not exceed an average operating turbidity of 2 NTU, determined monthly, and shall not exceed 5 NTU at any time.	Not specified.
Dissolved Oxygen (DO)	Grab, collected at least daily	Shall contain dissolved oxygen.	Not specified.
Kjeldahl Nitrogen (TKN)	24-hour composite collected weekly	Not specified.	Shall not exceed 3 mg TKN-N/L on an average annual basis.
Total Ammonia-Nitrogen	24-hour composite collected weekly	Not specified.	Shall not exceed Washington chronic standards for freshwater or as specified in Article 3 (4).
Total Phosphorus (TP)	24-hour composite collected weekly	Not specified.	Shall not exceed 1 mg P/L on an average annual basis.
Metals: Arsenic, Cadmium, Copper, Lead, Mercury, Nickel, Zinc	24-hour composite collected weekly	Not specified.	Shall not exceed Washington surface water quality standards, or as specified in Section 2; Article 3 (5).

Source: Ecology and Health 1997

¹ Treatment requirements are also stipulated for direct aquifer recharge but they are not summarized here because the strategies do not contemplate this use for reclaimed water.

² TSS sampling may be reduced for those projects generating Class A reclaimed water on a case by case basis by Ecology and Health.

³ Collected at least weekly.

3.2.2 Use Restrictions

The Washington State Water Reclamation and Reuse Standards (Ecology and Health 1997) stipulate a variety of Use Area Requirements (Article 12, Section 1) that apply to all or specific uses. Requirements applicable to uses contemplated by King County are summarized as follows:

- a) Public and employee notification requirements accomplished through signage, scorecards (e.g., at golf courses), written notices, etc.
- b) Measures to prevent unplanned ponding.
- c) Measures to prevent spraying of water on people or undesignated areas.
- d) Maximum attainable separation between reclaimed water lines and potable water lines shall be practiced (minimum horizontal separation of 10 feet between reclaimed water lines and potable water lines).
- e) Reclaimed water valves, storage facilities outlets and pipes must be tagged or labeled and color coded “purple” for reclaimed water.

- f) All reclaimed water valves and outlets shall be of a type, or secured in a manner, that permits operation only by authorized personnel.
- g) Except as authorized by the Washington Departments of Ecology and Health, hose bibs on reclaimed water lines are prohibited.
- h) The hydraulic loading rate of reclaimed water when used for irrigation shall be determined based on a detailed water balance analysis. The calculated loading rate(s) and the parameters and methods used to determine the loading rate(s) shall be submitted to the Washington Departments of Ecology and Health for approval.
- i) Irrigation with reclaimed water is not permitted when the ground is saturated or frozen.
- j) Adequate measures shall be taken to prevent the breeding of vectors of health significance and the creation of odors, slimes, or aesthetically displeasing deposits.
- k) A groundwater monitoring program may be required by Ecology and Health. Where required, the groundwater monitoring program based on reclaimed water quality and quantity, site specific soil and hydrogeologic characteristics, and other considerations shall be established by the permittee and approved by Ecology and Health.

The standards also include cross connection control requirements to prevent cross connections between potable water and reclaimed water systems (Article 12, Section 3) and setback distances (Article 12, Section 4). Required cross connection measures include (1) coordination between the organization producing reclaimed water and the local drinking water purveyor and (2) installation of backflow prevention devices if potable water is provided to the same area as reclaimed water (e.g., water fountains in parks irrigated with reclaimed water). The Ecology and Health setback distance requirements for Class A reclaimed water vary depending on the specific water use and location in relation to a water supply well.

3.2.3 Environmental Enhancement of Wetlands

Discharge of reclaimed water to Category I and saltwater wetlands is not allowed unless it can be demonstrated that no existing significant wetland functions will be decreased and overall net environmental benefits will result. Category I wetlands by definition are highly functional systems that are difficult if not impossible to replace, are highly sensitive to disturbance, and/or represent rare or unique wetland types (Hruby 2006). Consequently, it may be difficult to demonstrate a net environmental benefit to adding reclaimed water to Category I or saltwater wetlands.

In addition to the water quality standards listed in Table 3-2, Section 2 of the Washington State Water Reclamation and Reuse Standards specifies the following criteria:

Hydrologic and Hydraulic Criteria (Article 2)

- Average annual hydraulic loading rate cannot exceed 2 centimeters per day (cm/day) to Category II wetlands, slightly higher rates are allowed for Category III and IV wetlands (3 cm/day) and constructed wetlands (5 cm/day, maximum).
- Average monthly water levels cannot increase by more than 10 centimeters (cm) compared to the average pre-augmentation monthly water level. The frequency and

duration of water level fluctuations above pre-augmentation average may be further limited in the following situations:

- If the wetland is characterized by relatively high vegetation species richness, then the frequency of stage excursions above 15 cm shall not exceed 6 per year and the duration shall not exceed 72 hours per excursion; or
- If the wetland contains a high quality bog or fen component, then the duration of stage excursions shall not exceed 24 hours in any year; or
- If the wetland is inhabited by breeding native amphibians, then during the breeding season (February through May) and within the breeding zones, water level excursions shall not exceed 8 cm and the duration of all excursions shall not exceed 24 hours in any 30-day period.

Water Quality Criteria (Article 3)

- Mass average annual loadings are not to exceed: Total Phosphorus (TP) 0.2 kg/ha/d; Total Nitrogen (TN) 1.2 kg/ha/d; BOD₅ 5 kg/ha/d; and total suspended solids (TSS) 9 kg/ha/d.
- Ammonia concentration must not exceed Washington chronic toxicity standards (WAC 173-201A-040[3])
- Metal concentrations must not exceed Washington State water quality standards (WAC 173-201A)

Biological Criteria (Article 4)

- Existing beneficial uses shall be maintained and protected and no further degradation which would interfere with or become injurious to existing beneficial uses shall be allowed, unless the discharge of reclaimed water will result in a net environmental benefit as described in Article 6 (WAC 173-201A-070).
- Existing beneficial uses shall be maintained and protected (not degraded), unless net environmental benefit (WAC 173-201A-070) can be demonstrated through application of reclaimed water.
- Biological criteria related to species composition and abundance (e.g., vegetation, macroinvertebrates, amphibians, fish and birds) will not be lowered by more than 25 percent compared to the reference condition.

Groundwater Protection Criteria (Article 5)

- Determine whether the wetland is within an area that provides groundwater recharge at any time of the year.
- For reclaimed water with parameter concentrations at 50 percent or higher than groundwater quality criteria (WAC 173-200-040), additional hydrogeologic investigation is required to show hydrogeologic conditions are adequate to prevent degradation of groundwater.

Net Environmental Benefit (Article 6)

Exceptions to the criteria listed above may be possible if net environmental benefit can be demonstrated and the following criteria are met:

- Significant, existing beneficial uses of the receiving water will be uninterrupted and fully protected.
- New beneficial uses or increased provision of existing beneficial uses result from application of reclaimed water based on scientific evidence and ongoing monitoring.

