Appendix

WRIA 8 Cedar – Sammamish Watershed Plan

December 2024

The following appendices are linked to the report file at:

https://apps.ecology.wa.gov/publications/SummaryPages/2211014.html

Appendix A – Glossary

Appendix B – WRIA 8 Committee Members, Facilitation Team, and Support Staff

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Appendix D – Technical Memorandums

Appendix E – Project Descriptions

Appendix F – WRIA 8 Committee's Adaptive Management, Implementation, and Policy Recommendations

Appendix A – Glossary

Acre-feet (AF): A unit of volume equal to the volume of a sheet of water one acre in area and one foot in depth. (USGS)

Adaptive Management: An iterative and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions. (NEB)

Annual Average Withdrawal: RCW 90.94.030 (4)(a)(vi)(B) refers to the amount of water allowed for withdrawal per connection as the annual average withdrawal. As an example, a homeowner could withdraw 4,000 gallons on a summer day, so long as they did not do so often enough that their annual average exceeds the 950 gpd.

Beaver Dam Analogue (BDA): BDAs are man-made structures designed to mimic the form and function of a natural beaver dam. They can be used to increase the probability of successful beaver translocation and function as a simple, cost-effective, non-intrusive approach to stream restoration. (From Anabranch Solutions)

Critical Flow Period: The time period of low streamflow (generally described in bi-monthly or monthly time steps) that has the greatest likelihood to negatively impact the survival and recovery of threatened or endangered salmonids or other fish species targeted by the planning group. The planning group should discuss with Ecology, local tribal and WDFW biologists to determine the critical flow period in those reaches under the planning group's evaluation. (NEB)

Cubic feet per second (CFS): A rate of the flow in streams and rivers. It is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second (about the size of one archive file box or a basketball). (USGS)

Domestic Use: In the context of Chapter 90.94 RCW, "domestic use" and the withdrawal limits from permit-exempt domestic wells include both indoor and outdoor household uses, and watering of a lawn and noncommercial garden. (NEB)

ESSB 6091: In January 2018, the Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 in response to the Hirst decision. In the Whatcom County vs. Hirst, Futurewise, et al. decision (often referred to as the "Hirst decision"), the court ruled that the county failed to comply with the Growth Management Act requirements to protect water resources. The ruling required the county to make an independent decision about legal water availability. ESSB 6091 addresses the court's decision by allowing landowners to obtain a building permit for a new home relying on a permit-exempt well. ESSB 6091 is codified as Chapter 90.94 RCW. (ECY)

Evolutionarily Significant Unit (ESU): A population of organisms that is considered distinct for purposes of conservation. For Puget Sound Chinook, the ESU includes naturally spawned Chinook salmon originating from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Also, Chinook salmon from 26 artificial propagation programs. (NOAA)

Foster Pilots and Foster Task Force: To address the impacts of the 2015 Foster decision, Chapter 90.94 RCW established a Task Force on Water Resource Mitigation and authorized the Department of Ecology to issue permit decisions for up to five water mitigation pilot projects. These pilot projects will address issues such as the treatment of surface water and groundwater appropriations and include management strategies to monitor how these appropriations affect instream flows and fish habitats. The joint legislative Task Force will (1) review the treatment of surface water and groundwater appropriations as they relate to instream flows and fish habitat, (2) develop and recommend a mitigation sequencing process and scoring system to address such appropriations, and (3) review the Washington Supreme Court decision in Foster v. Department of Ecology. The Task Force is responsible for overseeing the five pilot projects. (ECY)

Four Year Work Plans: Four year plans are developed by salmon recovery lead entities in Puget Sound to describe each lead entity's accomplishments during the previous year, to identify the current status of recovery actions, any changes in recovery strategies, and to propose future actions anticipated over the next four years. Regional experts conduct technical and policy reviews of each watershed's four year work plan update to evaluate the consistency and appropriate sequencing of actions with the Puget Sound Salmon Recovery Plan. (Partnership)

Gallons per day (GPD): An expression of the average rate of domestic and commercial water use. 1 million gallons per day is equivalent to 1.547 cubic feet per second.

Group A public water systems: Group A water systems have 15 or more service connections or serve 25 or more people per day. Chapter 246-290 WAC (Group A Public Water Supplies), outlines the purpose, applicability, enforcement, and other policies related to Group A water systems. (WAC)

Group B public water systems: Group B public water systems serve fewer than 15 connections **and** fewer than 25 people per day. Chapter 246-291 WAC (Group B Public Water Systems), outlines the purpose, applicability, enforcement, and other policies related to Group B water systems.(WAC)

Growth Management Act (GMA): Passed by the Washington Legislature and enacted in 1990, this act guides planning for growth and development in Washington State. The act requires local governments in fast growing and densely populated counties to develop, adopt, and periodically update comprehensive plans.

Home: A general term referring to any house, household, or other Equivalent Residential Unit. (Policy and Interpretive Statement)

Hydrologic Unit Code (HUC): Hydrologic unit codes refer to the USGS's division and sub-division of the watersheds into successively smaller hydrologic units. The units are classified into four levels: regions, sub-regions, accounting units, and cataloging units, and are arranged within each other from the largest geographic area to the smallest. Each unit is classified by a unit code (HUC) composed of two to eight digits based on the four levels of the classification in the hydrologic unit system (two digit units are largest and eight digits are smallest). (USGS)

Impact: For the purpose of streamflow restoration planning, impact is the same as new consumptive water use (see definition below). As provided in Ecology WR POL 2094 "Though the statute requires the offset of 'consumptive impacts to instream flows associated with permit-exempt domestic water use' (RCW 90.94.020(4)(b)) and 90.94.030(3)(b)), watershed plans should address the consumptive use of new permit-exempt domestic well withdrawals. Ecology recommends consumptive use as a surrogate for consumptive impact to eliminate the need for detailed hydrogeologic modeling, which is costly and unlikely feasible to complete within the limited planning timeframes provided in chapter 90.94 RCW. " (NEB)

Instream Flow: a designated flow (also in cfs) that is set by rule as the amount of water needed to protect beneficial uses and used for determining whether there is water available for appropriation. Flow levels set as Instream Flows do not reflect the actual amount of water flowing at a given time. They are designated, or administrative numbers (flow levels) that are set for periods of time (bi-weekly to several months) throughout the year. The instream flows vary by season and account for different instream resource needs (such as fish spawning, rearing and migration). When (actual) stream flow is lower than the Instream Flow, there is not water available for appropriation (Instream Flows are not being met) and water users whose water rights are junior to the Instream Flows must discontinue water use under that right.

Instream Flow Rule (IFR): An administrative rule that establishes Instream Flows.

Instream Resources Protection Program (IRPP): The IRPP was initiated by the Department of Ecology in September 1978 with the purpose of developing and adopting instream resource protection measures for Water Resource Inventory Areas (WRIAs) (see definition below) in Western Washington as authorized in the Water Resources Act of 1971 (RCW 90.54), and in accordance with the Water Resources Management Program (WAC 175-500).

Instream Resources: Fish and related aquatic resources. (NEB)

Large woody debris (LWD): LWD refers to the fallen trees, logs and stumps, root wads, and piles of branches along the edges of streams, rivers, lakes and Puget Sound. Wood helps stabilize shorelines and provides vital habitat for salmon and other aquatic life. Preserving the debris along shorelines is important for keeping aquatic ecosystems healthy and improving the survival of native salmon. (King County)

Lead Entities (LE): Lead Entities are local, citizen-based organizations in Puget Sound that coordinate salmon recovery strategies in their local watershed. Lead entities work with local and state agencies, tribes, citizens, and other community groups to adaptively manage their local salmon recovery chapters and ensure recovery actions are implemented. (Partnership)

Listed Species: Before a species can receive the protection provided by the Endangered Species Act (ESA), it must first be added to the federal lists of endangered and threatened wildlife and plants. The List of Endangered and Threatened Wildlife (50 CFR 17.11) and the List of Endangered and Threatened Plants (50 CFR 17.12) contain the names of all species that have been determined by the U.S. Fish and Wildlife Service (Service) or the National Marine Fisheries Service (for most marine life) to be in the greatest need of federal protection. A species is added to the list when it is determined to be endangered or threatened because of any of the following factors: the present or threatened destruction, modification, or curtailment of its

habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or other natural or manmade factors affecting its survival. (USFWS)

Local Integrating Organizations (LIO): Local Integrating Organizations are local forums in Puget Sound that collaboratively work to develop, coordinate, and implement strategies and actions that contribute to the protection and recovery of the local ecosystem. Funded and supported by the Puget Sound Partnership, the LIOs are recognized as the local expert bodies for ecosystem recovery in nine unique ecosystems across Puget Sound. (Partnership)

Low Impact Development (LID): Low Impact Development (LID) is a stormwater and land-use management strategy that tries to mimic natural hydrologic conditions by emphasizing techniques including conservation, use of on-site natural features, site planning, and distributed stormwater best management practices (BMPs) integrated into a project design. (ECY)

Managed Aquifer Recharge (MAR): Managed aquifer recharge projects involve the addition of water to an aquifer through infiltration basins, injection wells, or other methods. The stored water can then be used to benefit stream flows, especially during critical flow periods. (NEB)

National Pollutant Discharge Elimination System (NPDES): The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Created by the Clean Water Act in 1972, the EPA authorizes state governments to perform many permitting, administrative, and enforcement aspects of the program. (EPA)

Net Ecological Benefit (NEB): Net Ecological Benefit is a term used in ESSB 6091 as a standard that watershed plans (see below for definition) must meet. The outcome that is anticipated to occur through implementation of projects and actions in a plan to yield offsets that exceed impacts within: a) the planning horizon; and, b) the relevant WRIA boundary. See *Final Guidance for Determining Net Ecological Benefit - Guid-2094 Water Resources Program Guidance.* (NEB)

Net Ecological Benefit Determination: Occurs solely upon Ecology's conclusion after its review of a watershed plan submitted to Ecology by appropriate procedures, that the plan does or does not achieves a NEB as defined in the Net Ecological Benefit guidance. The Director of Ecology will issue the results of that review and the NEB determination in the form of an order. (NEB)

Net Ecological Benefit Evaluation: A planning group's demonstration, using NEB Guidance and as reflected in their watershed plan, that their plan has or has not achieved a NEB. (NEB)

New Consumptive Water Use: The consumptive water use from the permit-exempt domestic groundwater withdrawals estimated to be initiated within the planning horizon. For the purpose of RCW 90.94, consumptive water use is considered water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment due to the use of new permit-exempt domestic wells. (NEB)

Office of Financial Management (OFM): OFM is a Washington state agency that develops official state and local population estimates and projections for use in local growth management planning. (OFM)

Offset: The anticipated ability of a project or action to counterbalance some amount of the new consumptive water use over the planning horizon. Offsets need to continue beyond the planning horizon for as long as new well pumping continues. (NEB)

Permit exempt wells: The Groundwater Code (RCW 90.44), identified four "small withdrawals" of groundwater as exempt from the permitting process. Permit-exempt groundwater wells often provide water where a community supply is not available, serving single homes, small developments, irrigation of small lawns and gardens, industry, and stock watering.

Permit-exempt uses: Groundwater permit exemptions allow four small uses of groundwater without a water right permit: domestic uses of less than 5,000 gallons per day, industrial uses of less than 5,000 gallons per day, irrigation of a lawn or non-commercial garden, a half-acre or less in size, or stock water. Although exempt groundwater withdrawals don't require a water right permit, they are always subject to state water law. (ECY)

Planning groups: A general term that refers to either initiating governments, in consultation with the planning unit, preparing a watershed plan update required by Chapter 90.94.020 RCW, or a watershed restoration and enhancement committee preparing a plan required by Chapter 90.94.030 RCW. (NEB)

Planning Horizon: The 20-year period beginning on January 19, 2018 and ending on January 18, 2038, over which new consumptive water use by permit-exempt domestic withdrawals within a WRIA must be addressed, based on the requirements set forth in Chapter 90.94 RCW. (NEB)

Projects and Actions: General terms describing any activities in watershed plans to offset impacts from new consumptive water use and/or contribute to NEB. (NEB)

Puget Sound Acquisition and Restoration (PSAR) fund: This fund supports projects that recover salmon and protect and recover salmon habitat in Puget Sound. The state legislature appropriates money for PSAR every 2 years in the Capital Budget. PSAR is co-managed by the Puget Sound Partnership and the Recreation and Conservation Office, and local entities identify and propose PSAR projects. (Partnership)

Puget Sound Partnership (Partnership): The Puget Sound Partnership is the state agency leading the region's collective effort to restore and protect Puget Sound and its watersheds. The organization brings together hundreds of partners to mobilize partner action around a common agenda, advance Sound investments, and advance priority actions by supporting partners. (Partnership)

Puget Sound Regional Council (PSRC): PSRC develops policies and coordinates decisions about regional growth, transportation and economic development planning within King, Pierce, Snohomish and Kitsap counties. (PSRC)

RCW 90.03 **(Water Code)**: This chapter outlines the role of the Department of Ecology in regulating and controlling the waters within the state. The code describes policies surrounding surface water and groundwater uses, the process of determining water rights, compliance measures and civil penalties, and various legal procedures.

RCW 90.44 **(Groundwater Regulations)**: RCW 90.44 details regulations and policies concerning groundwater use in Washington state, and declares that public groundwaters belong to the

public and are subject to appropriation for beneficial use under the terms of the chapter. The rights to appropriate surface waters of the state are not affected by the provisions of this chapter.

RCW 90.44.050 **(Groundwater permit exemption)**: This code states that any withdrawal of public groundwaters after June 6, 1945 must have an associated water right from the Department of Ecology. However, any withdrawal of public groundwaters for stock-watering purposes, or for the watering of a lawn or of a noncommercial garden not exceeding one-half acre in area, or for single or group domestic uses in an amount not exceeding five thousand gallons a day, or for an industrial purpose in an amount not exceeding five thousand gallons a day, is exempt from the provisions of this section and does not need a water right.

RCW 90.54 (**Water Resources Act of 1971**): This act set the stage for the series of rules that set instream flow levels as water rights, as well as a compliance effort to protect those flows.

RCW 90.82 **(Watershed Planning)**: Watershed Planning was passed in 1997 with the purpose of developing a more thorough and cooperative method of determining what the current water resource situation is in each water resource inventory area of the state and to provide local citizens with the maximum possible input concerning their goals and objectives for water resource management and development.

RCW 90.94 **(Streamflow Restoration)**: This chapter of the Revised Code of Washington codifies ESSB 6091, including watershed planning efforts, streamflow restoration funding program and the joint legislative task force on water resource mitigation and mitigation pilot projects (Foster task force and pilot projects).

Reasonable Assurance: Explicit statement(s) in a watershed plan that the plan's content is realistic regarding the outcomes anticipated by the plan, and that the plan content is supported with scientifically rigorous documentation of the methods, assumptions, data, and implementation considerations used by the planning group. (NEB)

Revised Code of Washington (RCW): The revised code is a compilation of all permanent laws now in force for the state of Washington. The RCWs are organized by subject area into Titles, Chapters, and Sections.

Salmon Recovery Funding Board (SRFB): Pronounced "surf board", this state and federal board provides grants to protect and restore salmon habitat. Administered by a 10-member State Board that includes five governor-appointed citizens and five natural resource agency directors, the board brings together the experiences and viewpoints of citizens and the major state natural resource agencies. For watersheds planning under Section 203, the Department of Ecology will submit final draft WRE Plans not adopted by the prescribed deadline to SRFB for a technical review (RCO and Policy and Interpretive Statement).

Section 202 or Section 020: Refers to Section 202 of ESSB 6091 or Section 020 of RCW 90.94 respectively. The code provides policies and requirements for new domestic groundwater withdrawals exempt from permitting with a potential impact on a closed water body and potential impairment to an instream flow. This section includes WRIAs 1, 11, 22, 23, 49, 59 and

55, are required to update watershed plans completed under RCW 90.82 and to limit new permit-exempt withdrawals to 3000 gpd annual average.

Section 203 or Section 030: Refers to Section 203 of ESSB 6091 or Section 030 of RCW 90.94 respectively. The section details the role of WRE committees and WRE plans (see definitions below) in ensuring the protection and enhancement of instream resources and watershed functions. This section includes WRIAs 7, 8, 9, 10, 12, 13, 14 and 15. New permit-exempt withdrawals are limited to 950 gpd annual average.

SEPA and SEPA Review: SEPA is the State Environmental Policy Act. SEPA identifies and analyzes environmental impacts associated with governmental decisions. These decisions may be related to issuing permits for private projects, constructing public facilitates, or adopting regulations, policies, and plans. SEPA review is a process which helps agency decision-makers, applications, and the public understand how the entire proposal will affect the environment. These reviews are necessary prior to Ecology adopting a plan or plan update and may be completed by Ecology or by a local government. (Ecology)

Stream Flow: a specific flow level measured at a specific location in a given stream, usually described as a rate, such as cfs. Stream flow is the actual amount of real water at a specific place and at a given moment. Stream flows can change from moment to moment.

Subbasins: A geographic subarea within a WRIA, equivalent to the words "same basin or tributary" as used in RCW 90.94.020(4)(b) and RCW 90.94.030 (3)(b). In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g. watershed divides). (NEB)

Trust Water Right Program: The program allows the Department of Ecology to hold water rights for future uses without the risk of relinquishment. Water rights held in trust contribute to streamflows and groundwater recharge, while retaining their original priority date. Ecology uses the Trust Water Right Program to manage acquisitions and accept temporary donations. The program provides flexibility to enhance flows, bank or temporarily donate water rights. (ECY)

Urban Growth Area (UGA): UGAs are unincorporated areas outside of city limits where urban growth is encouraged. Each city that is located in a GMA fully-planning county includes an urban growth area where the city can grow into through annexation. An urban growth area may include more than a single city. An urban growth area may include territory that is located outside of a city in some cases. Urban growth areas are under county jurisdiction until they are annexed or incorporated as a city. Zoning in UGAs generally reflect the city zoning, and public utilities and roads are generally built to city standards with the expectation that when annexed, the UGA will transition seamlessly into the urban fabric. Areas outside of the UGA are generally considered rural. UGA boundaries are reviewed and sometimes adjusted during periodic comprehensive plan updates. UGAs are further defined in RCW 36.70.

WAC 173-566 **(Streamflow Restoration Funding Rule)**: On June 25, 2019 the Department of Ecology adopted this rule for funding projects under RCW 90.94. This rule establishes processes and criteria for prioritizing and approving grants consistent with legislative intent, thus making Ecology's funding decision and contracting more transparent, consistent, and defensible.

Washington Administrative Code (WAC): The WAC contains the current and permanent rules and regulations of state agencies. It is arranged by agency and new editions are published every two years. (Washington State Legislature)

Washington Department of Ecology (DOE/ECY): The Washington State Department of Ecology is an environmental regulatory agency for the State of Washington. The department administers laws and regulations pertaining to the areas of water quality, water rights and water resources, shoreline management, toxics clean-up, nuclear and hazardous waste, and air quality.