3.2.4 Indirect Potable Reuse for Augmentation of Surface Waters

Projects that will augment stream flows are also required to identify a beneficial purpose such as in-stream flow enhancement, irrigation supplies, water right replenishment or transfer or fisheries propagation (Ecology and Health 1997).

Stream flow augmentation must also meet the requirements of the Clean Water Act (CWA), RCW 90.48. The use needs to be incorporated within a sewer or water comprehensive plan and have been adopted by the applicable local government and approved by Ecology and Health.

4.0. REDMOND/BEAR CREEK BASIN BRIGHTWATER CENTRALIZED STRATEGY

The Redmond/Bear Creek Basin Brightwater Centralized Strategy focuses on expanding reclaimed water service in the vicinity of Brightwater Treatment Plant, including areas in and around the Cities of Woodinville and Redmond and portions of Snohomish (Figures 4-1 and 4-2).

WTD has identified 31 potential sources of demand for reclaimed water produced from this strategy. Of these, three are wetland environmental enhancement uses near Crystal Lake, Cottage Lake, and Lake Sammamish. Other nonpotable consumptive uses include agricultural irrigation, non-agricultural irrigation, and industrial cooling, process, and wash uses.

Reclaimed water produced by Brightwater’s MBR treatment processes satisfies Class A reclaimed water requirements and can be directly applied for nonpotable consumptive uses. Because this strategy includes potential wetland enhancement uses, additional tertiary nutrient removal treatment processes for phosphorus and possibly nitrogen may be required for reclaimed water flows delivered to areas where environmental wetland enhancements are proposed.

Both the northern strategy area (near Woodinville) and the southern strategy area (near Redmond) are within the Redmond-Bear Creek Valley Groundwater Management Area¹⁴ and the recharge area for the Cold Creek Aquifer, which provides cool water to Bear Creek and the Sammamish River (King County 2007). A shallow sole source aquifer also underlies Crystal Lake in Snohomish County (Snohomish County 2007).

The Brightwater strategy areas traverse four local jurisdictions: the cities of Redmond and Woodinville and unincorporated King and Snohomish counties. Table 4-1 summarizes the uses included within each jurisdiction of the Brightwater strategy.

Table 4-1. Summary of Reclaimed Water Uses within Local Jurisdictions for Brightwater Strategy

Reclaimed Water Use	Redmond	Woodinville	Unincorporated King County	Unincorporated Snohomish County
Non-agricultural Irrigation	✓	✓	✓	✓
Agricultural Irrigation	✓			
Commercial/Industrial	✓	✓		✓
Environmental Enhancement	✓		✓	✓

¹⁴ <http://www.kingcounty.gov/environment/waterandland/groundwater/management-areas/redmond-bear-cr-gwma.aspx>

As shown in Figure 4-1, the Brightwater strategy includes using reclaimed water in wellhead protection areas and in an area overlying a sole source aquifer. One agricultural irrigation use and two non-agricultural irrigation uses are within Zone 1 and 2 wellhead protection areas. Two commercial/industrial uses are within Zone 1 wellhead protection areas. In addition, according to the Aquifer Recharge/Wellhead Protection Map (Snohomish County 2007), Crystal Lake and part of the strategy area within unincorporated Snohomish County overlies a shallow sole source aquifer. There is also one wellhead to the west of Crystal Lake.

There are two TMDLs within the strategy area: the Cottage Lake TMDL for total phosphorus (TP) and the Bear-Evans watershed TMDL for temperature, dissolved oxygen, and fecal coliform. The Cottage Lake TMDL does not include a load allocation for TP contained in reclaimed water. Crystal Lake is part of the Daniel's Creek watershed, which drains to Cottage Lake. Daniel's Creek subbasin has a total annual phosphorus waste load allocation of 16 kilograms (kg) TP for June through August (Washington State Department of Ecology 2007); new TP inputs would need to be offset with existing sources. The Bear-Evans watershed TMDL does not directly prohibit increases to nutrient and sediment loads but could limit regulatory feasibility of the wetland enhancement uses near Crystal Lake and Cottage Lake.

Sammamish River is on the 2008 Ecology 303(d) list for violation of fecal coliform, water temperature standards, and violations of the dissolved oxygen standards (shall exceed 9.5 mg/L). The river is categorized as Core Salmon Migration and Rearing Habitat for aquatic life use and Primary Contact for recreational use.

4.1 Regulatory Feasibility Challenges to Implementing Strategy

Review of the federal, state, and local regulations applicable to reclaimed water uses listed in Table 3-1 indicates that the federal guidelines as well as King County, Snohomish County, and City of Woodinville regulations do not contain prohibitions that would limit the regulatory feasibility of reclaimed water uses included in the Brightwater strategy. However, if groundwater recharge with reclaimed water is proposed in the future within unincorporated Snohomish County, Snohomish County Code 30.62C would apply and could limit regulatory feasibility.

The Washington State Reclaimed Water Standards, surface and groundwater water quality protection and anti-degradation requirements, and City of Redmond wellhead protection requirements would limit regulatory feasibility of portions of the Redmond/Bear Creek Basin Brightwater Centralized Strategy. These requirements and limitations are discussed in the following sections according to the type of reclaimed water use they would limit.

4.1.1 Wetlands

Adding reclaimed water to the Crystal Lake, Cottage Lake, and Lake Sammamish lake-fringe wetlands may not be feasible from a regulatory perspective. The wetlands in the vicinity of Crystal Lake and Cottage Lake are likely Category I wetlands and thus enhancement of these wetlands with reclaimed water would not be allowed under Washington State Water Reclamation and Reuse Standards unless a net environmental benefit can be demonstrated and no existing significant wetland functions would be decreased. Category I wetlands by definition are highly functional systems that are difficult if not impossible to replace, are highly sensitive to

disturbance, and/or represent rare or unique wetland types (Hruby 2006). Both wetland systems in the vicinity of Crystal Lake and Cottage Lake have indicators of high water quality and hydrologic and habitat functions (King County 2012b). The forested lake-fringe wetland in Marymoor Park may also be a Category I wetland and also displays indicators of high levels of water quality and hydrologic and habitat functions (King County 2012b). Areas inland from the forested lake-fringe wetland within Marymoor Park and in the vicinity of the rowing club may be suitable for wetland creation/enhancement as long as the existing wetlands in these areas were not created, restored, or enhanced as part of a wetland mitigation project.

Surface and groundwater water quality protection and anti-degradation requirements would present another regulatory challenge to implementation of reclaimed water uses for wetland enhancement for several reasons:

- The daily loading rate of total phosphorus and total nitrogen contemplated for the Cottage Lake wetlands and total phosphorus loading for the Sammamish Slough wetlands would be above the average annual rate specified in the Washington State Water Reclamation and Reuse Standards.
- The Cottage Lake Phosphorus TMDL has a total annual phosphorus waste load allocation of 16 kg total phosphorus (June through August) for the Daniels Creek subbasin, which includes Crystal Lake (Ecology 2007). Any additions of reclaimed water to the Daniels Creek subbasin would likely need to be offset with reductions in other sources of phosphorus loading.
- The Bear-Evans TMDL for temperature and dissolved oxygen identifies use and infiltration of reclaimed water as possible actions that could help to increase cool groundwater flows. However, analysis would be necessary to confirm that addition of reclaimed water to wetlands would result in a net environmental benefit given the additional nutrients this would add.
- Groundwater protection could also be an issue for the Crystal Lake wetland enhancement use and could trigger Snohomish Critical Area requirements for critical aquifer recharge areas.

4.1.2 Irrigation

City of Redmond wellhead protection regulations (RZC 21.64.050) limit the regulatory feasibility of the reclaimed water use strategies within specific parts of Redmond. Regulation RZC 21.64.050 prohibits irrigation with reclaimed water in Zone 1 and 2 wellhead protection areas, which the City lists among activities deemed to pose a significant contamination hazard to its groundwater supply¹⁵. As shown in Figure 4-1, the Brightwater strategy includes using reclaimed water for one agricultural irrigation use and two non-agricultural irrigation uses within Zone 1 or 2 wellhead protection areas. In addition, two commercial/industrial uses are within Zone 1 well head protection areas.

¹⁵ Wellhead Protection Zone 1 represents the land area overlying the 6-month time-of-travel zone of any public water source well owned by the City. Wellhead Protection Zone 2 represents the land area that overlies the 1-year time-of-travel zone of any public water source well owned by the City, excluding the land area contained within Wellhead Protection Zone 1.

Although the other jurisdictions in the Brightwater strategy area also have critical aquifer recharge requirements, none of them prohibit using reclaimed water for irrigation or any other use currently being considered by King County.

4.2 Approaches to Address Regulatory Challenges

The nonpotable consumptive and environmental enhancement uses proposed for the Brightwater strategy may not be feasible. The reclaimed water uses being considered in Redmond within Zone 1 and 2 wellhead protection areas are not allowed under Redmond City Code. Approval of the wetland enhancement uses at Crystal Lake, Cottage Lake, and Lake Sammamish lake-fringe wetlands as currently envisioned within the Brightwater strategy would require a demonstration of net environmental benefit. If these wetlands are Category I wetlands, demonstrating net environmental benefit would likely be difficult.

Studies necessary to demonstrate net environmental benefit from the proposed wetland enhancement use would likely include efforts to:

- identify the wetland category and conduct wetland delineation
- identify existing beneficial uses of the wetland
- determine the hydrologic regime and monthly water budget
- conduct downstream water quality modeling

If net environmental benefit cannot be demonstrated, modifications may be necessary to the wetland enhancement uses; for example, nutrient-loading rates could be reduced by decreasing the rates of reclaimed water application or incorporating a higher level of treatment in the production of reclaimed water.

5.0. RENTON/TUKWILA SOUTH PLANT CENTRALIZED STRATEGY

The Renton/Tukwila South Plant Centralized Strategy focuses on expanding reclaimed water service in the vicinity of South Treatment Plant, including areas in and around the Cities of Renton and Tukwila in King County (Figures 5-1 and 5-2).

WTD has identified 43 potential sources of demand for reclaimed water produced from this strategy. Of these, one is a wetland environmental enhancement use along the south bank of the Cedar River, opposite Cedar River Park. Other nonpotable consumptive uses include non-agricultural irrigation as well as industrial cooling, process, and wash water uses.

Reclaimed water produced by South plant's existing activated sludge wastewater treatment and tertiary reclaimed water sand filter processes satisfies Class A reclaimed water requirements and can be applied for nonpotable consumptive uses directly. However, the sand filter has limited capacity to produce reclaimed water, and the system would require expansion or replacement to meet demands identified in the strategy. The reclaimed water produced at South plant is currently inadequate for the proposed environmental enhancement uses. Concentrations of TP and Total Kjeldahl Nitrogen (TKN) in reclaimed water from South plant are 2 mg/L and 30 mg/L, respectively. These concentrations are above the water quality criteria for wetland enhancement or constructed beneficial use wetlands specified in the Reclaimed Water Standards, which are 1 mg/L and 3 mg/L for TP and TKN, respectively (Ecology and Health 1997). Although one small environmental enhancement use for creating a wetland has been identified within the strategy area, no additional nutrient removal treatment beyond Class A standards is currently proposed for the South plant reclaimed water strategy.

The South plant strategy falls within four local jurisdictions; however, new potential uses only fall within the boundaries of the City of Renton and the City of Tukwila. Table 5-1 summarizes the uses included within each jurisdiction of the South plant strategy area.

Table 5-1. Summary of Reclaimed Water Uses within Local Jurisdictions for South Plant Strategy

Reclaimed Water Use	Renton	Tukwila	Kent	Unincorporated King County
Non-agricultural Irrigation	✓	✓		
Agricultural Irrigation			None currently included in strategy area	None currently included in strategy area
Commercial/Industrial	✓			
Environmental Enhancement	✓			

Water quality within the Cedar River is generally very good. The Lower Cedar River basin's most significant water quality problems are total phosphorus loadings into Lake Washington, locally toxic concentrations of urban pollutants, high fecal coliform counts, and localized sediment problems (King County 2011a). The lowest reaches of the Cedar River are listed on Ecology's 2008 303(d) list for fecal coliform, temperature, and dissolved oxygen; however, a TMDL has not been developed.

The Cedar River Aquifer is designated a sole source aquifer under the Safe Drinking Water Act (SDWA) and is accorded additional protection from degradation. Any project receiving federal funding that has potential to contaminate the aquifer is reviewed by the EPA. The City of Renton has developed critical area requirements to protect the aquifer.

The bench above the Cedar River that is being evaluated for wetland creation under this strategy is elevated 15–20 feet from the river and there is a steep bluff from the top of the bench to the river. Wetland construction activities would likely be subject to the geological hazard requirements contained in City of Renton Ordinance 5137 Section 2. J.

5.1 Regulatory Feasibility Challenges to Implementing Strategy

The requirements that protect the Cedar Valley Aquifer from contamination may challenge the feasibility of the South plant strategy for the proposed wetland enhancement and reclaimed water irrigation uses located within the City of Renton. In addition, the higher TP and TKN concentrations in the reclaimed water produced by the South plant would necessitate resolution on some issues internally and with Ecology and Health before moving forward with project design and permitting. Challenges related to each use (wetland enhancement and irrigation) are discussed below.

5.1.1 Aquifer Protection Requirements

The City of Renton aquifer protection requirements (Ordinance 5137) may present challenges to the regulatory feasibility of several of the uses included in this reclaimed water strategy. As shown in Figures 5-1 and 5-2, the created beneficial use wetland and several non-agricultural irrigation uses are within the 6-month, 1-year, and 5-year zones of travel to City of Renton production wells, which are within the Zone 1 or 2 aquifer protection areas (APAs) as defined by the City; Figure 5-3 depicts Zone 1 and 2 APAs. The nitrate application limits specified in the code, which limit total annual application rates of nitrate to 8 pounds of nitrogen per thousand square feet (see Table 3-1), may apply to reclaimed water uses within these zones. This may represent a substantial limitation to the uses being considered. For example, TN applied to the created wetland annually at concentrations and loading rates currently envisioned would equate to over 60 pounds of TN per 1,000 square feet per year. Even if there is very little nitrogen in the form of nitrate in the reclaimed water, the concentration of various types of nitrogen would change as the water moved through the wetland.