Washington Department of Fish and Wildlife (WDFW): An agency dedicated to preserving, protecting, and perpetuating the state's fish, wildlife, and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities. Headquartered in Olympia, the department maintains six regional offices and manages dozens of wildlife areas around the state, offering fishing, hunting, wildlife viewing, and other recreational opportunities for the residents of Washington. With the tribes, WDFW is a co-manager of the state salmon fishery. (WDFW)

Washington Department of Natural Resources (WADNR or DNR): The department manages over 3,000,000 acres of forest, range, agricultural, and commercial lands in the U.S. state of Washington. The DNR also manages 2,600,000 acres of aquatic areas which include shorelines, tidelands, lands under Puget Sound and the coast, and navigable lakes and rivers. Part of the DNR's management responsibility includes monitoring of mining cleanup, environmental restoration, providing scientific information about earthquakes, landslides, and ecologically sensitive areas. (WADNR)

Water Resources (WR): The Water Resources program at Department of Ecology supports sustainable water resources management to meet the present and future water needs of people and the natural environment, in partnership with Washington communities. (ECY)

Water Resources Advisory Committee (WRAC): Established in 1996, the Water Resources Advisory Committee is a forum for issues related to water resource management in Washington State. This stakeholder group is comprised of 40 people representing state agencies, local governments, water utilities, tribes, environmental groups, consultants, law firms, and other water stakeholders. (ECY)

Watershed Plan: A general term that refers to either: a watershed plan update prepared by a WRIA's initiating governments, in collaboration with the WRIA's planning unit, per RCW 90.94.020; or a watershed restoration and enhancement plan prepared by a watershed restoration and enhancement committee, per RCW 90.94.030. This term does not refer to RCW 90.82.020(6). (NEB)

Watershed Restoration and Enhancement Plan (WRE Plan): The Watershed Restoration and Enhancement Plan is directed by Section 203 of ESSB 6091 and requires that by June 30, 2021, the Department of Ecology will prepare and adopt a watershed restoration and enhancement plan for WRIAs 7, 8, 9, 10, 12, 13, 14 and 15, in collaboration with the watershed restoration and enhancement committee. The plan should, at a minimum, offset the consumptive impact of new permit-exempt domestic water use, but may also include recommendations for projects

and actions that will measure, protect, and enhance instream resources that support the recovery of threatened and endangered salmonids. Prior to adoption of an updated plan, Department of Ecology must determine that the actions in the plan will result in a "net ecological benefit" to instream resources in the WRIA. The planning group may recommend out-of-kind projects to help achieve this standard.

WRIA: Water Resource Inventory Area. WRIAs are also called basins or watersheds. There are 62 across the state and each are assigned a number and name. They were defined in 1979 for the purpose of monitoring water availability. A complete map is available here: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability/Watershed-look-up.

Appendix B – WRIA 8 Committee Members, Facilitation Team, and Support Staff

WRIA 8 Committee Members – Primary Representatives and Alternates

Brian Landau, City of Bellevue*^

Janet Geer, City of Bothell*

Chris Hall, City of Bothell*

Allen Quynn, City of Issaquah*

Bob York, City of Issaquah*

Richard Sawyer, City of Kenmore*

Evan Swanson, City of Kent

Mike Mactutis, City of Kent

Shawn Gilbertson, City of Kent

Mick Matheson, City of Mukilteo*^[+]

Aaron Moldver, City of Redmond*^

Danika Globokar, City of Sammamish*^

Michele Koehler, City of Seattle

Elizabeth Garcia, City of Seattle

Denise Di Santo, King County

Joan Lee, King County

Eric Ferguson, King County

Joe Hovenkotter, King County

Tom Beavers[+], King County

Terri Strandberg, Snohomish County

Elisa Dawson, Snohomish County

Ann Bylin, Snohomish County

Jacqueline Reid[+], Snohomish County

Henry Martin, Muckleshoot Indian Tribe

Carla Carlson, Muckleshoot Indian Tribe

Matt Baerwalde, Snoqualmie Indian Tribe

Ann House, Snoqualmie Indian Tribe

Julie Lewis[+], Snoqualmie Indian Tribe

Kurt Nelson, Tulalip Tribes

Anne Savery, Tulalip Tribes

John McClellan, Alderwood Water and Wastewater District

Jenifer Galatas, Alderwood Water and Wastewater District

Stewart Reinbold, Washington Department of Fish and Wildlife

Ezekiel Rohloff, Washington Department of Fish and Wildlife

Tristan Weiss, Washington Department of Fish and Wildlife

Megan Kernan, Washington Department of Fish and Wildlife

Gina Clark, Master Builders Association of King and Snohomish Counties

Jennifer Anderson, Master Builders Association of King and Snohomish Counties

Dan Von Seggern, Center for Environmental Law and Policy

Trish Rolfe, Center for Environmental Law and Policy

Rick Reinlasoder, King County Agriculture Program

Melissa Borsting, King County Agriculture Program

Stephanie Potts, Washington Department of Ecology

Ingria Jones, Washington Department of Ecology

Jason Wilkinson, WRIA 8 Salmon Recovery Council (ex officio)

Jason Mulvihill-Kuntz, WRIA 8 Salmon Recovery Council (ex officio)

* Cities caucus member

^ The following entities joined the WRIA 8 Committee and signed the Operating Principles, but withdrew from the Committee before the vote to approve the plan: City of Bellevue, City of Mukilteo, City of Redmond, and City of Sammamish.

[+] Staff no longer at entity

Thank you to the committee members that participated in the technical workgroup and policy workgroups.

Thank you to King County and Snohomish County staff for providing resources to support the permit-exempt well projection and presentations during committee meetings.

Thank you to Jason Wilkinson and Jason Mulvihill-Kuntz for serving as the representative for the cities caucus during committee meetings.

Technical Consultant Team

Bridget August, GeoEngineers

Jonathan Rudders, GeoEngineers

Michael August, GeoEngineers

Cynthia Carlstad, Northwest Hydraulic Consultants

Patty Dillon, Northwest Hydraulic Consultants

GeoEngineers and NHC Support Staff

Washington Water Trust Staff

Facilitation Team

Gretchen Muller, Cascadia Consulting

Caroline Burney, Cascadia Consulting

Ruth Bell, Cascadia Consulting

Angela Pietschmann, Cascadia Consulting

Cascadia Consulting Support Staff

Department of Ecology Staff

Stephanie Potts, Chair

John Covert, Lead Technical Support

Paulina Levy, Committee and Plan Development Support

Ingria Jones, Alternate Chair

Ria Berns, Northwest Region Water Resources Section Manager

Bennett Weinstein, Streamflow Restoration Section Manager

Streamflow Restoration Section Technical and Support staff

Northwest Region Water Resources Section Technical and Support staff

Mugdha Flores, Streamflow Restoration Communications Consultan

Appendix C – Final WRIA 8 Committee Meeting Summary

FEBRUARY 2021 MEETING SUMMARY

Cedar-Sammamish (WRIA 8)
Watershed Restoration and Enhancement Committee

February 25, 2021 | 9:30 a.m. - 12:00 p.m. | Committee website

Location	Committee Chair	Next Meeting
WebEx	Stephanie Potts Stephanie.Potts@ecy.wa.gov 425-649-7138	*Tentative:* March 25 9:30 a.m. – 11:30 a.m. WebEx

Attendance

Committee Representatives and Alternates*

John McClellan, *Alderwood Water & Wastewater District*
Janet Geer, *Bothell*
Dan Von Seggern, *Center for Environmental Law and Policy*
Allen Quynn, *Issaquah*
Richard Sawyer, *Kenmore*
Evan Swanson, *Kent*
Denise Di Santo, *King County*
Rick Reinlasoder, *King County Agriculture Program*
Gina Clark, *Master Builders Association of King and Snohomish Counties*
Carla Carlson, *Muckleshoot Indian* Tribe
Michele Koehler, *Seattle*
Terri Strandberg, *Snohomish County*
Elisa Dawson (alternate), *Snohomish County*
Matt Baerwalde, *Snoqualmie Indian Tribe*
Kurt Nelson, *Tulalip Tribes*
Stewart Reinbold, *Washington Department of Fish and Wildlife*
Stephanie Potts (chair), *Washington State Department of Ecology*
Ingria Jones (alternate), *Washington State Department of Ecology*
Kelsey Taylor (alternate), Snoqualmie Indian Tribe

Cities caucus members: Bothell, Issaquah, and Kenmore.

Committee Members Not in Attendance*

WRIA 8 Salmon Recovery Council

Other Attendees

Gretchen Muller (facilitator), *Cascadia Consulting Group*
Caroline Burney (information manager), *Cascadia Consulting Group*
Bridget August (technical consultant), *GeoEngineers*
John Covert, *Washington State Department of Ecology*
Stacy Vynne McKinstry, *Washington State Department of Ecology*
Paulina Levy, *Washington State Department of Ecology*
Joe Hovenkotter, *King County*
Mugdha Flores, *Washington State Department of Ecology*
Angela Johnson, *Washington State Department of Ecology*

*Attendees list is based on roll call and participants signed into WebEx.

Standing Business

Facilitator reviewed the agenda. *No revisions to the agenda.*

Chair received one comment on the November meeting summary to revise a typo. The Committee voted to approve the November WRIA 8 WREC meeting summary. The final version will be posted on the Committee website.

Updates and Announcements

Chair provided updates from Ecology.

- Ecology adopted the remaining 3 plans under section 020 of the streamflow restoration law by the Feb 1, 2021 deadline. Those plans are posted on the streamflow restoration planning webpage.
    - WRIA 22/23: Chehalis
    - WRIA 49: Okanagan
    - WRIA 55: Little Spokane
- Streamflow Restoration Grant program: Ecology will determine the timing for the next grant round after the Washington State Legislature approves a budget for the 2021-2023 biennium. The Governor's capital budget includes Ecology's request of $40 million for the grant program.
- Committee membership: Bellevue and Sammamish decided to withdraw from the Committee since the November meeting. Since the Committee formed, the following entities withdrew: Mukilteo, Redmond, Bellevue, Sammamish.
- Operating principles: Updated Appendix A "Committee Membership" to note the cities that withdrew and add the entities that declined to join the Committee.

Committee member updates and discussion:

- Matt Baerwalde asked if Ecology requested funding for adaptive management of the plans and whether Ecology communicated to the legislature that watershed planning groups emphasized adaptive management as a need.
    - Stephanie shared that once plans are approved by Committees and submitted to Ecology for review, Ecology will review the policy and adaptive management recommendations from the Committees. Ecology drafted the streamflow restoration report to the legislature last summer, when the Committee was still in the early stages of drafting the plans.
    - Matt and Kurt Nelson shared that it's unfortunate that adaptive management was not included in the legislative request.
    - Dan von Seggern encouraged Ecology to come up with a proposal to include adaptive management in the budget.

Public Comment

No comments.

Steps to Plan Adoption

Objective: Overview of pathways to get to plan adoption.

Reference Materials:

- Plan Adoption Pathways

Stephanie provided an overview of the plan adoption pathways.

- Plans must be approved by all members of the Committee prior to submission to Ecology for review and consideration for adoption.
- Deadline for adoption is June 30, 2021.
- Ecology will vote on the plan today. This local approval step is preliminary and distinct from the plan review Ecology will undertake if, and when, plans are locally approved and submitted to Ecology for review and agency action in accordance with RCW 90.94.090(3)(c).
- If plan is approved, the chair will submit the plan to Ecology on behalf of the Committee and Ecology will undertake the following steps:
    - State Environmental Policy Act (SEPA) review: This is a non-project programmatic plan review, with an anticipated 30 day public comment period (minimum 14 days for public comment).
    - Technical review: Ecology's technical staff evaluate whether the plan achieves a Net Ecological Benefit as described in the Streamflow Restoration law (RCW 90.94.030), the Final NEB Guidance (GUID-2094), and the Streamflow Restoration Policy and Interpretative Statement (POL-2094).
    - Ecology management review: The Water Resources Program reviews the plan and prepares a recommendation to the Director.
    - Ecology Director review and determination: The Director reviews all materials and makes a determination by June 30, 2021 on whether to adopt the plan.
    - Plan adoption: The Director of Ecology will issue the results of the plan review and the NEB determination in the form of an order. The Streamflow Restoration law has a June 30, 2021 deadline for adoption by the Director of Ecology. If the Director signs adoption orders by June 30, 2021, the planning process is completed.
    - After plan adoption, the Water Resources Program will review policy, adaptive management, and implementation recommendations across all of the Watershed Plans and make a programmatic decision on where and how to invest resources on recommendation implementation.
- If the plan is note adopted (e.g. not locally approved, not submitted to Ecology with time for review by June 30, or not adopted for other reasons):
    - Ecology prepares the plan with input from the Salmon Recovery Funding Board: Ecology must prepare a final draft plan and submit it to the Salmon Recovery Funding Board (SRFB) for technical review. Ecology will then consider the SRFB review, prior to finalizing and adopting the plan. Ecology may amend the plan without Committee approval prior to adoption.
    - Plan adoption. After plan adoption, the Director shall initiate rulemaking within six months to incorporate recommendations into rules adopted under this chapter or under Chapter 90.22 or 90.54 RCW, and shall adopt amended rules within two years of initiation of rule making. Ecology rulemaking is guided by the Administrative Procedure Act (APA), Chapter 34.05 RCW.
    - No timeline for plan adoption identified in law.
    - No role for Committee identified in law.
- If the plan is not approved today, that does not preclude the Committee from continuing to work on the plan or vote again.

Discussion:

- Kurt asked how Ecology will address substantial comments on the SEPA review and whether those comments will be shared with the Committee.
    - Stacy Vynne McKinstry from Ecology shared that because the SEPA is on the overall plan and not specific to a project, Ecology does not anticipate substantive comments. Staff will review

the comments that come in and bring forward substantial comments to the Ecology Director. SEPA comments could become a part of the Director's consideration on plan adoption.
    - Comments on the SEPA review will be addressed on a case by case basis. There is the potential that substantial comments could impact the review timeline and adoption.
    - Ecology will make it clear in the SEPA comment form that comments should be on the SEPA review and not on the plan itself.
    - SEPA comments can be shared with the Committee.
    - Ecology may also engage the Committee to address substantial comments if they require plan revisions.
- Dan asked whether there is a way to discuss areas of disagreement if the plan is not approved today.
    - Stephanie explained that if the plan is not approved today, that does not preclude the Committee from continuing to meet and vote again over the next few months. There does need to be time for Ecology to do SEPA review, internal review, and adopt by June 30.
- Dan added that he interprets the law as stating that the deadline for committee approval is June 30 – not the deadline for Ecology's review.
    - Stephanie agreed that there is more time for the committee to work on the plan, but the legislation requires Ecology to adopt the plans by June 30, 2021. Per Ecology's Policy Interpretive Statement, the plans need to be approved and then submitted to Ecology with reasonable time for review prior to the June 30, 2021 deadline.
    - *Post-meeting update: RCW 90.94.030(3) states "By June 30, 2021, the department shall prepare and adopt a watershed restoration and enhancement plan for each watershed listed under subsection (2)(a) of this section, in collaboration with the watershed restoration and enhancement committee. Except as described in (h) of this subsection, all members of a watershed restoration and enhancement committee must approve the plan prior to adoption."*
- Matt asked whether during the rulemaking process, the appeals body is the Pollution Control Hearings Board.
    - Stephanie to confirm and follow up.
    - *Post-meeting update: Appeals of rulemaking go to the Thurston Superior Court.*

Committee Member Comments

Objective: Opportunity for Committee members to make a statement about the planning process or the final plan to include in the meeting summary. This is optional.

Facilitator invited Committee members to provide comments on the plan or the overall process.

- Washington Department of Ecology: no comments.
- Muckleshoot Indian Tribe: no comments.
- Snoqualmie Indian Tribe: The Snoqualmie Indian Tribe submitted a letter. Matt added that the government-to-government relationship between Snoqualmie Indian Tribe and Ecology has been severely damaged. As a result of that, Matt has been directed by Tribal Council to not approve either of the plans that the Tribe is a committee member for. He added that as a committee member he feels it's unfortunate, and acknowledged the significant work by the committee. Until that government-to-government relationship is repaired, Snoqualmie Indian Tribe is unable to approve the plans.
- Tulalip Tribes: no comments.
- Washington Department of Fish and Wildlife: Stewart Reinbold thanked everyone for all the hard work.
- King County: Denise Di Santo thanked everyone for their hard work and dedication to the process.

- Snohomish County: no comments.
- City of Bothell: Janet Geer thanked everyone for the hard work.
- City of Issaquah: Allen Quynn added that there are several restoration projects in Issaquah that are not in the plan. He asked whether they are still eligible for funding.
    - Yes, the grant program is statewide and can fund projects that are not in plans.
- City of Kenmore: Richard Sawyer shared his gratitude for allowing the cities caucus format.
- City of Kent: Evan thanked Stephanie and team for all the hard work on this process.
- City of Seattle: Michele Koehler thanked Ecology staff, Gretchen Muller, and all Committee members. Seattle submitted a letter with recommendations to Ecology, which summarizes their comments.
- Alderwood Water and Wastewater District: no comments.
- Master Builders Association of King and Snohomish Counties: Gina Clark thanked everyone for their participation and collaboration.
- Center for Environmental Law and Policy: Dan thanked everyone for their hard work and added that he is impressed by how disparate interests have worked together so well. CELP submitted a letter emphasizing their concern that streams are actually protected, and projects do what they are supposed to do. He added that he understands where Snoqualmie Indian Tribe is coming from both in terms of the nature of consultation relationship, as well as the potential that watershed restoration process may be about pulling more water out of river for municipal use. CELP wants to ensure that this process is designed to restore streamflows – not do the opposite.
- King County Agriculture Program: no comments.

Discussion:

- Denise asked about how decisions are made to fund projects as a part of the streamflow grant program.
    - Stephanie explained that scoring criteria are outlined in the grant guidance and funding rule. The 2020 grant round prioritized funding for projects that would quantitatively improve streamflow, projects located in planning watersheds, and projects in approved plans. Once applications come in, they are screened by technical reviewers. Two evaluators score the grant based on the scoring criteria included in the grant guidance. Those scores are reviewed by Water Resources Management and then funding decisions are made.
    - The streamflow grant program is statewide and is open to projects that restore streamflows or benefit instream resources across the state, including those not in an approved plan. However, scoring is set up to prioritize projects in approved plans.
    - The biggest factor that determines whether a project gets funded is that an application is submitted. In the first rounds of the program, there were not as many applications for projects in WRIA 8 and other Puget Sound watersheds. Many of the water offset projects included in the WRIA 8 plan were developed by the Committee and technical consultants after the 2020 grant round application period closed. Hopeful that project sponsors will submit applications for those projects in the next grant round.
- Denise asked whether there is anything the Committee can do to address Snoqualmie Indian Tribe's concerns and work towards plan approval.
    - Matt replied that Snoqualmie Indian Tribe is waiting on a response from Ecology's Director. He doesn't see a role for Committee members (other than Ecology) to address their concerns.
    - Matt added he appreciates and respects everyone's work on this plan and process and thanked the Committee.

Vote on WRIA 8 WRE Plan

Objective: Vote on the WRIA 8 WRE plan.

Reference Materials

- WRIA 8 Final Draft WRE Plan – revisions if approved
- WRIA 8 WRE Plan – Compendium Cover

Facilitator reviewed the section of the Operating Principles regarding voting on final approval of the plan.

> *RCW 90.94 (3) states that "… all members of a watershed restoration and enhancement committee must approve the plan prior to adoption." Approval will be assessed by voting. If all Committee members vote "yes" in support of the plan it will be considered approved and provided to Ecology for "net ecological benefit" review and potential adoption. If the plan is not approved, the facilitator or chair will document agreement and disagreement on the plan elements and the matter will go to Ecology to establish a plan through rulemaking.*

Options for the vote on final plan approval are: approve or disapprove.

Committee Member votes:

- Washington Department of Ecology: approve.
- Muckleshoot Indian Tribe: approve.
- Snoqualmie Indian Tribe: disapprove.
- Tulalip Tribes: approve.
- Washington Department of Fish and Wildlife: approve.
- King County: approve.
- Snohomish County: approve.
- City of Bothell (cities caucus): approve.
- City of Issaquah (cities caucus): approve.
- City of Kenmore (cities caucus): approve.
- City of Kent: approve.
- City of Seattle: approve.
- Alderwood Water and Wastewater District: approve.
- Master Builders Association of King and Snohomish Counties, representing the residential construction industry: approve.
- Center for Environmental Law and Policy, representing environmental interests: approve.
- King County Agriculture Program, representing agricultural interests: approve.

Decision: Not approved. 15 Committee members voted to approve and 1 Committee member voted disapprove. Approval must be unanimous; therefore the plan is not approved.

Next Steps

The Committee discussed options for continuing to meet and hold another vote and decided on the following approach:

- Reconvene if a Committee member requests another vote.
- Schedule meetings during the Committee's normal meeting time in March and April (4th Thursday of the month in the morning) in order to hold time on calendars. Cancel the meetings if the Committee is not ready to vote again.
- Revise the operating principles to allow a re-vote without a quorum of Committee members present, as long as the plan content is unchanged.

Amendment to Operating Principles:

The Committee voted on adding the following language to "Voting on the final approval of the plan" under Section 6. Decision Making.

> *The Committee can vote as many times as needed to attempt to approve the plan. If no changes are made to the plan, a quorum is not required for subsequent votes on final approval of the plan. Only the Chair and the Committee member(s) that change their vote(s) need to be present for the subsequent votes. The Chair will notify the Committee of the result of subsequent votes.*

Decision: Approved. All Committee members voted to approve the amendment to the Operating Principles.

Discussion:

- Matt shared that Snoqualmie Indian Tribe's core issue is not embedded in the plan, but has to do with how Ecology is implementing the plans. He expects that if the Committee votes again, the plan would be unchanged.
- Matt requested that when Stephanie is giving updates to Ecology management, to consider updating them that a number of Committee members in WRIA 8 agreed that adaptive management for streamflow restoration planning and allocating human resources as well, should have been requested in this legislative cycle.

Next steps:

- Stephanie will send calendar invites for meetings in March and April.
- Stephanie will revise the Operating Principles and post the new version to the Committee website.
- Stephanie will send an update to Ecology water resources management with the results of the vote, the final draft plan, letters and resolutions shared by Committee members, and inform them that a number of Committee members said that funding for adaptive management should have been included in Ecology's 2021-2023 budget request

Action Items for Chair:

- Confirm the entity that acts as the appeals body during the rulemaking process.
- Send calendar invites for meetings in March and April.
- Revise the Operating Principles and post the new version to the Committee website.
- Send an update to Ecology water resources management with the results of the vote, the final draft plan, letters and resolutions shared by Committee members, and inform them that a number of Committee members said that funding for adaptive management should have been included in Ecology's 2021-2023 budget request.
- Distribute February meeting summary.

Action Items for Committee Members

- Notify the chair to request another vote or to request the Committee meet in March and/or April.
- Review February meeting summary by March 24.

Next Meeting

Tentative: Thursday, March 25 from 9:30 a.m. – 11:30 a.m. Stephanie will confirm or cancel the meeting at least a week in advance.

Appendix D – Technical Memorandums

The following technical memos were developed for the WRIA 8 Committee process. Therefore, final conclusions as presented in this plan may not align with the technical memos.

GeoEngineers

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Memorandum

To: Stephanie Potts, Washington State Department of Ecology

From: Bridget August, LG, LHG and John Monahan, FP-C

Date: August 20, 2020

File: 0504-161-00

Subject: WRIA 8 Subbasin Delineations

INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) Committees for Water Resource Inventory Areas (WRIAs) 7, 8 and 9. This memorandum provides a summary of the deliverable for Work Assignment GEO102, Task 2, WRIA 8 Subbasin Delineations.

BACKGROUND AND CONTEXT

The Streamflow Restoration law (Revised Code of Washington [RCW] Chapter 90.94) specifies that by June 30, 2021, Ecology must establish a WRE Committee and adopt a WRE Plan in the Cedar-Sammamish Watershed (WRIA 8). The Cedar-Sammamish (WRIA 8) Watershed Restoration and Enhancement Plan (watershed plan) must address impacts on streamflows from consumptive use from new domestic permit-exempt wells (PE wells[1]) anticipated between January 19, 2018 and January 18, 2038. Dividing WRIA 8 into subbasins is an essential step in developing a plan that complies with the law. RCW 90.94.030(3)(b) states "The highest priority recommendations must include replacing the quantity of consumptive water use during the same time as the impact and in the same basin or tributary." The *Final Guidance for Determining Net Ecological Benefit* (Final NEB Guidance) (Ecology 2019) states that, "Planning groups must divide the WRIA into suitably sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets. Subbasins will help the planning groups understand and describe location and timing of projected new consumptive water use, location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. Planning at the subbasin scale will also allow planning groups to consider specific reaches in terms of documented presence (e.g., spawning and rearing) of salmonid species listed under the federal Endangered Species Act."

WRIA 8 includes the Cedar River, Sammamish River, Lake Washington, Lake Sammamish and associated tributaries. It also includes streams draining directly to Puget Sound between the City of Mukilteo and the City of Seattle.

[1] "PE wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells, including homes on group systems relying on permit-exempt wells.

The WRIA 8 Committee uses the term "subbasin" as defined in the Final NEB Guidance (Ecology 2019) and not based on the scientific definition. The Final NEB Guidance defines subbasins as: "A geographic subarea within a WRIA, equivalent to the words "same basin or tributary" as used in RCW 90.94.020(4)(b) and RCW 90.94.030 (3)(b). In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g. watershed divides)." The methods used to delineate subbasins in WRIA 8 are summarized below.

SUBBASIN DELINEATION METHODS

GeoEngineers worked with the WRIA 8 Committee to delineate subbasins for WRIA 8. The WRIA 8 Committee considered existing subwatershed units to develop their subbasin delineation, including hydrologic unit codes and King County drainage basins.

- Hydrologic unit codes (HUCs) refer to the U.S. Geological Survey (USGS) delineation of watersheds into successively smaller hydrologic units (USGS 2013). The USGS uses a nationwide system based on surface hydrologic features. This system divides the country into 21 regions (2-digit), 222 subregions (4-digit), 370 basins (6-digit), 2,270 subbasins (8-digit), ~20,000 watersheds (10-digit) and ~100,000 subwatersheds (12-digit). A hierarchical HUC consisting of 2 additional digits for each level in the hydrologic unit system is used to identify any hydrologic area. HUC-12 is at the subwatershed level (12-digit) of HUCs and there are over 15 HUC-12 subwatersheds in WRIA 8.
- King County drainage basins are a boundary layer developed by King County using LiDAR technology to delineate drainage basins. There are 38 King County drainage basins in the King County portion of WRIA 8.

Subbasin Selection Considerations

Snohomish County developed interim growth projections using HUC-12 subwatersheds and King County developed interim growth projections using drainage basins, which the technical workgroup then used to develop subbasin delineations. The WRIA 8 Committee used existing HUC-12s and King County drainage basins and applied the following guiding principles to develop subbasin delineations:

- Combine HUC-12s and King County drainage basins in areas of the watershed that are urbanized and have existing water service and are therefore, unlikely to have new homes using PE domestic wells.
- Keep distinct subbasins for HUC-12s and King County drainage basins with higher projected growth of new homes using PE wells.

WRIA 8 Subbasin Delineation

The WRIA 8 subbasin boundaries are based on HUC-12 subwatersheds in the Snohomish County portion of the watershed and King County drainage basin boundaries in the King County portion of the watershed. GeoEngineers used existing HUC-12 shapefiles from the USGS (USGS 2016) and drainage basin shapefiles from King County (King County 2018) to develop a map and GIS shapefile for the WRIA 8 Committee's subbasins. The WRIA 8 subbasin delineations are shown on Figure 1.

WRIA 8 Subbasins

- **Seattle/Lake Union**: Middle Puget Sound - Seattle Lower, Elliott Bay and Lake Union drainage basins are combined into one subbasin.
- **Puget Sound Shorelines**: The Pipers Creek, Middle Puget Sound – Seattle Upper, Boeing Creek and Middle Puget Sound – Shoreline drainage basins (King County) are combined with the Shell Creek Frontal Puget Sound HUC-12 (Snohomish County) to form one subbasin.
- **Swamp/North**: Swamp Creek and North Creek HUC-12s (Snohomish County) are combined with the Swamp and North Creek drainage basins (King County) to form one subbasin.
- **Little Bear**: The Bear Creek - Sammamish River HUC-12 (Snohomish County portion only) is combined with the Little Bear Creek drainage basin (King County) to form one subbasin.
- **Sammamish River Valley**: The Sammamish River drainage basin is one subbasin.
- **Bear/Evans**: Bear Creek and Evans Creek drainage basins (King County) are combined with the Bear Creek HUC-12 (Snohomish County) to form one subbasin.
- **Greater Lake Washington**: East Lake Sammamish and Lake Washington Creeks are combined into one subbasin. This includes the following HUC-12 subwatersheds and drainage basins:
  - Lake Washington – Sammamish River HUC-12; and
  - East Lake Washington (ELW) Kenmore North, ELW Kenmore South, ELW Bellevue North, ELW Renton, Lyon Creek, McAleer Creek, Thornton Creek, West Lake Washington (WLW) Lake Forest Park, WLW Seattle North, WLW Seattle South, Juanita Creek, Juanita Bay, Forbes Creek, Kelsey Creek, Mercer Slough and Mercer Island drainage basins.
- **May/Coal**: Coal Creek and May Creek drainage basins are combined into one subbasin.
- **Lake Sammamish Creeks**: East Lake Sammamish, West Lake Sammamish and Tibbets Creek drainage basins are combined into one subbasin.
- **Issaquah:** Issaquah Creek drainage basin is one subbasin.
- **Lower Cedar**: Lower Cedar River drainage basin is one subbasin.
- **Upper Cedar**: Upper Cedar River drainage basin is one subbasin.

NEXT STEPS

- The WRIA 8 Committee agreed to use 12 subbasins to estimate PE well growth and consumptive use by subbasin.

REFERENCES

King County, 2018. GIS Open Data, *Basin boundaries derived from terrain data, King County only / topo basin kc area*. https://gis-kingcounty.opendata.arcgis.com/datasets/basin-boundaries-derived-from-terrain-data-king-county-only-topo-basin-kc-area, December 3, 2018.

U.S. Geological Survey (USGS) and U.S. Department of Agriculture, Natural Resources Conservation Service, 2013. Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD) (4 ed.). USGS Techniques and Methods 11-A3, 63 p.

U.S. Geological Survey (USGS), 2016. USGS National Hydrography Dataset (NHD) Downloadable Data Collection - National Geospatial Data Asset (NGDA) National Hydrography Dataset (NHD): USGS - National Geospatial Technical Operations Center (NGTOC): Rolla, MO and Denver, CO. http://nhd.usgs.gov, http://viewer.nationalmap.gov/.

Washington State Department of Ecology (Ecology), 2019. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079, p. 131. http://leg.wa.gov/JointCommittees/WRM/Documents/EcologyFinalGuidanceForDeterminingNEB.pdf.

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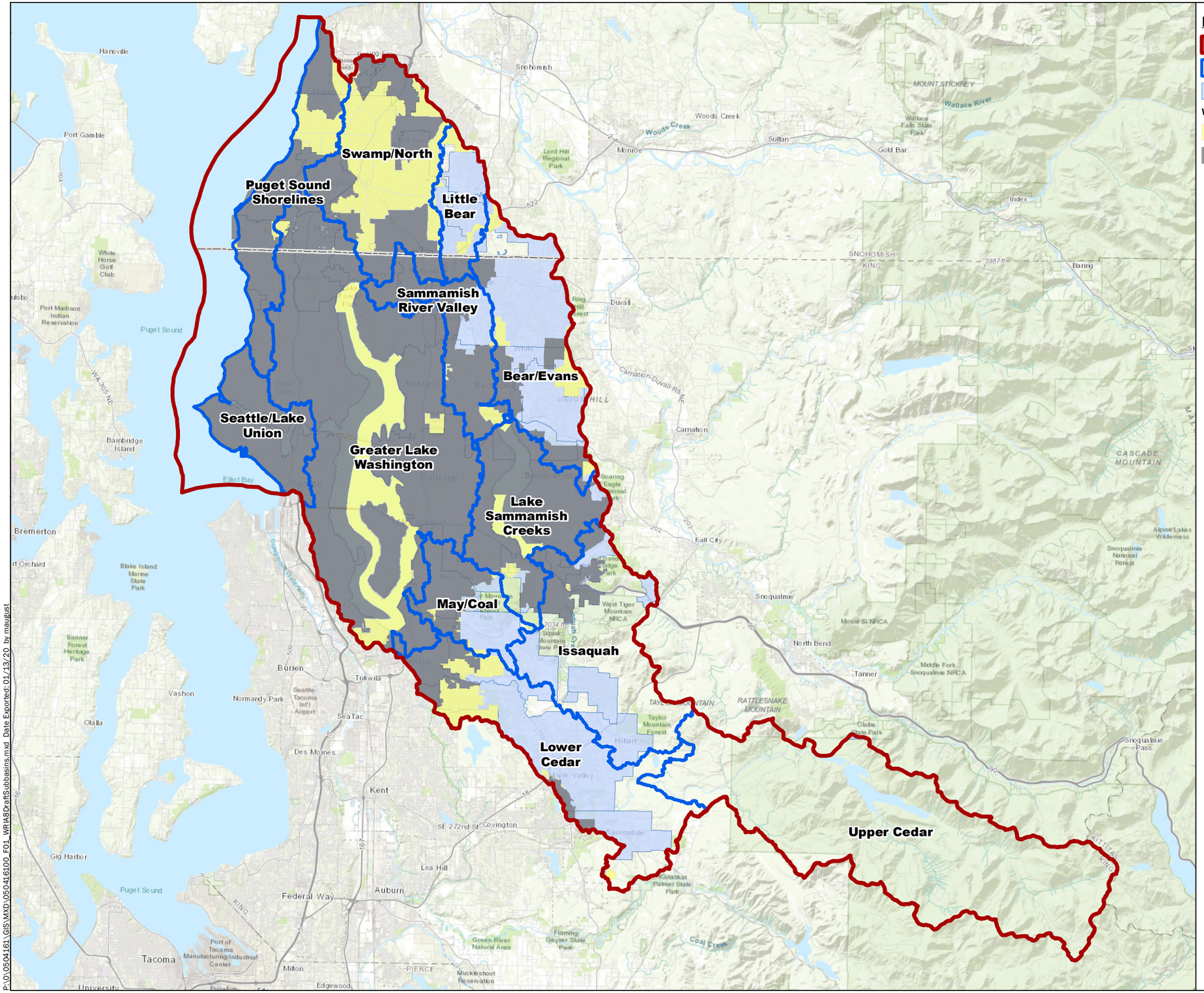
Attachment:
Figure 1. WRIA 8 Subbasin Delineations



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WRIA 8 Subbasin Delineations

Watershed Restoration and Enhancement Plan
King and Snohomish Counties, Washington

GeoEngineers | **Figure 1**

GeoEngineers

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Memorandum

To: Stephanie Potts, Washington State Department of Ecology

From: Bridget August, LG, LHG and John Monahan, FP-C (GeoEngineers, Inc.)

Date: November 16, 2020

File: 0504-161-00

Subject: WRIA 8 PE Well Projections

INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) Committees for Water Resource Inventory Areas (WRIAs) 7, 8 and 9. This memorandum provides a summary of the deliverable for Work Assignment GEO102, Task 3, WRIA 8 Growth Projections.

BACKGROUND AND CONTEXT

The Streamflow Restoration law (Revised Code of Washington [RCW] 90.94) specifies that by June 30, 2021, Ecology must establish a WRE Committee and adopt a WRE Plan in the Cedar-Sammamish Watershed (WRIA 8). The Cedar-Sammamish (WRIA 8) Watershed Restoration and Enhancement Plan (watershed plan) must address impacts on streamflows from consumptive use from new domestic permit-exempt wells (PE wells[1]) anticipated between January 19, 2018 and January 18, 2038.

The watershed plan must estimate new PE wells in the watershed (growth projections) for January 2018 through January 2038 (at a minimum). Based on the projected PE wells, the plan will estimate the associated consumptive water use.

Ultimately, watershed plan PE well projections need to address the following two primary questions:

1. How many new PE wells could be installed throughout the watershed over the next 20 years?
2. Where could the PE sourced growth occur at the subbasin level?

WRIA 8 includes parts of unincorporated King and Snohomish County and 30 incorporated cities and towns. The methods used to estimate the number and location of new PE wells in unincorporated and incorporated areas in WRIA 8 are summarized below.

[1] "PE wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells, including homes on group systems relying on permit-exempt wells.

PE WELL GROWTH PROJECTION METHODS

GeoEngineers worked with the Cedar-Sammamish Watershed Restoration and Enhancement Committee (WRIA 8 Committee) to define PE well growth projection methods and PE well growth projections for WRIA 8. The WRIA 8 PE well growth projection methods included using King and Snohomish County historical building permit and year-built data to project PE well growth over the 20-year planning horizon. This methodology assumes that the rate and general location of past growth will continue over the 20-year planning horizon. Using past building permits to predict future growth is one of Ecology's recommended methods (Ecology 2019). Projecting future PE well growth involves accounting for populations that will be served by community water systems and municipalities (Ecology 2019). Due to data availability, King and Snohomish County used different methods to remove those populations from the PE well growth estimates. Snohomish County considered distance to existing water lines, whereas King County considered rates of connection to water service within water service area boundaries.[2] King and Snohomish County completed their analyses in-house and the methods are described in detail in Attachments A and B, respectively, and summarized below.

GeoEngineers also completed an analysis of projected PE well growth within the incorporated and unincorporated Urban Growth Areas (UGAs) using Ecology's Well Report Viewer database. The methods and assumptions are described below and GeoEngineers data tables are included in Attachment C.

In addition, King County also completed a PE Well Potential Assessment which identified potential parcels where growth could occur within rural King County. Snohomish County completed a similar assessment which they have referred to as a Rural Capacity Analysis. The PE Well Potential Assessment and Rural Capacity Analysis results were used to assess whether a subbasin, as identified by the WRIA 8 Committee (GeoEngineers 2020), has the capacity to accommodate the number of PE wells in the 20-year growth projection. In those areas where the number of projected PE wells exceeded the potential parcels available, the wells were reallocated to the nearest subbasin with similar growth patterns and parcel capacity. The King County PE Well Potential Assessment methods and assumptions are described in Attachment A and summarized below. The Snohomish County Rural Capacity Analysis methods and assumptions are described in Attachment B and summarized below.

King County PE Well Projection Methodology

King County does not have a growth target for the unincorporated rural area and therefore decided to use building permit data as its chosen method to project future growth. King County elected to complete the WRIA 8 historic growth analysis for the King County portion of the WRIA in-house using 2000 to 2017 building permit data for new residential structures from the King County Assessor's office. The analysis estimated the number of recently built homes that relied on PE wells as their water source in unincorporated King County, both inside and outside of water service areas. King County used historic rates of connection to water service because the County does not have county-wide information on the location of water lines.

King County used the time period 2000 through 2017 because those data were available. The building permit data for 2000 through 2017 includes both periods of high growth and periods of low growth. King County

[2] Water service area boundaries include areas currently served by existing water lines and may also include areas not yet served by water lines.

compared these data with information from Vision 2040 and population data and is confident in using the average of this time period to project into the future.

King County used the results from the historic growth analysis to determine the projected number of PE wells per year and over the 20-year planning horizon for unincorporated King County. GeoEngineers then used the King County historic growth results to project new PE wells per subbasin over the 20-year planning horizon. King County historic growth and PE well projection methods and data tables are provided in Attachment A for reference. This methodology assumes that the rate and location of past growth will continue over the 20-year planning horizon. This method is referred to as the King County Past Trends Analysis and the general methodology used was as follows:

King County:

- Obtain available King County building permit and parcel data for new residential structures (2000 to 2017).
- Use centroid of parcel to determine location relative to other boundaries (e.g. WRIA, inside or outside water district service areas, King County drainage basin, WRIA 8 subbasin, etc.).
- Assess the total number of permits and average number of permits per year for the WRIA.
- Link building permits and parcel data layers to determine water source for each building permit/parcel. The parcel database indicates the water source as "public" (pub) for buildings connected to water service, "private" (pvt) for buildings relying on a permit-exempt well, and "other" (unknown/null). The "other" category includes parcels listing their water source as "unknown," referring to parcels with no assigned water source (likely vacant land or unoccupied structure) or "null," referring to building permits that did not link to existing parcels. King County used the "other" category to calculate an error of 6 percent (of the total number of building permits).[3]
- Determine the number of building permits/parcels inside and outside the water service areas that have a water source as:
    - Public water (pub)
    - Private water (PE wells) (pvt)
    - Other (unknown/null)
- Calculate the percentage of building permits for each type of water source (pub, pvt or other) by subbasin and the WRIA overall.
- Use the annual average number of permits per year multiplied by the percentage of permits/parcels on private water (pvt) to determine the projected number of PE wells per year.
- Multiply the number of PE wells per year by 20 to calculate the total PE wells projected over the 20-year planning horizon for unincorporated rural King County.