5.1.2 Water Quality Criteria for Wetland Enhancement

As discussed in Section 5.0 above, the TN and TP concentrations in South plant reclaimed water exceed the water quality criteria in the Washington State Water Reclamation and Reuse Standards. Analysis of the effects of the reclaimed water strategies on wetlands (King County 2012b) indicates that the nutrient concentrations in reclaimed water would result in mass loading rates¹⁶ that are higher than limits specified in the standard. Ecology and Health can authorize reclaimed water use with higher loading rates if King County is able to demonstrate biological

¹⁶ Mass loading on an average annual basis is expressed as kilograms per hectare per day (kg/ha/day).

criteria and if net environmental benefit requirements would be satisfied. However, the standards do not indicate whether Ecology and Health can authorize reclaimed water use if the water quality criteria¹⁷ are not met.

5.2 Approaches to Address Regulatory Challenges

The key issue to be resolved to determine regulatory feasibility of reclaimed water uses within Zone 1 and 2 APAs would be to ascertain how the nitrogen contained in reclaimed water would be treated under the City's restrictions regarding nitrate-containing materials. Once this technical question is resolved, it would also be necessary to demonstrate that no degradation of the aquifer would occur as a result of using reclaimed water for wetland enhancement.

Enhancement activities and approved restoration/mitigation can be exempted from the critical area requirements contained in Ordinance 5137 but require a Letter of Exemption from the City. However, the Ordinance indicates exemptions to the aquifer protection requirements are less likely to be granted.

Ecology may make an exception to the water quality criteria and annual average mass loading rates if net environmental benefit could be demonstrated. Studies necessary to demonstrate net environmental benefit from the proposed wetland enhancement use would likely include efforts to:

- identify the wetland category and conduct wetland delineation
- identify existing beneficial uses of the wetland
- determine the hydrologic regime and monthly water budget
- conduct downstream water quality modeling

If net environmental benefit could not be demonstrated, using South plant reclaimed water for a constructed beneficial use wetland would not be allowed unless there were additional nutrient removal from South plant reclaimed water.

¹⁷ Water quality criteria are expressed as the constituent concentration in milligrams per liter (mg/L).

6.0. RECLAIMED WATER SKIMMING OR POLISHING DECENTRALIZED STRATEGY

The Reclaimed Water Skimming or Polishing Decentralized Strategy represents opportunities for smaller-scale reclaimed water strategy implementation subject to certain infrastructure limitations. Specifically, infrastructure for this strategy is constrained to single treatment plants of up to 0.5 mgd capacity and up to 1 mile of reclaimed water piping. The single treatment plants would produce Class A reclaimed water. However, no additional nutrient removal treatment beyond Class A standards is currently included.

6.1 Decentralized Strategies

Three potential areas and configurations were identified to help define the decentralized strategy:

- Interbay Skimming Decentralized Strategy
- Duwamish Polishing Decentralized Strategy
- Lower Green River Valley (LGRV) Skimming Decentralized Strategy

The location of each strategy area is shown in Figure 1-1. The strategies are discussed in further detail in the following subsections.

6.1.1 Interbay Skimming Decentralized Strategy

The Interbay Skimming Decentralized Strategy lies wholly within the City of Seattle and focuses on implementing reclaimed water service in the Interbay area of the City of Seattle between the Queen Anne and Magnolia neighborhoods. This strategy would produce reclaimed water from untreated wastewater in adjacent conveyance pipelines for distribution near a new polishing plant via a new pipeline. The conceptual reclaimed water service area for this strategy area would surround the new decentralized skimming treatment plant and single distribution main.

A variety of potential uses and infrastructure locations were evaluated, and a conceptual service area was developed to serve potential uses based on estimated use types and volumes. WTD identified three potential sources of demand for reclaimed water produced in this strategy. The three conceptual uses are non-agricultural park and golf-course irrigation as well as industrial cooling.

6.1.2 Duwamish Polishing Decentralized Strategy

The Duwamish Polishing Decentralized Strategy focuses on implementing reclaimed water service in the Duwamish area of the City of Seattle. The Duwamish strategy area is located south of the Port of Seattle, between the West Seattle and Sodo neighborhoods. The conceptual reclaimed water service area for this strategy area would surround a new decentralized polishing treatment plant and single distribution main.

A variety of potential uses and infrastructure locations were evaluated, and a conceptual service area was developed to serve potential uses based on estimated use types and volumes. WTD identified two potential sources of demand for reclaimed water produced in this strategy. The two conceptual uses are non-agricultural irrigation and industrial cooling.

6.1.3 Lower Green River Valley Skimming Decentralized Strategy

The Lower Green River Valley (LGRV) Skimming Decentralized Strategy lies wholly within unincorporated King County. It focuses on implementing reclaimed water service along the floor of the LGRV, including areas in and around the Cities of Kent and Auburn in south King County. This strategy would produce reclaimed water from untreated wastewater in adjacent conveyance pipelines for distribution near the new skimming plant via a new pipeline. The conceptual reclaimed water service area for this strategy area would surround a new decentralized skimming treatment plant and single distribution main.

A variety of potential uses and infrastructure locations were evaluated, and a conceptual service area was developed to serve a single large agricultural irrigation use. During the irrigation season, the identified use could demand the entire capacity of the strategy treatment plant and reclaimed water supply. Outside of the irrigation season, the plant would be idle. The selected use is located conveniently relative to source wastewater pipelines, but many suitable agricultural uses exist in the LGRV strategy area, and could be alternatively targeted for reclaimed water service.

According to King County critical aquifer recharge area data layer (King County 2011b), the strategy area is within a Category 2 aquifer recharge area. In addition, at least a portion of the strategy area is within the King County shoreline area and is within the floodplain.

6.2 Regulatory Feasibility Challenges to Implementing Strategies

No strategy-specific regulatory feasibility challenges have been identified related to the three decentralized strategies.

6.3 Approaches to Address Regulatory Challenges

Not applicable; no strategy-specific challenges have been identified.

7.0. ANTICIPATED CHANGES TO REGULATIONS

This chapter reviews changes to reclaimed water regulations that are either being drafted or might reasonably be expected at federal, state, and local levels.

7.1 Federal Regulations

The EPA guidelines acknowledge that future permit conditions may become more restrictive and new data may merit the inclusion of additional water quality criteria for some constituents, particularly for indirect potable reuse applications. Such additional constituents could include pathogens, such as *Giardia* and *Cryptosporidium*, as well as emerging pollutants of concern, such as agricultural and industrial chemicals, pharmaceuticals and personal care products (PPCPs), and endocrine-disrupting compounds (EDCs).

7.2 State Regulations

Washington state is in the process of developing administrative rules that would revise, update, and codify the Washington State Water Reclamation and Reuse Standards (Ecology and Health 1997). The new rules have been drafted and would become WAC 173-219. The deadline for finalizing the new rules has been extended beyond 2013, however, and the final content of the new rules is uncertain.