[3] King County's percent error uses the number of unknown water use type parcels (unknown) plus those permit records that don't match parcel information (null), divided by the total number of permits for that area. The null data type, based on selected assessment of un-joined data, appears to be related to development that is not fully completed/sold. These developments are typically on public water.

GeoEngineers:

- Use the annual average number of permits per year multiplied by the past percentage of growth per subbasin and percentage of building permits using a private water source (well) per subbasin to determine a projected number of PE wells per year for each subbasin.
- Multiply the number of PE wells per year per subbasin by 20 to calculate the total of PE wells projected over the 20-year planning horizon for each subbasin.
- Add 6 percent error to 20-year growth projections per subbasin (error is based on the "other/null" category as described above).
- Tabulate the total growth projected over the 20-year planning horizon, including the 6 percent error, for each subbasin and sum to get the total of PE wells projected over the 20-year planning horizon in rural unincorporated King County.

Snohomish County PE Well Projection Methodology

Snohomish County elected to complete the WRIA 8 growth projection analysis for the Snohomish County portion of the WRIA in-house. Snohomish County used a different methodology than King County for their past trends analysis. They developed their growth projections by using a geographic information system (GIS) model to identify areas where homes are likely to connect to water service, based on proximity to existing water distribution lines. Areas that were not proximal to existing water distribution lines were assumed to be served by a PE well. For their growth projections, they referred to these areas as "water service areas" and "PE Well Areas" respectively. Snohomish County used this spatial model, in combination with analysis of year-built data for recently built single-family residences, to develop growth scenarios.

Snohomish County developed two growth projection scenarios by: 1) looking at past development trends in PE well areas for each HUC-12[4] within its portion of WRIA 8 and using those trends to estimate the number and location of new homes relying on PE wells over the planning horizon, and 2) using population projections from the Snohomish County 2015 Comprehensive Plan to estimate the number and location of new homes relying on PE wells over the planning horizon. The subbasins in the Snohomish County portion of WRIA 8 generally correspond to individual HUC-12s or an aggregation of multiple HUC-12s (Attachment B) and, for the purpose of growth projections in WRIA 8, the terms are used interchangeably. The term "Housing Unit (HU)" refers to an individual home or single-family residence.

In addition to the growth projection scenarios, Snohomish County developed a Rural Capacity Analysis that identified the total number of parcels that could be developed with a home relying on a PE well in each subbasin. The Rural Capacity Analysis was used to identify whether the number of available parcels that could be developed with homes relying on a PE well could accommodate the projected growth in each subbasin.

At the request of the WRIA 8 Committee, GeoEngineers developed a third growth projection scenario using the population growth rate from the 2012 Office of Financial Management (OFM) high population forecast for Snohomish County.

[4] HUC-12 is a level of Hydrologic Unit Code.

The WRIA 8 Committee discussed the three scenarios and agreed to move forward with the first scenario, the Snohomish County Past Trends Analysis, as the 20-year growth projection method for the Snohomish County portion of WRIA 8. Year-built data was derived from the County's permit data as provided to the Assessor by Snohomish County Planning and Development Services (PDS) and includes all new single-family residences in the WRIA built between 2008 and 2018, located outside of cities, UGAs, national and state forest lands, government property and tribal lands. Snohomish County used the time period 2008 through 2018 because those data were available. This methodology assumes that the rate and location of past growth will continue over the 20-year planning horizon. Snohomish County growth projection methods and data tables are provided in Attachment B for reference. The general methodology is as follows:

- Obtain available year-built data from the Snohomish County Assessor's Office for all single-family residences (i.e. HUs) in the WRIA built between 2008 and 2018.
- Use centroid of parcel to determine location of each HU relative to other boundaries (e.g. WRIA, cities, UGAs, national and state forest lands, government property, tribal lands, subbasin, water lines, zoning, etc.).
- Assign the 2008-2018 HUs to "Public Water Service Areas" or "P_E Well areas" based on the distance to existing water mains (data derived from water system comprehensive plans).
    - HUs designated to "Public Water Service Areas" (i.e. will not rely on a PE well) include:
        - HUs that are not part of a subdivision and any portion of the property boundary is located within 100 feet of a water main.[5]
        - HUs that are part of a rural cluster subdivision (RCS) and located within ¼ mile of a water main.[6]
    - All other HUs designated to "P_E Well areas."
- Determine the number of HUs per subbasin for each type of water source (Public Water Service Areas and P_E Well Areas).
- Calculate the percentage of HUs per subbasin for each type of water source.
- Divide the total number of HUs for WRIA 8 by 11 to calculate the average number of HUs per year over the past 11 years (2008-2018).
- Multiply the average number of HUs per year by 20 to calculate the estimated total of HUs projected over the 20-year planning horizon for rural unincorporated Snohomish County.
- Apply HU projections to WRIA 8 subbasins based on the past percentage of growth per subbasin and past percentage of HU for each type of water source.
- The projection of HUs located within P_E Well Areas represents the total number of PE wells projected over the 20-year planning horizon in rural unincorporated Snohomish County.

[5] 100 feet is selected due to lot sizes in the rural area, cost to extend water service, buy-in from rural water utilities as a reasonable assumption, and requirements in Snohomish County's draft water code (Attachment B).

[6] As of April 2009, this is a requirement in Snohomish County code for rural cluster subdivisions, however, most RCS that have been built were grandfathered to the previous rules which did not include this requirement to connect to public water (Attachment B).

Urban Growth Area PE Well Projection Methodology

As described above, the King and Snohomish County PE well projection methods focused on the potential for PE wells to be installed within rural, unincorporated King and Snohomish Counties. The King and Snohomish County methods do not account for potential PE wells in cities or UGAs. However, early in the growth projection planning process, the WRIA 8 Committee recommended looking at the potential PE well growth within UGAs. GeoEngineers completed an analysis of projected PE well growth within the incorporated and unincorporated UGAs using Ecology's Well Report Viewer database (referred to as the UGA Well Log Spot Check). UGA well log spot check data tables are included in Attachment C. The general methodology used was as follows:

- Obtain tabular and spatial data from Ecology's Well Report Viewer database (1998 through 2018). Ecology's complete Well Report Viewer database was filtered for water wells 6 to 8 inches in diameter and greater than 30 feet deep, which are typical dimensions and depths for domestic wells. PE wells greater than 8 inches in diameter are cost prohibitive and uncommon. Similarly, wells shallower than 30 feet are more susceptible to contamination and are also uncommon, especially in urban areas. Ecology does not have the ability to filter for permit-exempt domestic wells. Information in the database is based on records submitted by the well driller.
- Filter database for wells located within UGAs. Note that well locations were estimated to the nearest quarter-quarter section.
- Review randomly selected water well reports and note the well type (e.g. domestic, industrial, municipal, irrigation, test well, or other), and well location (physical address and/or parcel number).
- Determine the number of wells that were:
    - Domestic (assumed to be PE wells)
    - Irrigation
    - Other (test, municipal, dewatering, industrial, mitigation, underground injection control [UIC], deepened or refurbished wells)
    - Incorrect (location, date, etc.)
- Calculate the percentage of each type of well (domestic, irrigation, other and incorrect).
- Multiply the percentage of spot-checked wells that were identified as domestic wells (assumed to be PE wells) by the total number of wells located within UGAs to estimate the number of domestic wells installed over the past 20-year period within WRIA 8.
- Cross-check the physical address of the wells with the UGA boundary to determine in which subbasin the spot-checked domestic wells were located.
- Use the estimated number of domestic wells per subbasin over the past 20 years to project the number of PE wells located within the UGAs over the planning horizon for each WRIA 8 subbasin.

King County PE Well Potential Assessment

King County also completed a PE Well Potential Assessment which evaluated the parcels available for future growth in unincorporated King County. The purpose of the PE Well Potential Assessment was to determine if there would be enough parcels to accommodate the 20-year growth projection at the WRIA and subbasin level. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers

reallocated those wells to the nearest subbasin with parcel capacity and similar growth patterns. King County used historic rates of connection to water service because the County does not have county-wide information on the location of water lines. King County PE Well Potential Assessment data tables are included in Attachment A. The general methodology used was as follows:

King County:

- Use assumptions and screening criteria to identify parcels with potential for future growth by subbasin. A list of assumptions made by King County is provided in Attachment A.
- Use centroid of parcel to determine location information (e.g. WRIA, inside or outside water district service areas, WRIA 8 subbasin, etc.).
- Use King County parcel attribute data to determine total number of parcels and dwelling units per subbasin. A dwelling unit (DU) is a rough estimate of subdivision potential based on parcel size and zoning (e.g. a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).
- Determine the number of parcels and dwelling units that would be inside or outside water district service boundaries.
- Calculate water source projections for public connections and PE sourced parcels:
    - Public connection parcels would be those located within water district service boundaries and were calculated based on historic rates of connection to public water within each subbasin.
    - The remaining number of parcels located within water district service boundaries that exceeded the historic rate of public water connection were assigned to be PE sourced (e.g. served by a PE well).
    - PE sourced parcels were calculated based on the number of parcels located outside water district service boundaries plus the remaining parcels from "inside" water district boundaries, as described above.
- Calculate the shortfall or surplus of available parcels to be sourced by PE wells by taking the total PE sourced DUs minus the 20-year PE well growth projection from the King County past trends analysis.

GeoEngineers:

- If the projected PE well growth exceeds the total number of available PE sourced parcels, reallocate shortfall to adjacent subbasin with parcel capacity and similar growth patterns.

Snohomish County Rural Capacity Analysis

Snohomish County completed a Rural Capacity Analysis in 2011 that resulted in an assigned future capacity for each parcel in the rural area. Snohomish County updated their 2011 analysis for the purpose of watershed planning to determine if there would be enough parcels to accommodate the 20-year PE well growth projection at the WRIA and subbasin level. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with parcel capacity and similar growth patterns. The parcels included in the Snohomish County Rural Capacity Analysis were selected based on a set of assumptions, which are outlined in Attachment B. The Snohomish County Rural Capacity Analysis methods and data tables are also included in Attachment B. The general methodology used was as follows:

Snohomish County:

- Use assumptions and screening criteria to identify parcels with potential for future growth by subbasin. A list of assumptions made by Snohomish County are provided in Attachment B.
- For each parcel, obtain or calculate total acres, buildable acres, percent buildable acres and density based on zoning and land use designation (i.e. HUs per acre).[7]
- Assign development status (e.g. vacant, partially used or re-developable).
- Calculate basic capacity based on development status and density (e.g. if vacant, future capacity = total acres x density).
- Deduct new HUs built after 2011 from the 2011 available capacity to create an estimate of the capacity remaining as of 2019.
- Assign parcels to "Public Water Service Areas" or "P_E Well Areas" per the methodology described in the Past Trends Analysis.
- Aggregate capacity data by subbasin. Parcels located on HUC boundaries were assigned based on the centroid of the parcel.
- Calculate the shortfall or surplus of available parcels to be sourced by PE wells by taking the total PE sourced parcels (P_E Well Areas) minus the 20-year PE well growth projection from the Snohomish County past trends analysis.

GeoEngineers:

- If the projected PE well growth exceeds the total number of available PE sourced parcels, reallocate shortfall to adjacent subbasin with parcel capacity and similar growth patterns.

PE WELL GROWTH PROJECTON RESULTS

The King and Snohomish County Past Trends Analyses and GeoEngineers UGA Well Log Spot Check results were combined to determine the total number of projected PE wells per subbasin within WRIA 8. Using the King County PE Well Potential Assessment and Snohomish County Rural Capacity Analysis, GeoEngineers compared the total available PE sourced parcels (i.e. DUs and HUs) per subbasin with the projected PE well growth per subbasin. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with parcel capacity and similar growth patterns. The results are summarized in Table 1 and shown on Figure 1. GeoEngineers estimates 967 new permit-exempt domestic well connections in WRIA 8 over the 20-year planning horizon. The following is a brief summary of the calculations used to complete the WRIA 8 growth projection analysis:

- King County used the average number of building permits per year (102) for the 18-year period from 2000 to 2017, multiplied by the historic percentage of homes using PE wells (34.2 percent) to determine a projected number of new PE wells per year (35) in the WRIA 8 portion of rural unincorporated King County. The number of PE wells per year (35) was then multiplied by 20 to

[7] All sub-dividable parcels were assumed to develop using the rural cluster option. This option achieves the highest density.

determine the estimated total of PE wells projected over the 20-year planning horizon (698) for rural unincorporated King County. (Note that due to rounding, the total number is 698).

- To estimate the 20-year PE well projection per subbasin, GeoEngineers used the average number of building permits per year (102), multiplied by the historic distribution of growth per subbasin. The average building permits per subbasin was then multiplied by the historic percentage of homes using PE wells to estimate the average number of PE wells per year per subbasin. The number of PE wells per year per subbasin was then multiplied by 20 to calculate the estimated total of PE wells over a 20-year period per subbasin. A 6 percent error was then added to each subbasin total. The total number of estimated PE wells, including the 6 percent error, is 740. See Attachment A for detailed results.
- Snohomish County used the total number of HUs built during the 11-year period from 2008-2018 (238), divided by 11 to determine the average number of HUs built per year (22) for rural unincorporated Snohomish County. The average number of HUs per year (22) was multiplied by 20 to estimate the total number of HUs projected over the 20-year planning horizon (440) for the rural unincorporated Snohomish County portion of WRIA 8. (Note that due to rounding, the total number is 440 vs. 434, as shown in Attachment B).
- The total number of HUs (440) was then multiplied by the historic percentage of HUs in P_E Well Areas per subbasin. The number of HUs in P_E Well Areas per subbasin was added together to determine the estimated total of PE wells (equivalent to HUs in P_E Well Areas) over a 20-year period in rural unincorporated Snohomish County (210). (Note that due to rounding, the total number is 210 vs. 208, as shown in Attachment B).
- GeoEngineers also completed a UGA Well Spot Check for wells from the Ecology Well Report Viewer database that plot within the Urban Growth Area. Of the wells that plotted in WRIA 8, 205 wells were located within the UGA for 1998 through 2018. GeoEngineers checked about 56 percent of the wells by looking at the well logs and noting whether the wells were identified as being for domestic, irrigation, or other purposes (e.g. test, industrial, errors, etc.). According to the well logs, about 8 percent of the wells were for domestic use.
- GeoEngineers took the number and distribution of wells from the 1998-2018 data and projected the same rate and distribution per subbasin for the 20-year planning horizon. The estimated number of PE wells within the UGA over the 20-year period is 17. (Note that due to rounding, the total number is 17 vs. 16). See Attachment C for detailed results.
- King County completed a PE Well Potential Assessment and Snohomish County completed a Rural Capacity Analysis to determine whether a subbasin has capacity for the number of wells in the 20-year projection.
- The PE Well Potential Assessment showed a capacity shortfall of 1 well in the Upper Cedar subbasin, which is mostly protected from development. Therefore, the projected PE well in the Upper Cedar subbasin was reallocated to the adjacent Lower Cedar subbasin.
- The Snohomish County Rural Capacity Analysis showed a capacity shortfall of 59 wells in the Little Bear subbasin. These 59 wells were reallocated to the Bear/Evans subbasin because it has parcel capacity, is adjacent, and has similar growth patterns. (Note that due to rounding, the total shortfall is 59 vs. 57, as shown in Attachment B).

TABLE 1. NUMBER OF PE WELLS PROJECTED BETWEEN 2018 AND 2038 FOR THE WRIA 8 SUBBASINS

Subbasins[1]	King County Past Trends[2]	Snohomish County Past Trends[3]	UGA Well Log Spot Check[4]	Total PE Wells[5] per Subbasin[6]
Seattle/Lake Union	0	--	0	0
Puget Sound Shorelines	0	--	2	2
Swamp/North	0	0	5	5
Little Bear	0	118	0	118
Sammamish River Valley	8	--	0	8
Bear/Evans	138	92	4	234
Greater Lake Washington	0	--	4	4
May/Coal	15	--	0	15
Lake Sammamish Creeks	6	--	0	6
Issaquah	235	--	0	235
Lower Cedar	338	--	2	340
Upper Cedar	0	--	0	0
Totals	**740**	**210**	**17**	**967**

Notes:

1 = Subbasins from proposal approved at September 26, 2019 WRIA 8 Committee meeting.

2 = Based on 20-year projection of new PE wells in unincorporated King County, plus 6% error.

3 = Based on 20-year projection of new PE wells in unincorporated Snohomish County.

4 = Based on spot-check of Ecology Well Report Viewer database. Accounts for projected wells within the incorporated and unincorporated Urban Growth Areas (UGAs) over the 20-year planning period.

5 = "PE Wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells on group systems relying on permit-exempt wells.

6 = Includes redistribution of 1 well from Upper Cedar subbasin to Lower Cedar subbasin in the King County portion of WRIA 8 and redistribution of 59 wells from Little Bear subbasin to Bear/Evans subbasin in the Snohomish County portion of WRIA 8.

NEXT STEPS

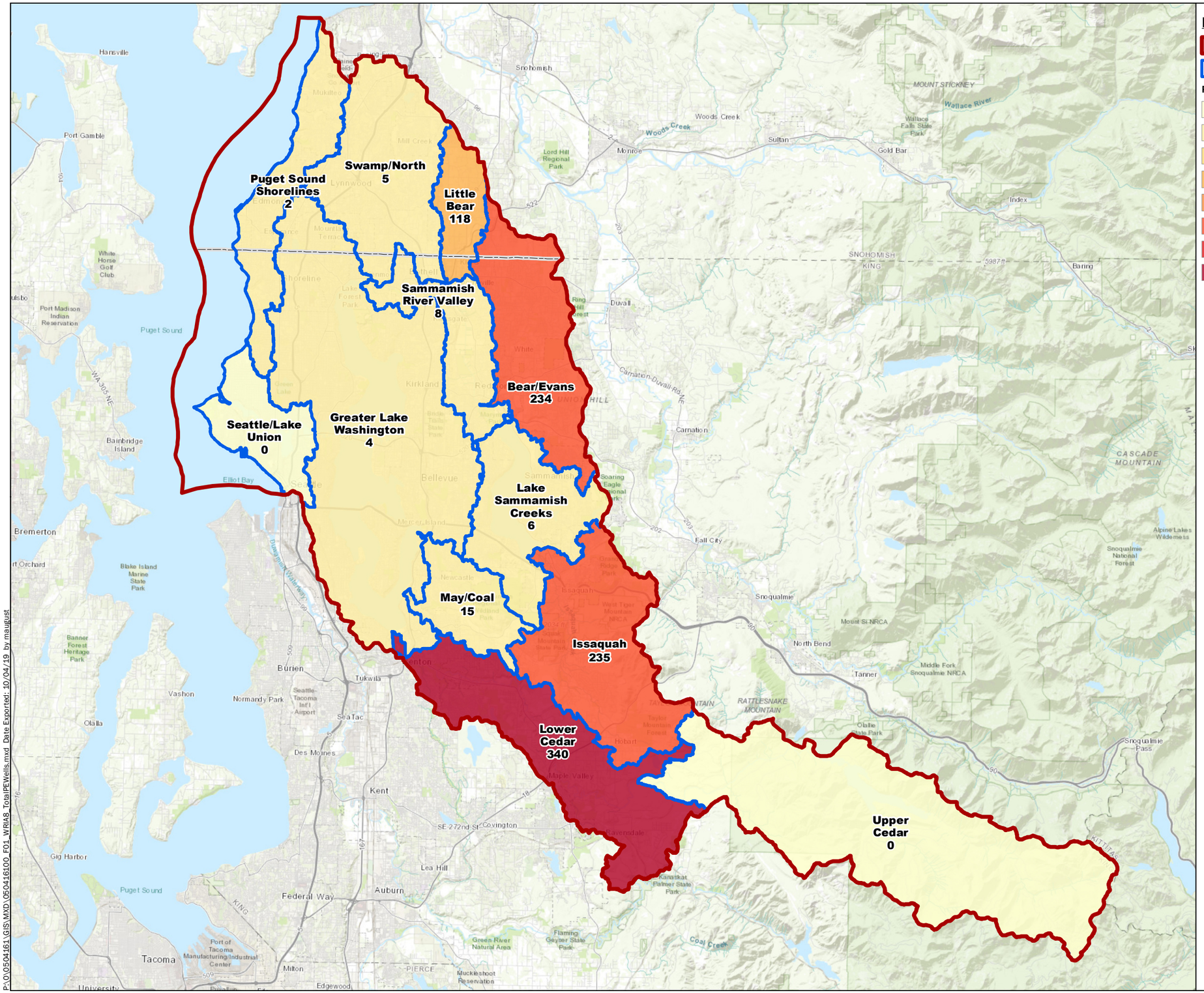
- The WRIA 8 Committee agreed to move forward with the WRIA planning process using 967 as the WRIA 8 20-year PE well growth projection to develop consumptive use estimates.

REFERENCES

GeoEngineers, Inc. (GeoEngineers), 2020. WRIA 8 Subbasin Delineations. Technical memorandum prepared for Washington State Department of Ecology. August 2020.

Washington State Department of Ecology (Ecology), 2019. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079, p. 131. http://leg.wa.gov/JointCommittees/WRM/Documents/EcologyFinalGuidanceForDeterminingNEB.pdf.

Attachments:
Figure 1. WRIA 8 Distribution of Projected Permit-Exempt Wells 2018-2038
Attachment A. King County PE Well Growth Projections and PE Well Potential Assessment Methods, Assumptions and Data Tables
Attachment B. Snohomish County PE Well Growth Projections and Rural Capacity Analysis Methods, Assumptions and Data Tables
Attachment C. GeoEngineers UGA Well Log Spot Check Data Tables



Legend

- WRIA 8 Boundary
- WRIA 8 Proposed Subbasins

Projected Permit-Exempt Wells 2018-2038

- 0
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 300
- >300

Projected WRIA 8 PE Well Total = 967

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI Topographic Map Base

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

N W E S

5 0 5
Miles

WRIA 8 Distribution of Projected Permit-Exempt Wells 2018-2038

Watershed Restoration and Enhancement Plan
Snohomish and King Counties, Washington

GeoEngineers | **Figure 1**

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ATTACHMENT A
King County PE Well Growth Projections and PE Well Potential Assessment Methods, Assumptions and Data Tables

Water and Land Resources Division
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 704
Seattle, WA 98104-3855
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TTY Relay: 711

TECHNICAL MEMORANDUM

December 12, 2019

TO: Stephanie Potts, Ingria Jones, Rebecca Brown, and Stacy Vynne McKinstry, Streamflow Restoration Implementation leads, Water Resources Program, Washington State Department of Ecology

FM: Eric Ferguson, LHG, Science and Technical Support Section, Water and Land Resources Division, Department of Natural Resources and Parks

RE: King County Growth Projections for all Watershed Restorations and Enhancement Committees – WRIAs 7, 8, 9, 10, and 15

This memorandum summarizes the work that King County did in support of generating 20-year growth projections in the rural areas of the county for Watershed Restoration and Enhancement committee (WREC) work. This effort will be incorporated into another technical memorandum that is area specific for each Watershed Resource Inventory Area (WRIA). The additional memorandum will be authored by consultants working for the Washington State Department of Ecology.

Introduction

King County is participating in five WRECs, one for each of the WRIA within its boundary. King County is providing growth projections for each area that assesses a two-part question:

A. How much potential growth could occur during the 20-year (2018-2038) planning period?

B. Where could that growth occur at a sub-basin/watershed scale within each WRIA?

Principles

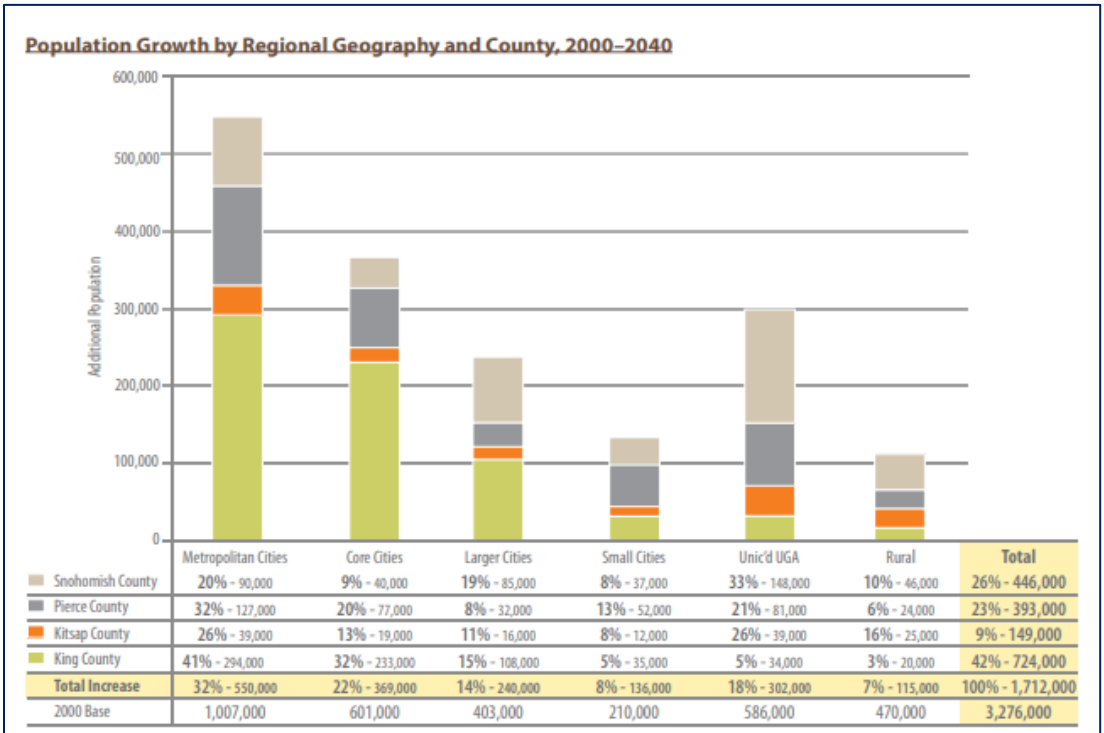
King County does not have growth targets for unincorporated rural areas in the county. All growth targets are for the urban growth area (UGA). No changes to the UGA boundary are intended during the 20-year planning period.

The following are highlights from planning policies:

- Accommodate most recent 20-year population forecast from OFM, and 20-year jobs forecast from Puget Sound Regional Council.
- Plan for growth consistent with Regional Growth Strategy
  - Focus growth in cities with major centers, and in other large cities
  - Limit development in Rural Areas, protect Resource Lands

Source: Policy DP-11 in Countywide Planning Policies, 2012

Population growth in the unincorporated rural area is estimated to be about 20,000 people or ~3% of overall population from Vision2040, Figure 1.



	Metropolitan Cities	Core Cities	Larger Cities	Small Cities	Unic'd UGA	Rural	Total
Snohomish County	20% - 90,000	9% - 40,000	19% - 85,000	8% - 37,000	33% - 148,000	10% - 46,000	26% - 446,000
Pierce County	32% - 127,000	20% - 77,000	8% - 32,000	13% - 52,000	21% - 81,000	6% - 24,000	23% - 393,000
Kitsap County	26% - 39,000	13% - 19,000	11% - 16,000	8% - 12,000	26% - 39,000	16% - 25,000	9% - 149,000
King County	41% - 294,000	32% - 233,000	15% - 108,000	5% - 35,000	5% - 34,000	3% - 20,000	42% - 724,000
Total Increase	32% - 550,000	22% - 369,000	14% - 240,000	8% - 136,000	18% - 302,000	7% - 115,000	100% - 1,712,000
2000 Base	1,007,000	601,000	403,000	210,000	586,000	470,000	3,276,000

Figure 1. Estimated population growth for rural King County from 2000-2040 is 20,000, King County, Vision 2040.

Note: the updated Vision (2050) document is due to be adopted in May 2020. The updated growth for rural King County is planned to be about 1% during 2017–2050 period (or ~6,000 people).

Methods

The first part of the growth projection assessment was performed in order to respond to the question: "How many new single-family permit-exempt well connections will be installed throughout each watershed over the next 20 years?" King County does not have a growth target

for the unincorporated rural area (as noted above) and therefore decided to use building permit data (for new residential structures) as its chosen method to assess future growth potential.

The following is the methodology used to assess the potential growth:

1. Compiled 18 years (2000–2017) of building permit data for new residential structures;
    a. This data was subdivided into two periods: 2000–2009 and 2010–2017, Table 1; each period has a range of low to high growth.

Table 1. Building permits from 2000-2017; new residental structures only

Building permits (unincorporated rural KC)	
2000-2009	4595
2010-2017	1252
Total	5847

2. Used GIS to provide location based information about building permits
    a. Use centroid of the building permit/parcel to assess location relative to other boundaries such as WRIA boundaries, stream basins, water district service areas, sub-basin delineations.
    b. Assess the number of permits per each WRIA, Table 2

Table 2. Building permits by WRIA

WRIA*	Total permits	Permits per year	Percentage of total
7	1864	104	32%
8	1836	102	31%
9	1430	79	24%
10	100	6	2%
15	617	34	11%

* = WRIA boundaries are delineated by Ecology coverage

3. Linked building permits and parcel data layers to assess percentage of parcels using public versus private water with parcel attribute data.
4. Determined the number of building permits/parcels that have a water source as:
    a. Public (pub) water
    b. Private (pvt) water (Permit-Exempt wells)
    c. Other (unknown/null)
        i. “unknown” refers to parcels with no assigned water source (likely unoccupied structure)
        ii. “null” refers to those building permits that did not link to existing parcels.

iii. This category can be used as an "error" since it refers to the amount of information that is undetermined and could potentially be private sourced.

5. Calculated the percentage of building permits for each type of water source (i.e. public, private or other) for entirety of King County as shown in Table 3 below as well as by WRIA and its sub-basin delineations.

Table 3. Water source by parcel/permit

Type of water use	Total permits	Percentage of total
Public	3113	53%
Private	2369	40%
Other -unknown	73	1%
Other - null	292	5%

6. Used the annual average number of permits per year multiplied by the percentage of permits/parcels on private water to determine a projected number of Permit Exempt (PE) wells per year, Table 4.

   Multiplied the number of PE wells per year by 20 to calculate the estimated total of PE wells projected over a 20-year period for unincorporated rural King County, Table 4.

Table 4. Average number of permit exempt well users by WRIA for the planning period.

WRIA*	Permit-exempt well/year^	20-year estimate	Error®
7	46	926	6%
8	35	698	6%
9	29	578	6%
10	4	81	2%
15	18	368	4%

* = WRIA boundaries are delineated by Ecology coverage
^ = WRIA specific percentage of private well users
® = Error calculated from percentage of building permits with "other" water service

Projected number of permit-exempt wells for time period (01/18/2018 to 01/18/2038) for all of King County is 2650. Each WRIA has a series of tables of this specific information, see Tables.

The second part of the growth projection assessment was performed in order to respond to the question: "Where will the well connections be installed?" The PE potential assessment is a GIS assessment of current (2019) parcel data. This work used a series of assumptions to assess potential area of growth within the county, specifically at the sub-basin scale as defined by the WREC for each WRIA.

The following are the assumptions used to refine the parcels:

- Outside Urban Growth Boundary
- Outside Forest Production District
- Outside Agriculture Production District
- Not Encumbered by K`C Parks or TDR conservation easements
- Not enrolled in Farmland Preservation Program
- Not Owned by Public Agencies
- Vacant land (with appraised improvements <$10,000)
- Have at least 1 acres of land outside 100 year Floodway and Severe River Channel Migration Hazard Areas.
- Parcel size – 1 acre or greater.
- Zoning – no exclusion and maximum density allowed by current zoning

7. Used centroid of the refined parcel data to determine location information, similar to step 2 (above).
8. Linked parcel and assessor attribute data to determine total number of parcels and dwelling units per sub-basin. A dwelling unit (DU) is a rough estimate of subdivision potential based on parcel size and zoning (e.g., a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).
9. Determined the number of parcels and DUs that are inside or outside water district service boundaries.
10. Calculated water use projections for public connections and PE sourced parcels:
    a. Public connection parcels are located within water district service boundaries and are calculated based on historic rates of connection to public water within each sub-basin, assessed in step 5 (above).

    b. Any remaining number of parcels located within water district service boundaries are assigned to be PE sourced.

    c. PE sourced parcels were calculated based on the number of parcels located outside water district service boundaries plus the remaining parcels from “inside” water district boundaries, as described above, Table 5.

Table 5. Permit exempt (PE) estimate along with PE potential assessment data.

WRIA*	PE 20yr estimate^	Parcel^	DU
7	926	1175	1901
8	698	819	1070
9	578	746	1077
10	81	72	82
15	368	788	888

* = WRIA boundaries are delineated by Ecology coverage
^ = WRIA specific percentage of private well users
DU = Dwelling unit as noted in step 9.

WRIA specific data along with sub-basin assessments can be found in the Tables.

References

King County Countywide Planning Policies
https://www.kingcounty.gov/depts/executive/performance-strategy-budget/regional-planning/CPPs.aspx

https://www.kingcounty.gov/~/media/depts/executive/performance-strategy-budget/regional-planning/CPPs/2012-CPPsAmended062516withMaps.ashx?la=en

Vision 2040 link:
https://www.kingcounty.gov/~/media/depts/executive/performance-strategy-budget/regional-planning/Comp%20Plan/VISION_2040_-_2008.ashx?la=en

King County Growth Projection data tables by WRIA (Watershed Resource Inventory Area)

King County - Unincorporated

WRIA 8 Growth Projections

Draft 9/25/19

WRIA (Ecology Coverage)	(KC building permitting data) 2000-2009	2010-2017		total	permits per year
8	1354	482		1836	102

% of county-wide total: 31%

WRIA 8 Future Permit-	PE/yr 35	20 yr est 698

Historic Percentages	pub	0.595
	pvt	0.342

Water District info	2000-2009	2010-2017		total
total	1354	482		1836
wtr dst (within water district)	1226	422		1648
no dst (outside water district)	128	60		188

Water service info	(derived from KC parcel attribute data)			
public water system (pub)	843	250		1093
well - private water (pvt)	498	130		628
other	13	102		115
total	1354	482		1836

Ag PD	permits	% of WRIA total
WRIA 8	2	0%

Forest PD	permits	% of WRIA total
WRIA 8	1	0%

Existing	2000-2009	2010-2017	Total
PE wells	498	130	628
error	1%	21%	6%

WRIA 8 - Historic Growth and Water Use by Subbasin

Sub-basin delineations *v 9/25/19*

Sub-basin w/ permits	Number of permits	Distribution of growth
Seattle/ Lake Union	Urban	0%
Puget Sound Shorelines	Urban	0%
Swamp/North	Urban	0%
Little Bear Creek	0	0%
Samm River Valley	109	6%
Bear/Evans	516	28%
Greater Lake Washington	3	0%
May/Coal (Cedar)	134	7%
Lake Samm creeks	5	0%
Issaquah Creek	367	20%
Lower Cedar	701	38%
Upper Cedar	1	0%
total	1836	100%

Water use by basin

pub	pvt	oth	%pub	%pvt
0	0	0	0%	0%
0	0	0	0%	0%
0	0	0	0%	0%
0	0	0	0%	0%
96	7	6	88%	6%
376	117	23	73%	23%
3	0	0	100%	0%
113	13	8	84%	10%
0	5	0	0%	100%
144	199	24	39%	54%
361	286	54	51%	41%
0	1	0	0%	100%
1093	628	115	total	1836

WRIA 8 - 20 year PE Well Projection by Subbasin

permits/year 102

Added by GeoEngineers:

Average bldg. permits per year	Average wells per year (pvt)	Total wells in 20 years	Total wells in 20 years + 6% error	**Total Rounded**	Sub-basins	Distribution of PE
0.0	0.0	0.0	0.0	0	Seattle/ Lake Union	0%
0.0	0.0	0.0	0.0	0	Puget Sound Shorelines	0%
0.0	0.0	0.0	0.0	0	Swamp/North	0%
0.0	0.0	0.0	0.0	0	Little Bear Creek	0%
6.1	0.4	7.8	8.2	8	Samm River Valley	1%
28.7	6.5	130.0	137.8	138	Bear/Evans	19%
0.2	0.0	0.0	0.0	0	Greater Lake Washington	0%
7.4	0.7	14.4	15.3	15	May/Coal (Cedar)	2%
0.3	0.3	5.6	5.9	6	Lake Samm creeks	1%
20.4	11.1	221.1	234.4	235	Issaquah Creek	32%
38.9	15.9	317.8	336.8	337	Lower Cedar	46%
0.1	0.1	1.1	1.2	1	Upper Cedar	0%
102.0	**34.9**	**697.8**	**739.6**	**740**		

WRIA 8 - Permit-Exempt Well Potential Assessment

Assessment of potential parcels for future growth

Sub-basins	Number of parcels	Number of Dwelling Units (DU)
Seattle/ Lake Union	Urban	Urban
Puget Sound Shorelines	Urban	Urban
Swamp/North	Urban	Urban
Little Bear Creek	0	0
Samm River Valley	85	88
Bear/Evans	398	526
Greater Lake Washington	0	0
May/Coal (Cedar)	142	163
Lake Samm creeks	20	21
Issaquah Creek	429	534
Lower Cedar	578	818
Upper Cedar	0	0
total	1652	2150

Water district boundaries: Inside parcels	Inside DU	Outside Parcels	Outside DU	sub-basin
0	0	0	0	Seattle/ Lake Union
0	0	0	0	Puget Sound Shorelines
0	0	0	0	Swamp/North
0	0	0	0	Little Bear Creek
85	88	0	0	Samm River Valley
398	526	0	0	Bear/Evans
0	0	0	0	Greater Lake Washington
142	163	0	0	May/Coal (Cedar)
18	19	2	2	Lake Samm creeks
242	291	187	243	Issaquah Creek
492	713	86	105	Lower Cedar
0	0	0	0	Upper Cedar
1377	1800	275	350	

Water Use Projection: public connection parcels	public connection DU	PE sourced parcels	PE sourced DU	**20 year well projection (incl error)**	Shortfall (red if present) in 20 year well projection	**Redistribution - 20 year well projection**
0	0	0	0	**0**	0	**0**
0	0	0	0	**0**	0	**0**
0	0	0	0	**0**	0	**0**
0	0	0	0	**0**	0	**0**
75	78	10	10	**8**	2	**8**
290	383	108	143	**138**	5	**138**
0	0	0	0	**0**	0	**0**
120	137	22	26	**15**	11	**15**
0	0	20	21	**6**	15	**6**
95	114	334	420	**235**	185	**235**
253	367	325	451	**337**	114	**338**
0	0	0	0	**1**	-1	**0**
833	1080	819	1070	740	--------	740

total parcels 1652 | total DU 2150 | total parcels 1652 | total DU 2150

20 year Permit Exempt well total 740

Notes:

The Permit-Exempt Well Potential Assessment is outlined in red

Columns in yellow include redistribution of wells in the 20 year growth projection, based on the permit-exempt well potential assessment done by King County.