New requirements could also become effective as new TMDLs are developed to address water quality issues in 303(d) listed waters. For example, there are numerous listed waters within Puget Sound, including Elliot Bay and the Duwamish Waterway, as well as hypoxic conditions (low dissolved oxygen) in Hood Canal. In addition, shallow marine embayments are currently being investigated for their relationship to nutrient inputs from human activity.

7.3 Local Regulations

To date, only two of the local jurisdictions included in this assessment (City of Redmond and Snohomish County) have incorporated specific reclaimed water uses into their critical area requirements. As the availability and use of reclaimed water becomes more widespread, the regulatory landscape at the local level is likely to change. How it changes will be entirely dependent on local jurisdictions, the primary water sources, and the extent to which water supply is limited.

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 - Wellhead Protection Areas- Ten Year Time of Travel (kcwhpa_10yr)
 - Wellhead Protection Areas- One Year Time of Travel (kcwhpa_1yr)
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FIGURES

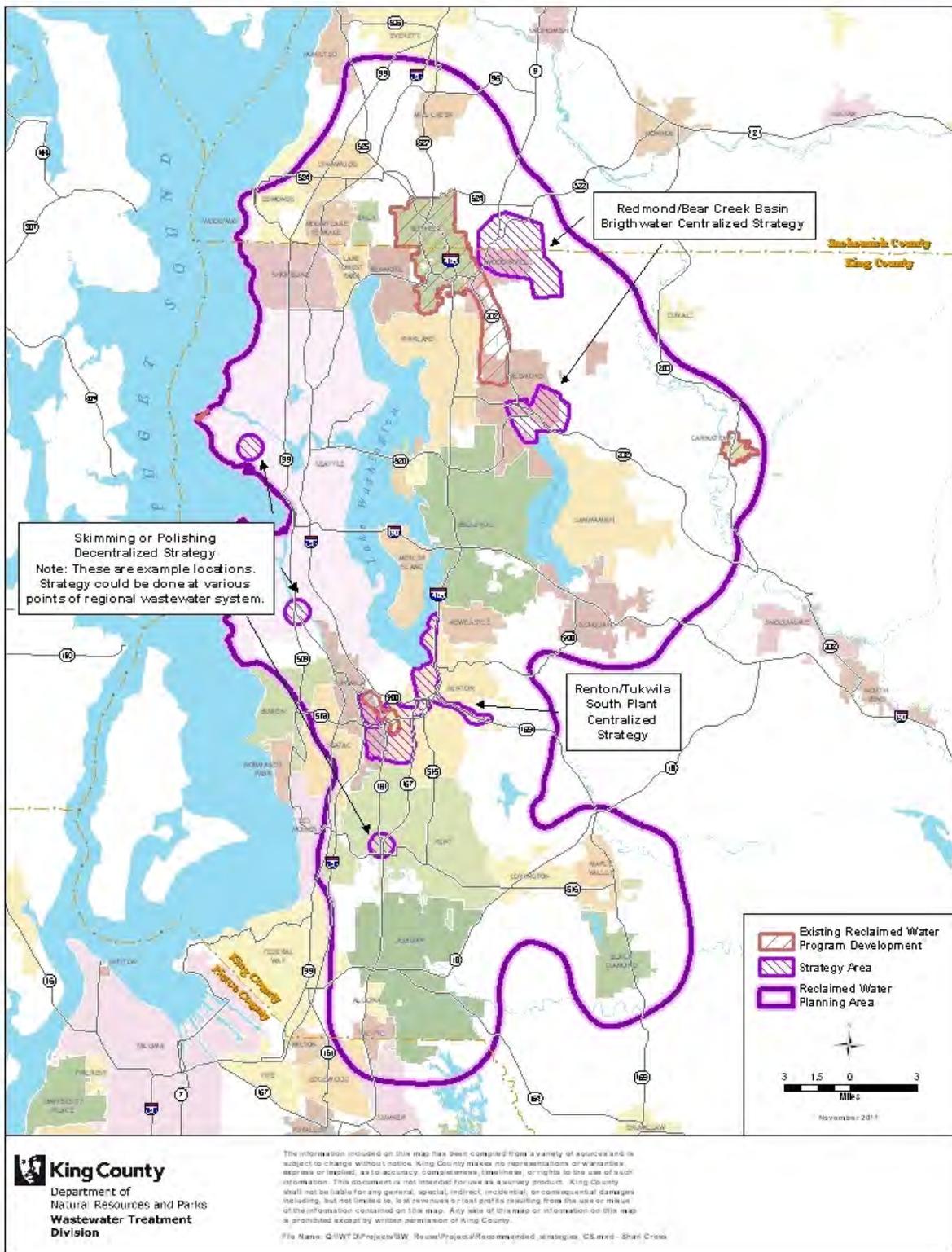
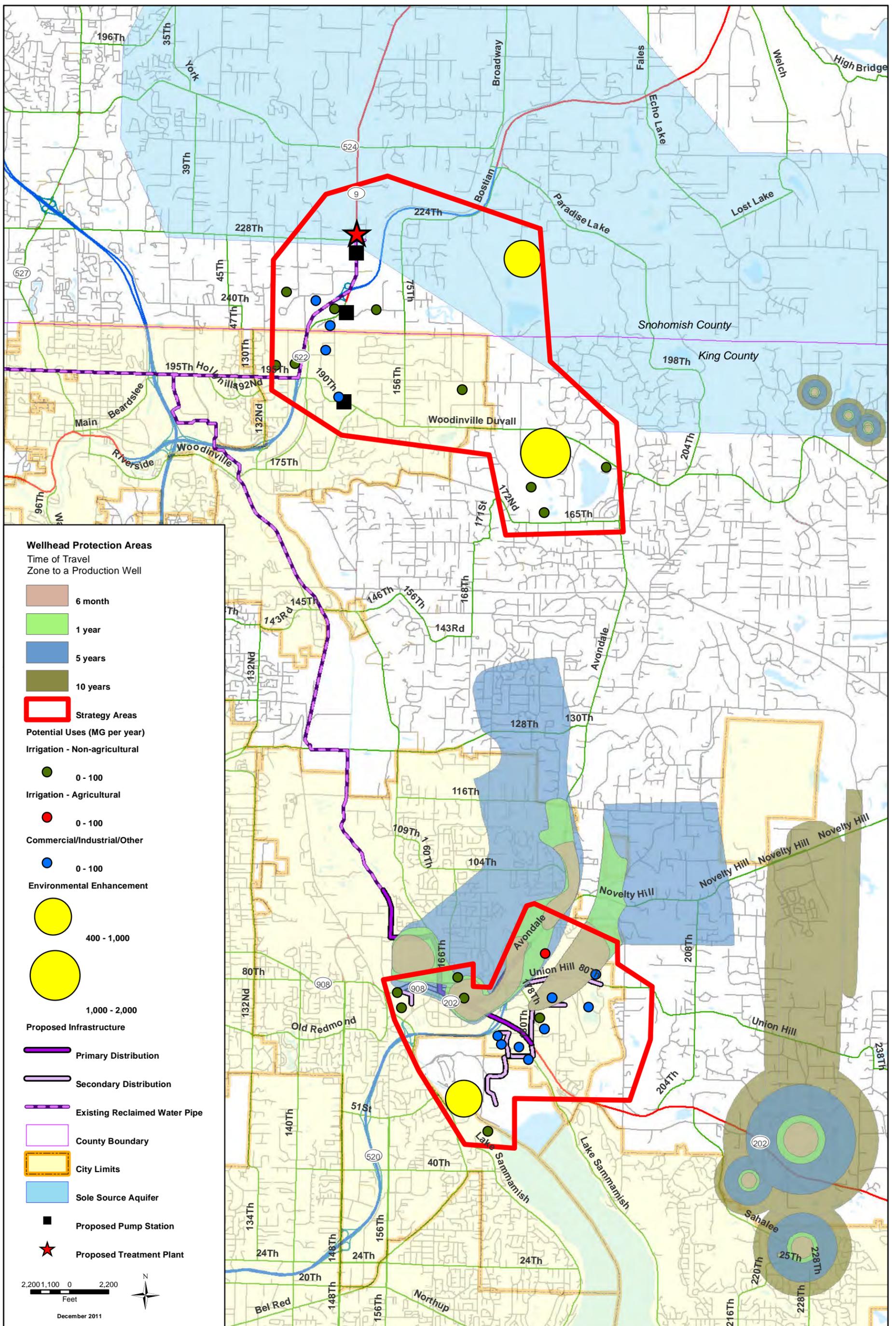