Red numbers *indicate a shortfall (more 20 year projected PE wells than parcels/DU)*

Blue numbers *indicate redistribution of 20 year PE projected numbers*

ATTACHMENT B
Snohomish County PE Well Growth Projections and Rural Capacity Analysis Methods, Assumptions and Data Tables

Snohomish County Methodology – housing unit growth forecasts by WRIA

1) Using year-built statistics from the Assessor database. This data is derived from the county's permit data as provided to the Assessor by Planning and Development Services (PDS).
    a. All new single-family residences (SFRs) in the WRIA (by HUC 12) built between 2008 and 2018, located outside of the cities, UGAs, national and state forest lands, government property and tribal lands.
2) Assigning the 2008-2018 SFRs to "Public Water Service Areas" or to "P_E Well areas"
    a. Depending on distance to existing water main – water main data is derived from system comprehensive plans:
        i. New homes not part of a subdivision located within 100' of a water main.
            1. 100' is selected due to lot sizes in the rural area, cost to extend water service, buy-in from rural water utilities as a reasonable assumption, and requirements in the county's draft water code.
        ii. New homes that were part of a rural cluster subdivision (RCS) within ¼ mile
            1. As of April 2009, this is a requirement in county code for rural cluster subdivisions – (however, most RCS that have been built were grandfathered to the previous rules which did not include this requirement to connect to public water)
3) The distribution of future growth by WRIA and by HUC12 is assumed to mirror the distribution observed from past growth using (1) a straight-line forecast, and (2) a forecast based on an adopted control total. The number of new homes expected over the next twenty years looks at two options:
    a. A straight-line forecast based on the past housing unit change: average annual change 2008-2018 extended out an additional 20 years;
    - or -
    b. Housing Unit forecast based on County-adopted growth targets (2015 comprehensive plan), urban/rural growth share policy and observed (2008-2018) growth shares for each WRIA. Table 1 shows HU forecasts by WRIA for "PE Well Areas" and "Water Service Areas."

Table 1-2015 Comprehensive Plan Growth Forecast: Urban/Rural Growth Share and Projected New Housing Units in PE Well and Water Service Areas by WRIA

2015 Snohomish County Comp Plan			Snohomish County population growth forecast (Pop. Change) 2018 to 2038	2016 Countywide Planning Policy Population Allocation		Rural/Resource growth share by WRIA (Based on rural growth share) 2008-2018		
2011	Adopted Growth Target 2035	Avg. Annual increase 2011-2035		Urban share 92.1%	Rural share 7.9%	WRIA 3 & 5 (33%)	WRIA 7 (62%)	WRIA 8 (5%)
717000	955257	9927	198548	182862	**15685**	5176	9725	784
New Housing Units (HUs) by WRIA 2018-2038: (Rural Avg HU size* = 2.75)						1882	**3536**	**285**
Allocation of NEW HU based on SnoCounty Model for likely "Water Service Areas" and "P-E Well Areas"			Total Available HU Capacity (Sheet 1)				13994	646
			Growth Share in "Water Service Area" (Sheet 1)				59%	52%
			Growth Share in "P-E Well Area" (Sheet 1)				41%	48%
			New HU in "Water Service Area" 2018- 2038				2086	148
			New HU in "P-E Well Area" 2018- 2038				**1450**	**137**

* Rural Avg Housing Unit (HU) size is based on adopted growth targets; based on Population and HU increase 2011-2035.

Parcels included in the future capacity analysis were selected based on the following criteria:

1) All parcels .5 acre or larger marked as “vacant”, or with “0” or “Null” in the improvement value field in the Assessor data base located within the unincorporated rural and resource areas (outside of cities and outside of the unincorporated UGA) –
   a) Includes agricultural areas and private forest lands (non-state and non-federal). Does not include tribal lands within the Tulalip Reservation – development in this area is under Tribal planning and jurisdiction.
   b) The lot size of .5 acre or larger will likely meet requirements for accommodating both a well and a septic system (sewer hook-up is not allowed outside the UGA). Wells and septic systems must be separated from each other a specified distance – this includes separation on a single parcel and from the systems on adjacent parcels. Lots under .5 acre in size are somewhat unusual in the rural area due to zoning code – most likely to occur as lot fragments created by right-of-way or located around lakes due to legacy zoning (Waterfront Beach = WB).
   c) Within cities and UGAs, residential lot sizes are small (typically the minimum necessary to meet front, back and side yard setback requirements) and public water and sewer are available. The likelihood of new permit-exempt wells for domestic use is very low and possibly zero. County data since the state legislation was passed (RCW 90.94) in January 2018, shows that there have been zero new wells inside the unincorporated UGA; 99 new wells outside of the UGA. Cities typically report that new wells for domestic use are not allowed within city limits.
2) All parcels that are underdeveloped and large enough to subdivide (i.e. one house on ten or twenty acres in an R-5-acre zone)

3) All subdividable parcels where assumed to develop using the rural cluster option – this option achieves the highest density.
4) Parcels were assigned to "Public Water Service Areas" or to "P_E Well areas" per the methodology described above.
5) Land capacity analysis conducted in 2011 was used to assign the number of new housing units that could potentially be built on each parcel. This analysis considered future land use designation from the comprehensive plan with reductions for critical areas.
6) Capacity data was aggregated by HUC12 assigning parcels on HUC boundaries according to parcel centroid.
7) At the HUC12 level, new housing units built after 2011 were deducted from the 2011 available capacity to create an estimate of the capacity remaining as of 2019.

2011 Rural Capacity Analysis

The rural capacity analysis conducted using the 2011 Assessor data resulted in an assigned future capacity for each parcel in the rural area. It should be noted that this analysis of the rural area employed a similar, but less robust model than is used to determine future capacity within the UGAs.

The rural land capacity analysis is summarized as follows:

1) For each parcel the following data was obtained or calculated:
    a. Total acres
    b. Buildable acres (total acres less critical areas)
    c. Percent buildable acres (buildable / total) – if percent buildable is less than 35%, additional capacity is reduced per "f" below.
    d. Density based on land use designation (dwelling units per acre)
        i. For land use designations where Rural Cluster Subdivisions are allowed, density assumes maximum potential under RCS.
    e. Development status was assigned:
        i. Vacant = Improvement value less than $2000
        ii. Partially used = existing home and less than 1000 sq ft commercial
        iii. Redevelopable = improvement value / land value ratio is less than 1
    f. Calculate basic capacity:
        i. If vacant, future capacity = total acres * density (dwelling units/acre)
        ii. If partially used or redevelopable, future capacity = total acres * density – existing dwelling units (DUs)
        iii. If buildable area is less than 35% of total area, capacity is reduced to 75% and will be reduced further if buildable area is less than 20% (50% capacity); and further still if less than or equal to 10% (.25%)
        iv. If buildable area is zero, capacity is assigned as 1 (reasonable use criteria per property rights laws)
        v. Old substandard lots over ½ acre not otherwise accounted for in above steps, capacity = 1
        vi. Assign 0 new residential capacity for:
            1. Areas where residential is not allowed
            2. Existing use codes are incompatible with residential

3. Government property
4. Open space or Native Growth Protection Area (NGPA)
5. Land value is less than $500
6. Conservation Futures restrict residential development
7. Other development moratoriums related to potable water availability

vii. Pending project capacity from actual project applications

SNOHOMISH COUNTY WRIA 7 - HUC 12 Name	Growth Forecast Scenarios - New Homes						2019 Available Capacity			Capacity Surplus or Shortfall Current Trends Scenario			Capacity Surplus or Shortfall Comp Plan Targets		
	Current Trends			V 2040 Comp Plan Targets											
	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas
Little Pilchuck River	525	236	289	373	168	205	2142	834	1308	1617	598	1019	1769	666	1103
Quilceda Creek (1)	302	51	251	214	36	178	1213	466	747	911	415	496	999	430	569
Lower Pilchuck River	789	560	229	560	397	163	2309	1488	821	1520	928	592	1749	1091	658
Woods Creek	713	489	224	506	347	159	1904	1206	698	1191	717	474	1398	859	539
Tulalip Creek - Frontal Possession Sound (1)	453	249	204	321	177	145	603	379	224	150	130	20	282	202	79
French Creek	416	293	124	296	208	88	1093	904	189	677	611	65	797	696	101
Snohomish River - Frontal Possession Sound	480	362	118	341	257	84	574	382	192	94	20	74	233	125	108
Elwell Creek - Skykomish River	149	33	116	106	23	83	593	156	437	444	123	321	487	133	354
Evans Creek - Snohomish River	333	220	113	236	156	80	889	659	230	556	439	117	653	503	150
Peoples Creek - Snoqualmie River	116	18	98	83	13	70	404	50	354	288	32	256	321	37	284
McCoy Creek - Skykomish River	91	24	67	65	17	48	297	60	237	206	36	170	232	43	189
Wallace River	78	18	60	55	13	43	454	182	272	376	164	212	399	169	229
Lower Sultan River	145	93	53	103	66	37	254	82	172	109	-11	119	151	16	135
Upper Pilchuck River	327	278	49	232	197	35	1012	800	212	685	522	163	780	603	177
Lower South Fork Skykomish River	38	0	38	27	0	27	96	0	96	58	0	58	69	0	69
Lower North Fork Skykomish River	15	0	15	10	0	10	70	0	70	55	0	55	60	0	60
Cherry Creek - SnoCo Portion	11	0	11	8	0	8	35	0	35	24	0	24	27	0	27
Olney Creek	0	0	0	0	0	0	5	0	5	5	0	5	5	0	5
Upper Sultan River	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2
Middle North Fork Skykomish River	0	0	0	0	0	0	45	0	45	45	0	45	45	0	45
Total WRIA 7	4981	2924	**2059**	3536	2075	**1463**	13994	7648	6346	9013	4724	4287	10458	5573	4883

(1) Connections to public water are likely to be over-estimated due to capacity issues with Seven Lakes Water Association.

Excluded HUCs: (all urban or all forest) Powder Mill Gulch - Frontal Possession Sound, Middle Sultan River, Upper North Fork Skykomish, Upper Beckler River, Lower Beckler River, Rapid River, Upper North Fork Tolt (SnoCo portion).

SNOHOMISH COUNTY WRIA 8 - HUC 12 Name	Growth Forecast Scenarios - New Homes						2019 Available Capacity			Capacity Surplus or Shortfall - Current Trends Scenario -			Capacity Surplus or Shortfall - Comp Plan Targets -		
	Current Trends			V 2040 Comp Plan Targets											
	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas
North Creek (2)	0	0	0	0	0	0	7	5	2	7	5	2	7	5	2
Bear Creek - Sammamish River	275	100	175	181	66	115	393	275	118	118	175	-57	212	209	3
Bear Creek	159	126	33	105	83	22	253	145	108	94	19	75	148	62	86
Total WRIA 8	434	226	208	286	149	137	653	425	228	219	199	20	367	276	91

(2) North Creek is located entirely within the county's Southwest Urban Growth Area (SWUGA) where connection to water providers is nearly certain. Providers have verified capacity in their water system comprehensive plans.

Additional changes to forecast not reflected here:

1. Revise allocations in HUCs where forecast exceeds available capacity.
2. Revise allocations within UGAs to add potential for limited number of new wells based on GeoEngineers analysis.
3. Revise connections to public water system in HUCs where public water service is already at capacity due to water rights.
4. Add growth forecasts from Tulalip Planning for WRIA 7.

ATTACHMENT C
GeoEngineers UGA Well Log Spot Check Data Tables

GeoEngineers - WRIA 8 Urban Growth Area PE Well Projection

GeoEngineers - UGA Well Log Spot Check						
Period	**Total Wells**	**Total Wells Spot Checked**	**Domestic wells (includes Group B wells)**	**Irrigation wells**	**Other (Test, Municipal, Dewatering, Industrial, Mitigation, UIC, Deepened or Refurbished)**	**Incorrect (Location, Date, etc.)**
1998-2007	129	66	7	40	14	5
2008-2018	76	48	2	11	28	7
Totals	205	114	9	51	42	12
Percent of Total		56%	8%	45%	37%	11%
Potential number of new wells based on percentage of past 20 year total (205)						
WRIA 8			**16**	92	76	22

Developed 8/9/19

Notes:

Domestic and Irrigation well numbers have been adjusted based on information provided by The Highlands, Olympic View Water & Sewer District, City of Redmond, City of Sammamish and cross-checking well address with UGA boundary.

A total of 21 wells logged as "domestic" are actually irrigation wells and were moved to that category.

The remaining domestic wells that have been spot checked are located in the following City UGAs: Maple Valley (1), Mukileto (1), Mill Creek (3), Maltby (1), Kirkland (1) and Seattle (1).

Service Area/City Policy Notes:

Alerwood Water and Wastewater District - expanding service rapidly.

Redmond - PE wells not allowed. No new wells for irrigation that they know of.

Sammamish - PE wells not allowed. No known areas that can not be reached by public water.

The Highlands - all public water. Most lots have wells for irrigation due to large lawn size.

Woodway - all public water. Many lots have wells for irrigation due to large lawn size.

GeoEngineers - WRIA 8 Urban Growth Area PE Well Projection

Subbasins	Spot Checked 1998-2007	Spot Checked 2008-2018	Total	Total Potential Wells in UGA in 20 years	Total Rounded	County	City UGA
Seattle/Lake Union	0	0	0	0.00	**0**	King	
PS Shorelines	1	0	1	1.77	**2**	Sno co/King co	Mukilteo
Swamp North	3	0	3	5.31	**5**	Sno co/King co	Mill Creek
Little Bear	0	0	0	0.00	**0**	Sno co/King co	
Samm Rvr Valley	0	0	0	0.00	**0**	King co	
Bear/Evans	1	1	2	3.54	**4**	Sno co/King co	Maltby
Greater Lake Washington	1	1	2	3.54	**4**	Sno co/King co	Kirkland/Seattle
May/Coal	0	0	0	0.00	**0**	King	
Lk Samm Creeks	0	0	0	0.00	**0**	King	
Issaquah	0	0	0	0.00	**0**	King	
Lower Cedar	1	0	1	1.77	**2**	King	Maple Valley
Upper Cedar	0	0	0	0.00	**0**	King	
Totals	7	2	9	15.93	**17**		

Developed 8/9/19

Note: This tables includes data for wells in Ecology's Well Report database, filtered for a depth greater than 30 feet and diameter 6-8 inches. Ecology does not have the ability to filter for permit-exempt domestic wells. Information in the database is based on records submitted by the driller. Well Report Data and Images released from the Department of Ecology are provided on an “AS IS” basis, without warranty of any kind.

nhc
GeoEngineers

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Memorandum

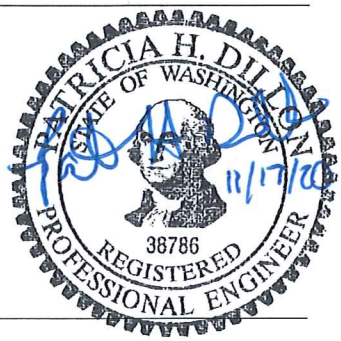
To: Stephanie Potts, Washington State Department of Ecology

From: Patty Dillon, Cynthia Carlstad, NHC;
Bridget August, John Monahan, GeoEngineers

Date: November 17, 2020

File: 0504-161-00

Subject: WRIA 8 Consumptive Use Estimates



INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) Committees for Water Resource Inventory Areas (WRIAs) 7, 8 and 9. This memorandum provides a summary of the deliverable for Work Assignment GE0102, Task 4, WRIA 8 Consumptive Use Estimates.

BACKGROUND AND CONTEXT

The Streamflow Restoration law (Revised Code of Washington [RCW] 90.94) specifies that by June 30, 2021, Ecology must establish a WRE Committee and adopt a WRE Plan in the Cedar-Sammamish Watershed (WRIA 8). The Cedar-Sammamish (WRIA 8) Watershed Restoration and Enhancement Plan (watershed plan) must include projects and actions that offset new consumptive water use (consumptive use) from future domestic permit-exempt wells (PE wells[1]). Consumptive use is water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment. For watershed planning purposes, consumptive use is water that is drawn from groundwater via a domestic PE well and not replaced through the septic system, irrigation return flow, or other means.

Projections for number and location of new PE wells within WRIA 8 were developed by King County, Snohomish County, and GeoEngineers (GeoEngineers 2020b) for purposes of the watershed plan. This memorandum summarizes the methods used to estimate consumptive use associated with the new PE well connections and provides results for three water use scenarios. Methodology is based on Appendix A of Ecology's Final Guidance for Determining Net Ecological Benefit (Final NEB Guidance) (Ecology 2019) and documented in further detail in the Consumptive Use Estimates Workplan prepared by the GeoEngineers team (GeoEngineers 2019).

CONSUMPTIVE WATER USE METHODOLOGY

Measurement of consumptive water use in any setting is difficult, and it is virtually impossible for residential groundwater use, which must account for both indoor and outdoor use. PE wells are generally unmetered, so

[1] "PE wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells, including homes on group systems relying on permit-exempt wells.

supply to each home is usually unknown, let alone the amount that is lost to the groundwater system. Therefore, we are limited to estimating consumptive use based on projections of future growth, local patterns and trends in water use, and generally accepted and reasonable assumptions. Water use data from local water purveyors may be useful as a check on calculated estimates but must be used with caution. Homes that pay for municipal water tend to exhibit different water use behaviors, including water saving appliances and reduced landscape watering, that reduce usage compared to homes on wells.

The two categories of household consumptive use are indoor water use and outdoor water use. The methodologies used to estimate these quantities for WRIA 8 are described in the following sections.

Indoor Consumptive Use

Indoor consumptive use was estimated using methods and assumptions from the Final NEB Guidance (Ecology 2019), which was based on groundwater monitoring and modeling studies conducted by the U.S. Geological Survey in several areas of Washington. There are two basic elements to estimating indoor consumptive use:

- Amount of total water used. The Final NEB Guidance recommends an assumption of 60 gallons per person per day as a reasonable estimate of indoor water use. To estimate indoor usage per well, the per capita usage was multiplied by the average rural household size, estimated by King County and Snohomish County as 2.73 and 2.75 people per household, respectively. For analysis areas spanning both counties, a weighted value was estimated based on the number of projected PE well connections in each county. Table 1 summarizes the household sizes for each WRIA 8 delineated subbasin with projected PE wells (GeoEngineers 2020a) and for all of WRIA 8.
- Percentage of total water used that is consumptive. The Final NEB Guidance recommends that 10 percent of the total indoor water use is considered consumptive when a home is on a septic system. (All indoor water use is considered consumptive for homes with sewer connections.) Areas projected to be served by PE wells are outside of sewer service areas, so the 10 percent assumption was applied for all projected indoor water use.

TABLE 1. AVERAGE RESIDENTS PER HOUSEHOLD

Subbasin	% Projected Wells by County		Avg. People per Rural Household
	King	Snohomish	
Puget Sound Shorelines		100%	2.75
Swamp/North		100%	2.75
Little Bear		100%	2.75
Sammamish River Valley	100%		2.73
Bear/Evans	59%	41%	2.74
Greater Lake Washington	100%		2.73
May/Coal	100%		2.73
Lake Sammamish Creeks	100%		2.73
Issaquah	100%		2.73
Lower Cedar	100%		2.73
WRIA Total	**77%**	**23%**	**2.73**

Outdoor Consumptive Use

Outdoor water use is typically the larger portion of domestic single-family residential water use, with irrigation of lawn and garden being the dominant outdoor water use component. The GeoEngineers team conducted a subbasin-specific assessment to determine typical outdoor water use patterns, namely the typical size of irrigated lawn, garden, and landscaping areas associated with newer residential development and irrigation water needs, which vary by crop and climate. The consumptive use estimate assumes that current rural residential landscaping practices and outdoor water use will continue over the 20-year planning horizon.