Figure 1-1 Reclaimed Water Strategies Recommended for Analysis



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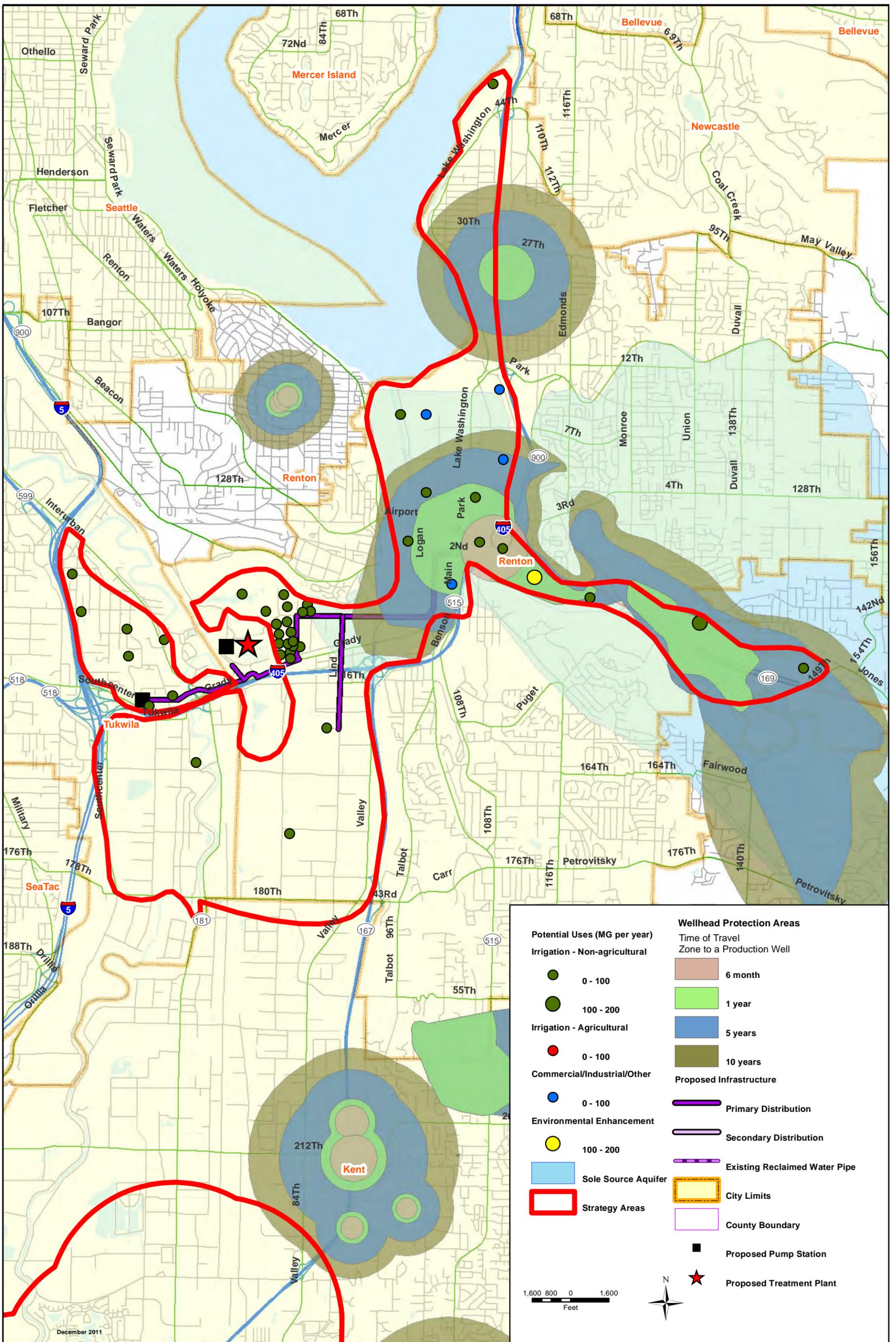
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Figure 4-1

Wellhead Protection Areas- Brightwater

Technical Memorandum:

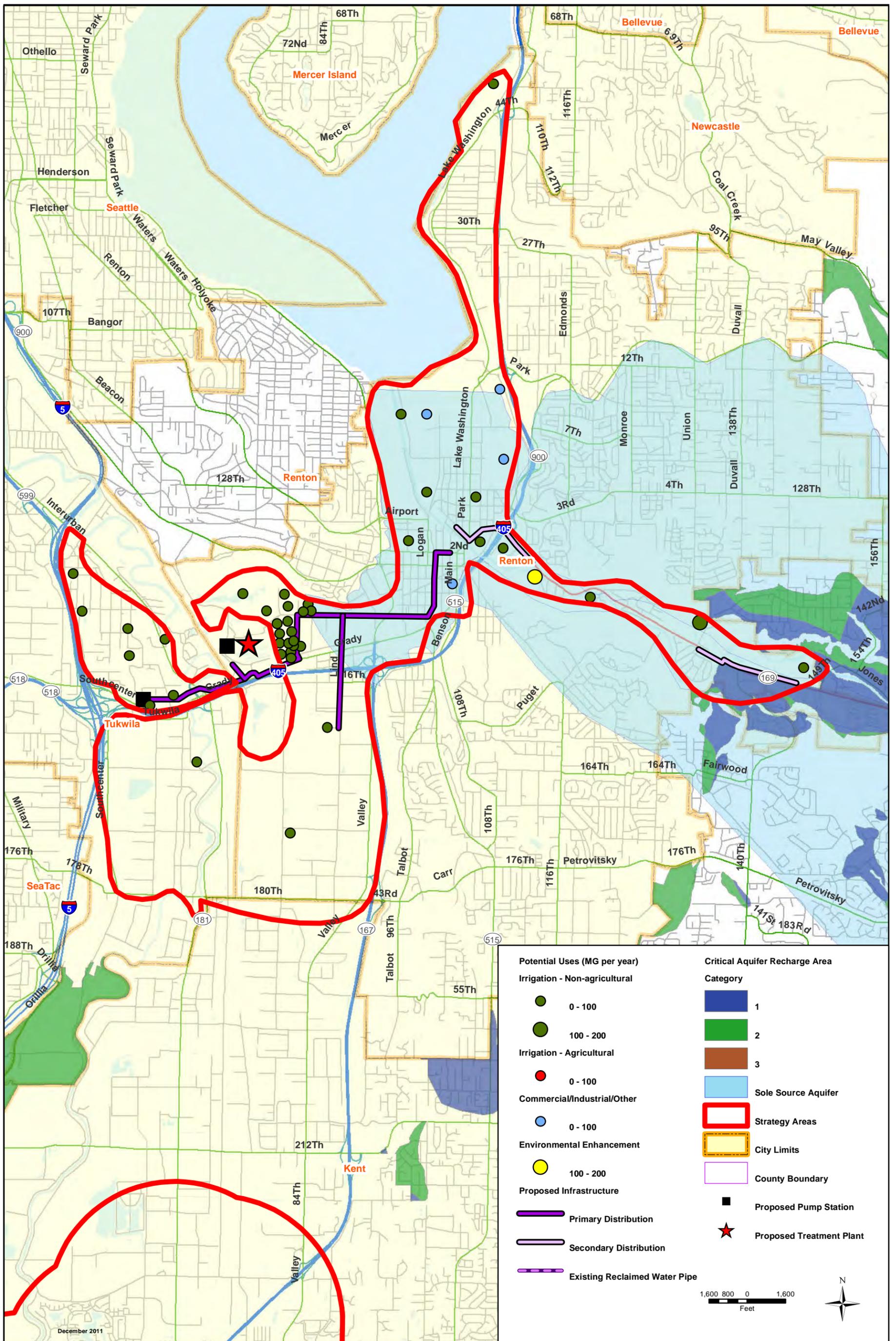
Reclaimed Water Strategy Assessment of Regulatory Feasibility

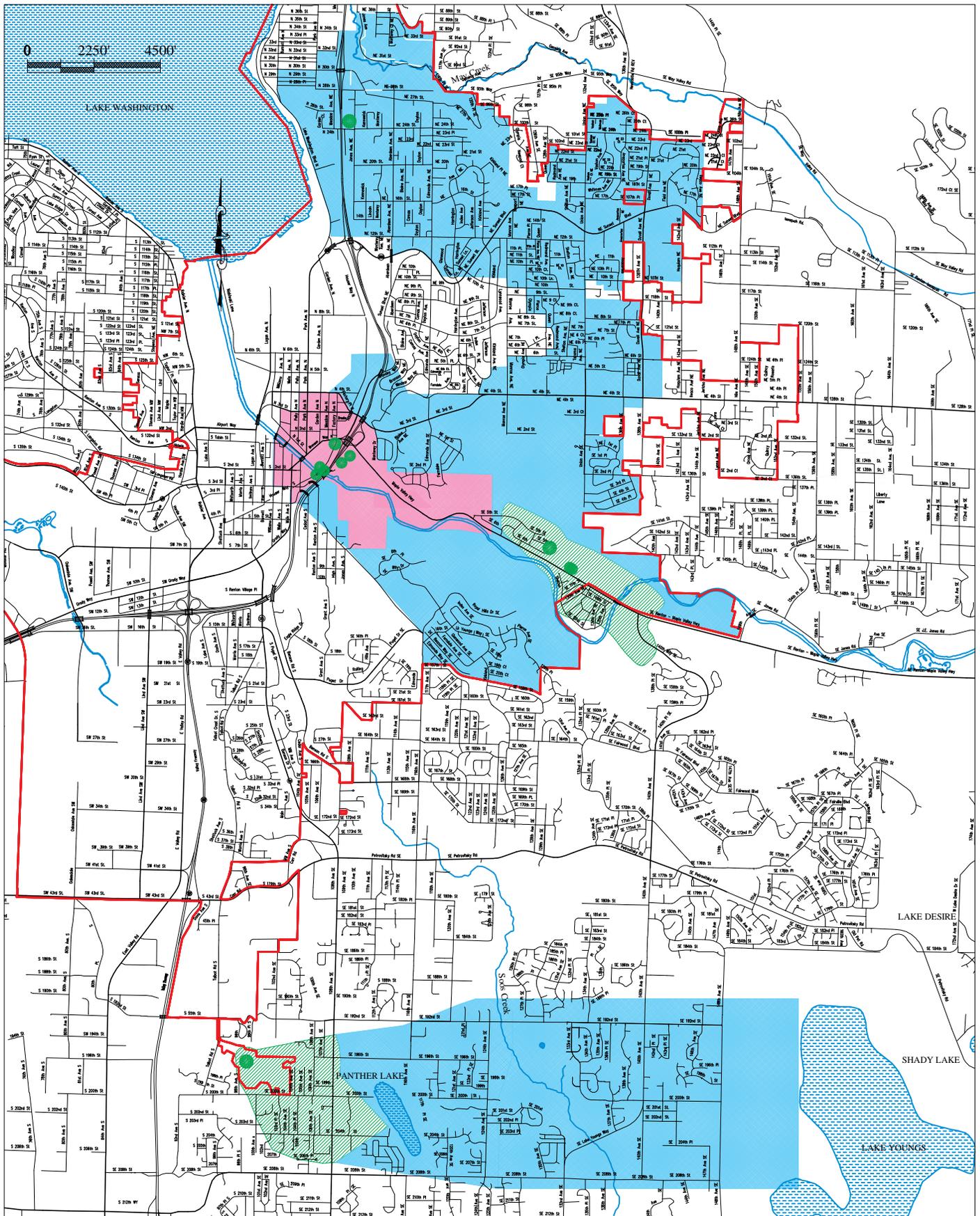


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City of Renton Aquifer Protection Areas

- APA Zone 1
- APA Zone 1 Modified
- APA Zone 2
- Renton City Limits
- Production Wells

Source: City of Renton. 2004. Water System Plan. Appendix Q. Wellhead Protection Plan
 Figure 5-3