Irrigated Footprint Analysis

The GeoEngineers team conducted an aerial photo-based analysis of irrigated lawn and garden area for 153 parcels in seven of the WRIA 8 subbasins. Parcels used for the irrigated footprint analysis were selected based on recent (2006 to 2017) building permits for new single-family residential homes not served by public water. Permits for accessory dwelling units (ADUs) or reconstruction/remodel were excluded. There were more than 400 permits in WRIA 8 meeting these criteria—more than could be reasonably evaluated for this project. For subbasins with more than 20 applicable building permits, a statistically representative sample size was identified based on statistics from similar analyses in WRIAs 1 and 9 and a pilot study in the Bear/Evans subbasin. The target sample size is sufficient to ensure that the sample mean is representative over the WRIA within a 95 percent confidence limit. Sample parcels were selected by assigning a random number to each building permit, and then evaluating sites in rank order up to the target sample size. Using a random selection from the permit list avoids the bias that could be introduced if selecting from the imagery. Table 2 shows the number of permits by subbasin and the targeted minimum sample size.

TABLE 2. SAMPLE SIZE FOR IRRIGATED FOOTPRINT ANALYSIS

Subbasin	Applicable Building Permits (2006-2017)	Target Minimum Sample Size
Little Bear	98	30
Sammamish River Valley	3	3
Bear/Evans	79	30
May/Coal	7	7
Lake Sammamish Creeks	1	1
Issaquah	108	30
Lower Cedar	150	30
WRIA Total	**446**	**131**

Each parcel was evaluated visually in Google Earth for irrigated lawn areas. Google Earth's historical imagery collection allowed for clearer identification of irrigated areas by comparing aerial photos spanning multiple seasons and years. Late summer imagery was particularly helpful in determining boundaries of irrigated (green) versus non-irrigated (brown) grass areas. More often than not, the parcels did not demonstrate such a clear-cut distinction between green and brown spaces. It appears that many homeowners irrigate enough to keep lawns alive but not lush (or comparable to commercial turf grass/golf course green). Delineating these irrigated spaces is subjective and the GeoEngineers team tried to ensure consistency in the interpretation and results by having one geographic information system (GIS) analyst evaluate all of the selected parcels in the WRIA. The irrigated area was delineated for each parcel based on several key assumptions:

- Landscaped shrub/flower bed areas were included in the irrigated footprint (not just lawn areas).
- Homes that did not show visible signs of irrigation were tracked as zero irrigated footprint.
- Homes or landscaping still under construction in the most recent Google Earth imagery were excluded.
- Native forest or unmaintained grass/pasture were not included in the irrigated footprint.
- Pre-existing agricultural land use was not considered part of the residential irrigation footprint.

Figure 1 shows examples of irrigated area delineation for two parcels in the Bear/Evans subbasin. On each photo, the parcel boundary is shown in light blue and the area identified as irrigated in white. For the example on the left, photos at different times of year showed a clear break between irrigated and non-irrigated grass.

Figure 1. Example Irrigated Area Delineations

Results of the irrigated footprint analysis are summarized in Table 3. The analysis covered seven of the ten subbasins in WRIA 8 with projected PE well connections. Due to small sample sizes, the subbasin-level results for Lake Sammamish Creeks, Sammamish River Valley, and May/Coal subbasins are not considered representative. Parcels in these subbasins were included in the overall average, but average irrigated areas from similar adjacent subbasins (Bear/Evans, Little Bear, and Lower Cedar, respectively) were used for the purpose of subbasin-scale consumptive use estimates. Note that more permit parcels than the target minimum sample were analyzed in four of the subbasins. When identifying the random list for analysis, the GeoEngineers team identified 10 additional sites beyond the target minimum of 30 to allow for dropping parcels that did not meet the analysis criteria (e.g. construction not completed). The full list was analyzed, resulting in a few parcels above the target minimum in each subbasin. Similarly, one of the seven parcels in the May/Coal subbasin had to be dropped, so the analyzed sample is smaller than the projected target.

The Puget Sound Shorelines, Greater Lake Washington, and Swamp/North subbasins (with two, four, and five projected PE well connections, respectively) did not have any recent building permits for sites without purveyor-provided water service from which to estimate subbasin-specific irrigated area. The average irrigated area for the Little Bear subbasin was applied for purposes of subbasin-scale consumptive use estimates. Puget Sound Shorelines, Greater Lake Washington, and Swamp/North subbasins are almost entirely within the Urban Growth Area (UGA) and may have homes on smaller lots with smaller lawns than homes in Little Bear subbasin, which is mostly outside the UGA.

TABLE 3. WRIA 8 IRRIGATED FOOTPRINT SUMMARY

Subbasin	Parcels Analyzed	Total Irrigated Area (ac)	Average Irrigated Area (ac)
Little Bear	37	10.2	0.28
Sammamish River Valley	2	0.3	0.28†
Bear/Evans	39	12.2	0.31
May/Coal	6	1.4	0.23†
Lake Sammamish Creeks	1	1.5	0.31†
Issaquah	33	12.3	0.37
Lower Cedar	35	11.6	0.33
Full Analysis	**153**	**49.4**	**0.32**

† Calculated averages not used due to small sample size. Adjacent subbasins substituted.

Crop Irrigation Requirements

The amount of irrigation water required to grow and maintain vegetation depends on the crop, season, and local climate (temperature and precipitation) and thus varies by location throughout the WRIA. The Washington Irrigation Guide (WAIG) (NRCS 1997) includes an appendix listing net irrigation requirements for various common crops for 89 locations throughout Washington, derived from water use and meteorological data from the 1970s and 1980s. Since lawn is a fairly water-intensive crop and the most common target of residential irrigation, irrigation requirements for turf were used to estimate outdoor water needs.

Using the one WAIG station within WRIA 8 (Seattle-UW) and surrounding stations to the north, south, and east, the GeoEngineers team spatially interpolated crop irrigation requirements (CIRs) across WRIA 8 by creating a triangulated irregular network (TIN) surface between the WAIG station points. Since there are no stations east of Snoqualmie Falls, a lower value was imposed along the Cascade crest to enforce continued reduction in CIR with increasing precipitation. A value of 8 inches per year was used for the boundary value; this is believed to be a conservative value based on nearby Cascade foothill station estimates from an unpublished irrigation data set being developed by Washington State University (Peters et al. 2019). Values from the resulting TIN surface were averaged over each subbasin to estimate the irrigation requirement for each subbasin. This analysis was performed for both annual and summer (June-July-August) irrigation requirements to provide information to compare peak summer water use to annual use estimates. Figure 2 shows the locations of WAIG irrigation data stations and the interpolated distribution of annual turf irrigation requirements across WRIA 8. Table 4 summarizes the average values for both annual and summer CIRs for subbasins with projected PE well connections. Annual values were used for the consumptive use calculations described in this memo.

The CIR is the net amount of external water required by the crop, accounting for precipitation inputs. Since irrigation systems are not 100 percent efficient, additional water must be supplied to ensure that crop needs are met. The application efficiency varies by the type of system (drip irrigation, microsprinklers, pivot sprinklers, etc.). For WRIA 8, the Ecology-recommended value of 75 percent was used to determine the water applied for irrigation (Ecology 2019).

Outdoor water use for each home was then estimated as the applied water for irrigation (computed as a depth) times the average irrigation area. The consumptive use fraction is substantially higher for outdoor use than indoor use (to a septic system) because most of the applied water is taken up by plants or evaporated. Based

on the Final NEB Guidance, a consumptive use fraction of 80 percent was applied to the total outdoor water use, meaning that 80 percent of water used for outdoor watering does not return to the local groundwater system (Ecology 2019).

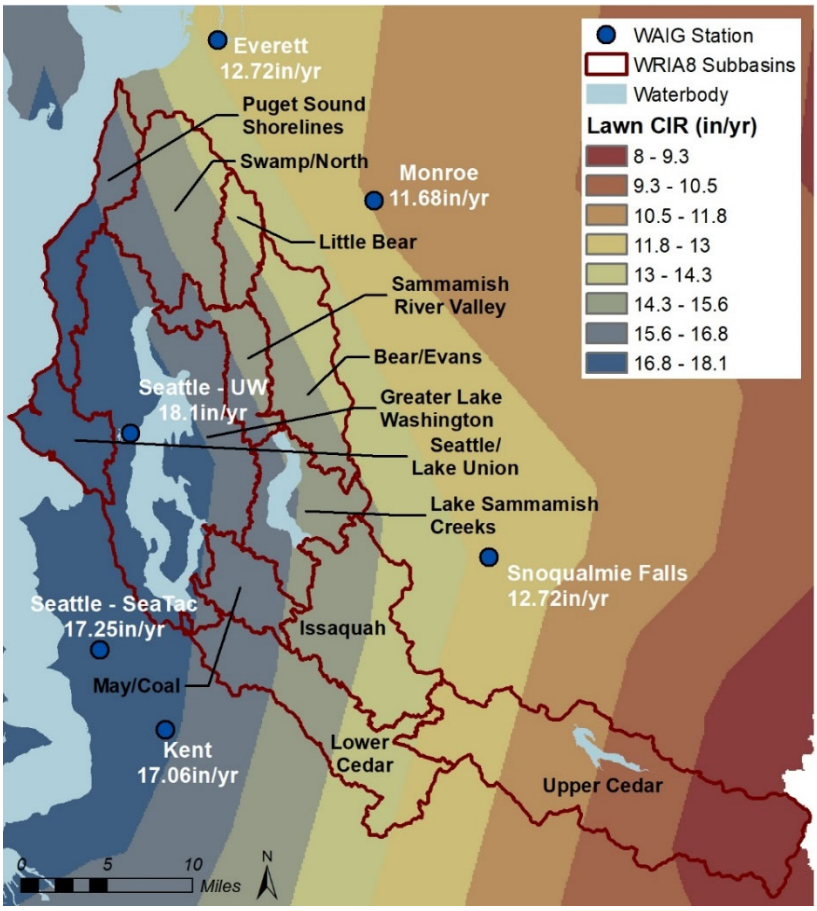


Figure 2. Spatial Distribution of Annual Turf Irrigation Requirement

TABLE 4. WRIA 8 CROP IRRIGATION REQUIREMENTS

Subbasin	Annual Turf CIR (in)	Summer (JJA) Turf CIR (in)
Puget Sound Shorelines	16.78	12.62
Swamp/North	15.22	11.99
Little Bear	14.35	11.51
Sammamish River Valley	15.55	12.31
Bear/Evans	14.33	11.65
Greater Lake Washington	17.15	13.11
May/Coal	16.15	12.67
Lake Sammamish Creeks	15.46	12.28
Issaquah	14.36	11.83
Lower Cedar	14.53	11.89
WRIA Average*	**15.66**	**12.35**

* Spatial average for subbasins with projected PE wells only

TOTAL CONSUMPTIVE USE

The methods described above were used to compute indoor and outdoor consumptive use per PE well connection. Totals for each subbasin were then computed by multiplying per home values by the projected number of PE well connections in each subbasin. The GeoEngineers team developed a consumptive use calculator (Excel spreadsheet) to compute consumptive use for projected PE well connections for each subbasin and the WRIA as a whole. Table 5 summarizes the consumptive use estimate, which assumes one home with the measured subbasin-average yard area per PE well. The consumptive use estimate for WRIA 8 is 425.4 acre-feet per year, as shown on Figure 3.

TABLE 5. ANNUAL CONSUMPTIVE USE FOR ONE HOME WITH SUBBASIN AVERAGE YARD

Subbasin ID	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Puget Sound Shorelines	2	0.28†	16.5	372.8	389.3	0.9
Swamp/North	5	0.28†	16.5	338.2	354.7	2.0
Little Bear	118	0.28	16.5	318.8	335.3	44.3
Sammamish River Valley	8	0.28‡	16.4	345.5	361.9	3.2
Bear/Evans	234	0.31	16.4	352.5	368.9	96.7
Greater Lake Washington	4	0.28†	16.4	381.0	397.4	1.8
May/Coal	15	0.33‡	16.4	422.9	439.3	7.4
Lake Sammamish Creeks	6	0.31‡	16.4	380.3	396.7	2.7
Issaquah	235	0.37	16.4	421.6	438.0	115.3
Lower Cedar	340	0.33	16.4	380.5	396.9	151.2
WRIA 8 Aggregated	**967**	**0.33**	**16.4**	**376.3**	**392.7**	**425.4**

Note: Values in table have been rounded.
† Representative measured value not available; uses Little Bear subbasin average irrigated area.
‡ Calculated average not used due to small sample size. Surrogate subbasin used: Little Bear for Sammamish River Valley, Lower Cedar for May/Coal, and Bear/Evans for Lake Sammamish Creeks.

CONSUMPTIVE WATER USE SCENARIOS

The consumptive use calculator was also used to explore additional consumptive use scenarios. "Default" input parameters and values discussed in the methods section above can be modified to explore the effect of changes or uncertainties in individual assumptions. Based on requests from the technical workgroup and WRIA 8 Committee, two additional scenarios were computed, and annual consumptive use results are summarized in Table 6 and Table 7:

1. One home with legal maximum 0.5-acre irrigated lawn area per PE well. Assumes 60 gallons per day per person indoor use and outdoor use to irrigate 0.5-acre lawn.
2. Legal limit of 950 gallons per day (maximum annual average withdrawal) per well connection for indoor and outdoor household use. Assumes 60 gallons per day per person indoor use and remainder to outdoor use.

TABLE 6. ANNUAL CONSUMPTIVE USE FOR ONE HOME WITH 0.5-AC YARD

Subbasin ID	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Puget Sound Shorelines	2	0.5	16.5	665.7	682.2	1.5
Swamp/North	5	0.5	16.5	603.8	620.3	3.5
Little Bear	118	0.5	16.5	569.3	585.8	77.4
Sammamish River Valley	8	0.5	16.4	616.9	633.3	5.7
Bear/Evans	234	0.5	16.4	568.5	585.0	153.3
Greater Lake Washington	4	0.5	16.4	680.4	696.8	3.1
May/Coal	15	0.5	16.4	640.7	657.1	11.0
Lake Sammamish Creeks	6	0.5	16.4	613.4	629.8	4.2
Issaquah	235	0.5	16.4	569.7	586.1	154.3
Lower Cedar	340	0.5	16.4	576.5	592.9	225.8
WRIA 8 Aggregated	**967**	**0.5**	**16.4**	**574.4**	**590.8**	**640.0**

Note: Values in table have been rounded.

TABLE 7. ANNUAL CONSUMPTIVE USE FOR ANNUAL AVERAGE 950 GPD WATER USE PER CONNECTION

Subbasin ID	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Puget Sound Shorelines	2	0.47	16.5	628.0	644.5	1.4
Swamp/North	5	0.52	16.5	628.0	644.5	3.6
Little Bear	118	0.55	16.5	628.0	644.5	85.2
Sammamish River Valley	8	0.51	16.4	629.0	645.3	5.8
Bear/Evans	234	0.55	16.4	628.6	645.0	169.1
Greater Lake Washington	4	0.46	16.4	629.0	645.3	2.9
May/Coal	15	0.49	16.4	629.0	645.3	10.8
Lake Sammamish Creeks	6	0.51	16.4	629.0	645.3	4.3
Issaquah	235	0.55	16.4	629.0	645.3	169.9
Lower Cedar	340	0.55	16.4	629.0	645.3	245.8
WRIA 8 Aggregated	**967**	**0.55**	**16.4**	**628.7**	**645.1**	**698.9**

Note: Values in table have been rounded.

Daily usage rates shown in Table 5 through Table 7 represent annual average values. While indoor use generally does not vary much from month to month, outdoor water needs range from zero during the winter rainy season to more than three times the annual average during the peak of the summer. Since streamflows are lowest in late summer for most western Washington streams, the WRIA 8 Committee may consider peak summer water use along with annual use when developing the watershed plan. It is important to remember that pumping rates are likely not equivalent to consumptive use impacts on stream depletion. While the Final NEB Guidance recommends considering stream depletion impacts to be a steady-state equivalent, there may be circumstances within a watershed where that is not appropriate.

Total Water Use and Comparison to Water Purveyor Data

Water use data from water purveyors serving rural areas in the central Puget Sound were obtained as one benchmark for comparison with estimated PE well usage. Snohomish County Public Utilities District #1 (Snohomish County PUD), serving about 20,000 customers in central and northern Snohomish County, and Covington Water District, serving about 18,000 customers in southern King County, each provided metered water use data from 2015 and 2017. In addition, Snohomish County compiled annual water demand forecasts from water system plans for 17 water purveyors operating in the county. Table 8 summarizes the available water purveyor data. Reported values are total water use, not consumptive use. For the two metered systems providing data, the average annual use is approximately 220 gallons per day (gpd) per household. About 160 gpd is attributed to indoor uses (year-round) and 50 to 70 gpd (averaged over 12 months) to outdoor uses. Note that outdoor use is typically concentrated over about 3 months during the summer, which equates to rates of 150 to 200 gpd of outdoor watering for those 3 months.[2]

Since most water purveyors charge customers by the amount of water delivered (not just consumptively used)—and in some cases at increased rates as water use goes up—metered water users may exhibit more water conservation behaviors than unmetered users. Total water use breakdowns for the projected PE well scenarios are presented in Table 9. Estimated indoor use of 164 gpd for the PE well scenarios is very consistent with the water purveyor data (based on metered winter water use), between 150 and 170 gpd.

Average annual total use for PE wells estimated from this analysis (see Table 9) are considerably higher, however, due to outdoor use estimates about a factor of 10 greater than average metered use: 470 gpd estimated for PE wells versus 50 to 70 gpd for metered users on an average annual basis or 1,500 gpd estimated for PE wells versus 150 to 200 gpd[3] for metered users on average during the summer. The magnitude of this difference seems unlikely to be accounted for strictly by price pressures and thus suggests that assumptions in this analysis regarding watering behavior are generally conservative. For example, studies have shown that most residential lawn watering is conducted at a deficit level to maintain some growth and green color (Water Research Foundation 2016), versus the assumption of watering for optimal growth of commercial crops (like a sod farm for turf grass) implicit in the WAIG crop irrigation requirements. Because of uncertainty inherent in estimating growth patterns, domestic PE well pumping rates, and potential changes in outdoor watering practices, conservative assumptions for future new household water use, and outdoor water use in particular, are justified.

[2] 50 gpd over 12 months is equivalent to 200 gpd over 3 months, both totaling about 18,000 gallons.
[3] Metered summer usage for several individual homes in the Covington Water District showed outdoor usage ranging from 25 gpd to 2,693 gpd for July-August 2015.

TABLE 8. WATER PURVEYOR HOUSEHOLD WATER USE DATA

Water Purveyor	Average Annual Water Use (gpd)	Average Winter Water Use (gpd)	Average Summer Water Use (gpd)
Metered Water Use Data†			
Snohomish County PUD‡	237	170	370
Covington Water District	200	150	300
Comprehensive Plan Forecast			
Alderwood	169		
Cross Valley*	234		
Edmonds	201		
Gold Bar	171		
Highland*	200		
Marysville	168		
Monroe	170		
Mukilteo	179		
Olympic View	189		
Roosevelt*	383		
Silver Lake	177		
Snohomish	190		
Snohomish County PUD*	190		
Stanwood	282		
Startup*	250		
Sultan	190		
Three Lakes*	191		
*Average Rural Non-City	241		

Note: Reported values are total water use, not consumptive use.
†Data from 2015 and 2017 ‡Average use for parcels ≥1 acre *Rural (non-city) water provider

TABLE 9. ESTIMATED PERMIT-EXEMPT WELL TOTAL WATER USE

Scenario	Average Annual Water Use (gpd)	Average Indoor Use (gpd)	Average Annual Outdoor Use (gpd)	Average Summer Outdoor Use (gpd)
1 home, average measured yard	634	164	470	1,522
1 home, 0.5 ac yard	882	164	718	2,321
1 home using 950 gpd (annual average)	950	164	786	n/a

Note: Reported values are total water use, not consumptive use.