APPENDIX A

EPA Guidelines for Water Reuse

Table A-1. EPA Suggested Guidelines for Water Reuse

Types of Reuse	Treatment	Reclaimed Water Quality²	Reclaimed Water Monitoring	Comments in EPA 2004 Document
Environmental Reuse Wetlands, marshes, wildlife habitat, stream augmentation	Variable Secondary ⁴ and disinfection ⁶ (minimum)	Variable, but not to exceed: < 30 mg/l BOD ⁷ < 30 mg/l TSS < 200 fecal coli/100 ml ^{9,13,14}	BOD – weekly TSS - daily Coliform - daily Cl ₂ residual -continuous	<ul style="list-style-type: none"> • No setback distance specified by EPA³. • Dechlorination may be necessary to protect aquatic species of flora and fauna. • Possible effects on groundwater should be evaluated. • Receiving water quality requirements may necessitate additional treatment. • The temperature of the reclaimed water should not adversely affect ecosystem. • Recommended treatment reliability (power failure alarms, automatic standby power sources, emergency storage, and back up units).
Indirect Potable Reuse Augmentation of surface supplies	Secondary ⁴ Filtration ⁵ Disinfection ⁶ Advanced wastewater treatment ¹⁶	pH = 6.5 -8.5 < 2 NTU 8 No detectable total coli/100 ml ^{9,10} 1 mg/l Cl ₂ residual (minimum) ¹¹ < 3 mg/l TOC Meet drinking water standards	pH - daily Turbidity continuous Total coliform daily Cl ₂ residual continuous Drinking water standards quarterly Other ¹⁷ - depends on constituent	<ul style="list-style-type: none"> • Site-specific setback distance³. • Recommended level of treatment is site-specific and depends on factors such as receiving water quality, time and distance to point of withdrawal, dilution and subsequent treatment prior to distribution for potable uses. • The reclaimed water should not contain measurable levels of viable pathogens.^{1,2} • See Sections 2.6 of EPA 2004 for more information. • A higher chlorine residual and/or a longer contact time may be necessary to assure virus and protozoa inactivation. • Recommended treatment reliability (power failure alarms, automatic standby power sources, emergency storage, and backup units).
Construction Use Soil compaction, dust control, washing aggregate, making	Secondary ⁴ Disinfection ⁶	< 30 mg/l BOD ⁷ < 30 mg/l TSS < 200 fecal coli/100 ml ^{9,13,14} 1 mg/l Cl ₂ residual (minimum) ¹¹	BOD -weekly TSS - daily Coliform - daily Cl ₂ residual -continuous	<ul style="list-style-type: none"> • No setback distance specified by EPA³. • Worker contact with reclaimed water should be minimized. • A higher level of disinfection, e.g., to achieve <14 fecal coli/100 ml, should be provided when frequent work contact with reclaimed water is likely. • Recommended treatment reliability (power failure alarms, automatic standby power sources, emergency storage, and back

Types of Reuse	Treatment	Reclaimed Water Quality ²	Reclaimed Water Monitoring	Comments in EPA 2004 Document
concrete				up units).
Industrial Reuse Once-through cooling	Secondary ⁴ Disinfection ⁶	pH = 6-9; < 30 mg/l BOD ⁷ ; < 30 mg/l TSS ; < 200 fecal coli/100 ml ^{9,13,14} ; 1 mg/l Cl ₂ residual (minimum) ¹¹	pH – weekly; BOD – weekly; TSS – daily; Coliform - daily Cl ₂ residual continuous	<ul style="list-style-type: none"> Setback distance 300 ft to areas accessible to the public³. Windblown spray should not reach areas accessible to workers or the public.
Industrial Reuse Recirculating cooling towers	Secondary ⁴ Disinfection ⁶ (chemical coagulation and filtration ⁵ may be needed)	Variable depends on recirculation ratio pH = 6-9 < 30 mg/l BOD ⁷ < 30 mg/l TSS < 200 fecal coli/100 ml ^{9,13,14} 1 mg/l Cl ₂ residual (minimum) ¹¹	pH - weekly BOD -weekly TSS - daily Coliform - daily Cl ₂ residual continuous	<ul style="list-style-type: none"> Setback distance 300 ft to areas accessible to the public. May be reduced or eliminated if high level of disinfection is provided³. Windblown spray should not reach areas accessible to workers or the public. Additional treatment by user is usually provided to prevent scaling, corrosion, biological growths, fouling and foaming. Recommended treatment reliability (power failure alarms, automatic standby power sources, emergency storage, and back up units).

Source: U.S. Environmental Protection Agency 2004.

1. These guidelines are based on water reclamation and reuse practices in the U.S., and they are especially directed at states that have not developed their own regulations or guidelines. While the guidelines should be useful in many areas outside the U.S., local conditions may limit the applicability of the guidelines in some countries. It is explicitly stated that the direct application of these suggested guidelines will not be used by USAID as strict criteria for funding.

2. Unless otherwise noted, recommended quality limits apply to the reclaimed water at the point of discharge from the treatment facility. Not necessarily an exhaustive list of parameters.

3. Setback distances are recommended to protect potable water supply sources from contamination and to protect humans from unreasonable health risks due to exposure to reclaimed water.

4. Secondary treatment processes include activated sludge processes, trickling filters, rotating biological contractors, and may include stabilization pond systems. Secondary treatment should produce effluent in which both the BOD and TSS do not exceed 30 mg/l.

5. Filtration means the passing of wastewater through natural undisturbed soils or filter media such as sand and/or anthracite, filter cloth, or the passing of wastewater through microfilters or other membrane processes.

6. Disinfection means the destruction, inactivation, or removal of pathogenic microorganisms by chemical, physical, or biological means. Disinfection may be accomplished by chlorination, ultraviolet radiation, ozonation, other chemical disinfectants, membrane processes, or other processes. The use of chlorine as defining the level of disinfection does not preclude the use of other disinfection processes as an acceptable means of providing disinfection for reclaimed water.

7. As determined from the 5-day BOD test.

8. The recommended turbidity limit should be met prior to disinfection. The average turbidity should be based on a 24-hour time period. The turbidity should not exceed 5 NTU at any time. If TSS is used in lieu of turbidity, the TSS should not exceed 5 mg/l.

9. Unless otherwise noted, recommended coliform limits are median values determined from the bacteriological results of the last 7 days for which analyses have been completed. Either the membrane filter or fermentation-tube technique may be used.

10. The number of fecal coliform organisms should not exceed 14/100 ml in any sample.

11. Total chlorine residual should be met after a minimum contact time of 30 minutes.

12. It is advisable to fully characterize the microbiological quality of the reclaimed water prior to implementation of a reuse program.

13. The number of fecal coliform organisms should not exceed 800/100 ml in any sample.

Types of Reuse	Treatment	Reclaimed Water Quality ²	Reclaimed Water Monitoring	Comments in EPA 2004 Document
				<p>14. Some stabilization pond systems may be able to meet this coliform limit without disinfection.</p> <p>15. Commercially processed food crops are those that, prior to sale to the public or others, have undergone chemical or physical processing sufficient to destroy pathogens.</p> <p>16. Advanced wastewater treatment processes include chemical clarification, carbon adsorption, reverse osmosis and other membrane processes, air stripping, ultrafiltration, and ion exchange.</p> <p>17. Monitoring should include inorganic and organic compounds, or classes of compounds, that are known or suspected to be toxic, carcinogenic, teratogenic, or mutagenic and are not included in the drinking water standards.</p>