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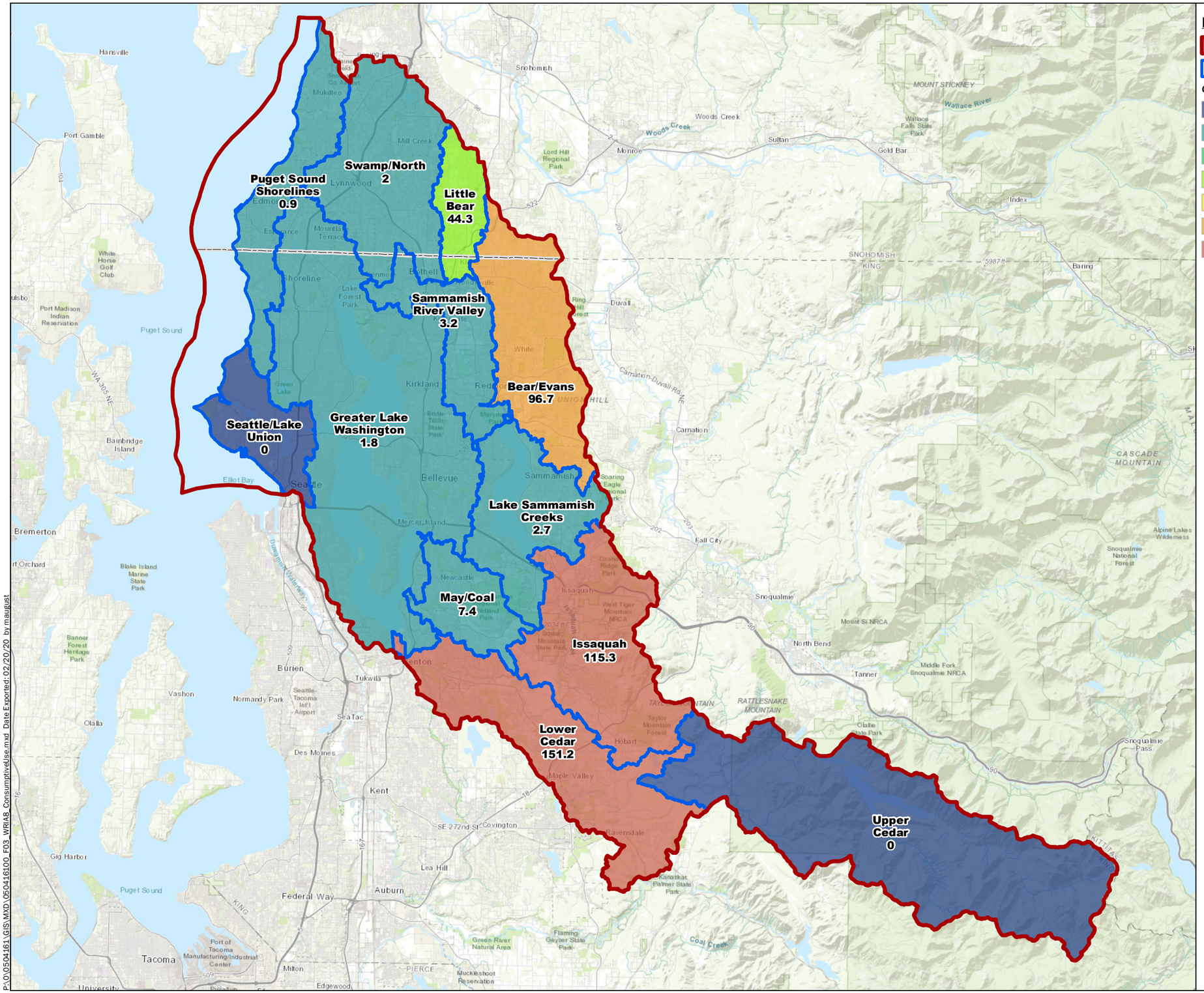
Attachment:
Figure 3. WRIA 8 Estimated Consumptive Use from Projected Permit-Exempt Wells 2018-2038



Legend

- WRIA 8 Boundary
- WRIA 8 Subbasins

Consumptive Use Estimate (acre-feet/year)

- 0
- 1 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100
- >100

Projected WRIA 8
Consumptive Use Total = 425.4 acre-feet per year

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI Topographic Map Base

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

N W E S

5 0 5
Miles

WRIA 8 Estimated Consumptive Use from Projected Permit-Exempt Wells 2018-2038

Watershed Restoration and Enhancement Plan
Snohomish and King Counties, Washington

GeoEngineers | Figure 3

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Appendix E – Projects

The following project descriptions were developed based on information provided to Ecology prior to December 2021.

Snohomish County Recycled Water Managed Aquifer Recharge

Project Name and Number

Snohomish County Recycled Water Managed Aquifer Recharge (8-LB-W1)

WRIA 8 WRE Subbasin

Little Bear

Water Offset

~181 acre-feet/year

Narrative Description

This project involves using recycled water as a source for managed aquifer recharge (MAR) projects. This project would augment stream flows by increasing surficial aquifer discharge above what occurs under existing conditions. The project concept includes diverting recycled water from Brightwater to a constructed MAR facility. Brightwater currently distributes reclaimed water from May to October, but recycled water may also be available year-round, if needed. This diverted water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to one or more adjacent streams as re-timed groundwater baseflow. A specific site for this project has not yet been identified, however, there may be opportunity for MAR on Snohomish County-owned property immediately north of Brightwater (i.e. Carousel Ranch) or at other sites to be selected in the future. The goal of the project is to increase baseflow to the subject stream(s) by recharging the aquifer adjacent to the stream(s) and providing additional groundwater discharge to the river through MAR.

The project should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Brightwater is located in the Snohomish County portion of the City of Woodinville, Washington between State Route 9 and Highway 522 in the WRIA 8 delineated Little Bear subbasin. Currently, recycled water is only available via King County's recycled water pipeline which extends from the Brightwater tunnel alignment in Bothell, south through the Sammamish River Valley to Redmond. However, King County is in the process of designing and constructing additional storage capacity at Brightwater, which would allow for distribution of recycled water to areas proximal to the plant and eventually to other portions of Snohomish County as recycled water infrastructure expands to meet future demand.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The proposed recycled water MAR facility will result in streamflow benefits to one or more subject streams by diverting and temporarily storing recycled water into the shallow glacial or alluvial aquifer underlying the project site. The project is currently conceptual, but anticipates the ability to divert recycled water from the existing pipeline at a rate of approximately 0.5 cubic feet per second (cfs) for six months (May through October). The goal is to increase streamflow, especially during months when demand for water is highest and surface flows are generally lowest (June through August). The proposed MAR facility will infiltrate recycled water into the shallow aquifer and provide increased baseflow to the subject stream and its tributaries, depending on where the facility is sited. The anticipated offset volume for this project is 181 acre-feet (AF) per year. The offset volume is calculated based on the quantity of water infiltrated annually, as described below.

Assuming water will be diverted between May 1 and October 31 every year (183 days), the annual diversion volume is estimated to be 181 acre-feet (AF) per year using Equation 1:

Annual Volume = Diversion Rate x Duration of Diversion Equation 1

It is anticipated that the MAR facility would be constructed as a buried infiltration gallery or open pond, but design details will be further developed at a later time. Development of this project would augment existing flow in subject stream(s) through an increase in groundwater baseflow, which could be year-round depending on site and down-gradient hydrogeology. The temporal distribution and absolute value of those benefits will be estimated during a feasibility study, which is required before a MAR project can proceed to construction and operation. Those streamflow augmentation benefits will continue to discharge to the river after each year's storage window closes because of the lag time of water moving through an aquifer and the distance of the flow path to the river. The rate at which the infiltrated water enters the river will vary based on in-situ aquifer parameters that will be tested and modeled during the feasibility study.

It is assumed that a site feasibility study will be conducted pursuant with Appendix B of Ecology's Net Ecological Benefit (NEB) guidance (Ecology 2019a) and Appendix D of the Streamflow Restoration grant application requirements, if funding from Ecology is pursued during a future grant round (Ecology 2019b). All values presented in this project description are for planning purposes and may not represent actual site conditions.

Conceptual-level map and drawings of the project and location.

No potential MAR facility site has currently been identified. The following map (Figure 1) provides an aerial view of Brightwater and the surrounding area.

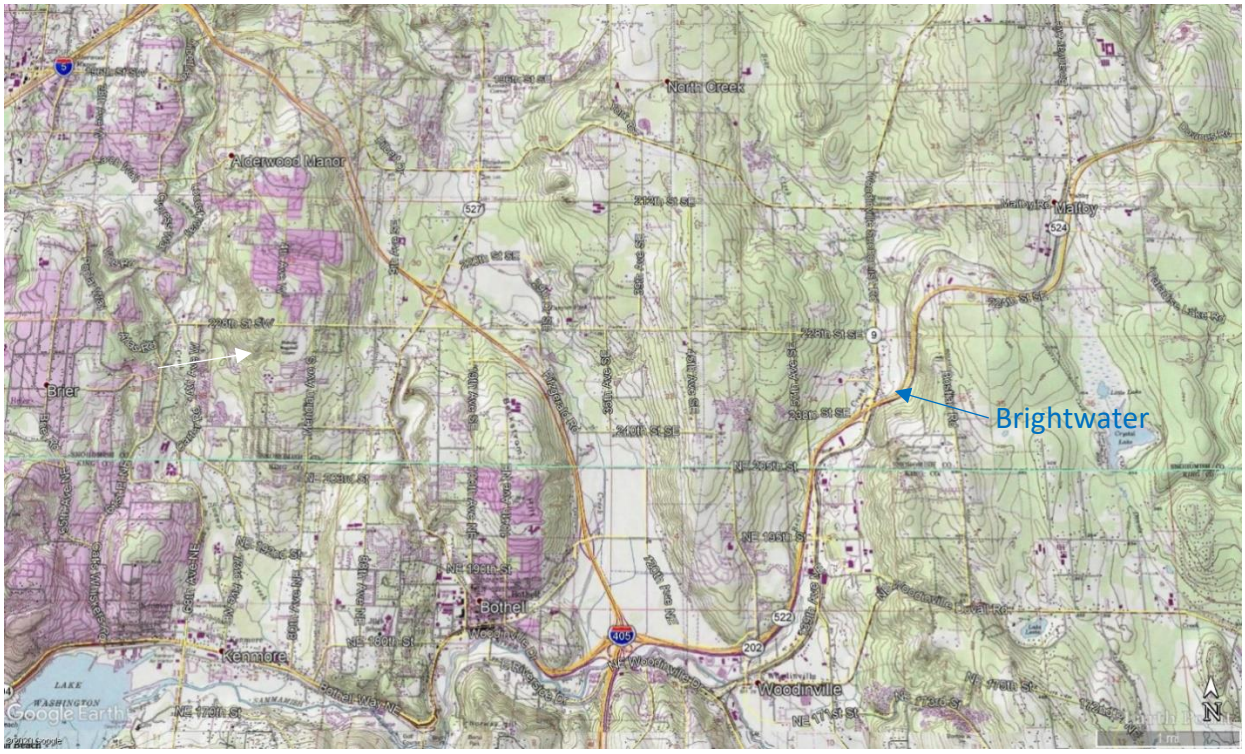

Figure 1: Aerial View of Brightwater Treatment Plant and surrounding area

Description of the anticipated spatial distribution of likely benefits.

The Brightwater Treatment Plant is located in the Little Bear subbasin. The project is expected to provide streamflow benefits in the subject stream(s) and downstream subbasins (including the Sammamish River Valley, Greater Lake Washington, and Seattle Lake Union subbasins).

Location relative to future PE well demand.

The consumptive use estimate for the WRIA 8 Little Bear subbasin is 44.3 AF per year (GeoEngineers 2020). Consumptive use estimates for subbasins downstream of the Sammamish River Valley subbasin include the following (GeoEngineers 2020):

- Sammamish River Valley subbasin: 3.2 AF per year.
- Greater Lake Washington subbasin: 1.8 AF per year.
- Seattle Lake Union subbasin: 0 AF per year.

Performance goals and measures.

The performance goals are to increase water storage in the glacial or alluvial aquifer adjacent to the subject stream(s) by infiltrating 181 AF per year through the MAR facility to improve baseflow in the subject stream(s). The performance measures will be an increase in baseflow in the subject stream, especially during the critical flow period. The increased baseflow should have the added benefit of reducing water temperatures in the river.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The Little Bear Creek subbasin drains to the Sammamish River Valley. Streams and tributaries in the Little Bear Creek subbasin are inhabited by numerous fish species, including Sockeye Salmon, fall Chinook Salmon, Coho Salmon, Coastal Cutthroat Trout, winter steelhead, and kokanee salmon (WDFW 2020). Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration law. MAR is one of the identified project types that could address the new consumptive water use and achievement of NEB. In addition, this project would reduce the amount of treated wastewater that our region sends to Puget Sound and puts water to better use.

The barriers to completion include funding for construction and O&M costs. In addition, the water available for diversion from the Brightwater recycled water pipeline is treated wastewater. The Brightwater plant is an advanced treatment facility that combines standard biological wastewater treatment with membrane filters to produce higher quality water that is seven to ten times cleaner than typical secondary treated wastewater. After disinfection, water is 99 percent cleaner than when it came into the treatment plant. Brightwater recycled water currently is used for irrigation of golf courses, soccer fields and farms, as an alternative to irrigating with drinking water. It is also used for environmental projects wherever it is available. However, despite the advanced treatment technology, it is anticipated that, as a component of project feasibility evaluation, water quality will be evaluated, and a geochemical compatibility analysis will be conducted to evaluate the potential for water quality degradation.

Potential budget and O&M costs.

No specific MAR site has been selected. Currently, recycled water is only available via King County's recycled water pipeline which extends from the Brightwater tunnel alignment in Bothell, south through the Sammamish River Valley to Redmond. However, King County is in the process of designing and constructing additional storage capacity at Brightwater, which would allow for distribution of recycled water to areas proximal to the plant and eventually to other portions of Snohomish County as recycled water infrastructure expands to meet future demand.

Ultimately, the cost of constructing the project will depend on project location and the conveyance infrastructure required to transport recycled water from existing Brightwater conveyance structures to the MAR facility.

Purchase of reclaimed water from King County would be ongoing and dependent on the negotiated rate. Assuming a rate of $0.26 per hundred cubic feet, which was the average reclaimed water rate in Florida in 2005 (King County Department of Natural Resources and

Parks 2008), the potential annual cost for an MAR project that injects 0.5 cfs for a period of 5 months would be approximately $16,850.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the MAR project to maintain the estimated water offset over time and despite changing external conditions (which could include seasonal variation in streamflow, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- The water source would be reliable.
- The rate of diversion would be precisely maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that significantly reduces the project offset.
- Land use changes external to the project site would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be resilient to the potential impacts of climate change based on the following:

- Project function would not be impacted by summer drought conditions.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the MAR site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase would not impact project function.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Washington Water Trust is a potential sponsor for this project.

Documentation of sources, methods, and assumptions.

Department of Ecology. 2019a. Final Guidance for Determining Net Ecological Benefit. GUID-2094 Water Resources Program Guidance. Publication 19-11-079. July 2019.

Department of Ecology. 2019b. Streamflow Restoration Competitive Grants, 2020: Guidance for project applicants. Publication 19-11-089. Revised December 2019. https://fortress.wa.gov/ecy/publications/documents/1911089.pdf

GeoEngineers, Inc. (GeoEngineers). 2020. WRIA 8 Consumptive Use Estimates. Technical memorandum prepared for Washington State Department of Ecology. November 2020.

King County Department of Natural Resources and Parks. 2008. Reclaimed Water Feasibility Study. March. 185 p.

Washington State Department of Fish and Wildlife (WDFW). 2020. Salmonscape Mapping of Fish Distribution. http://apps.wdfw.wa.gov/salmonscape/

WRIA 8 – Water Right Project Opportunity Profile
Wayne Golf Course Water Right Acquisition (Pre-identified No. 7)

Project Summary (8-SRV-W2)

FLOW BENEFIT: Additional .005 cfs in 1.8 miles of Sammamish River mainstem downstream to Lake Washington.

PRIORITY SUBBASIN: Sammamish River Valley

ESTIMATED OFFSET: 3.54 AFY consumptive

PRIORITY DATE(S): 07/26/1949, 07/01/1974

SOURCE AND PURPOSE: Surface water for irrigation.

PERIOD OF USE: Seasonally from April 15th – October 1st and seasonally during irrigation season.

WRIA 8 INSTREAM FLOW RULE (1979): Sammamish River is closed to further consumptive appropriation[1]

ESA LISTED FISH: Spring/Summer/Fall Puget Sound Chinook (Threatened), Puget Sound/Strait of Georgia Coho (Species of Concern), Winter/Summer Puget Sound steelhead, Bull Trout (Threatened)

OUTREACH STATUS: Interested

Project Description

The land and an underlying a portion of the water right was previously used as a golf course, which according to online news sources, closed in 2017. The other active irrigation within the water rights places of use occurs on a city park. The property is located within the City of Bothell. The parcels comprising the golf course property, were used as a golf course from 1931-2017. Forterra purchased the property in 2016 for permanent protection as a parkland. The City of Bothell purchased the property from Forterra in 2017 with assistance from King County, which now holds a conservation easement over the property. With the property change, there may be an opportunity for a water rights acquisition. Ecology has conducted initial outreach to

[1] Chapter 173-508 WAC

the water right holder. The water right holder has temporarily donated the water rights to the Trust Water Rights Program (TWRP) until March 31, 2026 and indicated interest in pursuing a permanent donation in the future.

Watershed

The Sammamish River is part of the Sammamish River Valley subbasin. The Sammamish River leaves Lake Sammamish and flows 14 miles before joining Lake Washington. The Sammamish River tributaries include: Little Bear Creek, Cottage Lake Creek, North Creek, Swamp Creek and Wildcat Creek. Water temperature and dissolved oxygen levels have been problems in the Sammamish River with increased flow cited as a solution. The Sammamish River and its tributaries were closed to further consumptive appropriation on the September 06, 1979. [2]

Land Use & Ownership

According to the King County Assessor, the currently land uses are listed as Park, Public (Zoo/Arbor), Vacant (Single Family), Single Family (Residential Use), and the land is zoned R9600 and R4000. These parcels are located within the City of Bothell. Prior to coming into common ownership, these nine parcels totaling 127 acres were owned by separate entities and managed under two separate uses, a public park, and a golf course. A review of the WSDA 2019 Agricultural Land Use map, identifies Developed as the crop group, and sprinklers as the irrigation method. Additionally, portions of the place of use were developed and now part of the Riverbend and Valhalla neighborhoods while other portions are forested. Since these areas are not likely relying on the subject water right, nor owned by the water right holder, they are not discussed in this profile.

[2] Chapter 173-508 WAC

Water Right

Table 1: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Trust Water Temp. Donation	-	0.2 cfs	3/8/2021	Instream Flow	20	Sammamish River
Trust Water Temp. Donation	96 AFY	0.7 cfs	3/9/2021	Instream Flow	48	Sammamish River
Certificate	-	0.2 cfs	07/26/1949	Irrigation	20	Sammamish River
Certificate	96 AFY	0.7 cfs	07/01/1974	Irrigation	48	Sammamish River

These quantities only reflect what is shown on the water right document, and do not represent any beneficial use assessment by Ecology.

Water Right History:

There are two water right certificates with places of use that overlap to cover the entirety of the subject property. The original certificate was issued for the sole purpose of irrigation of 20 acres, has a priority date of 07/26/1949, and asserts 0.2 cfs as the Qi, and no listed Qa. Limited history was available for this right and supporting documents include the application, progress sheet, and certificate. The listed source of this right is the Sammamish River, withdrawn by surface pump.

The second certificate was filed by the owners of the golf course for the purpose of irrigation of 48 acres, and asserts 0.7 cfs and 96 AFY. WRTS lists this use as primary, however, the application materials suggest this certificate is additive to the 07/26/1949 certificate. A Report of Examination (ROE) issued in 1975 did not modify any of the requested quantities. The listed source of this right is the Sammamish River, withdrawn by surface pump.

The water right holder temporarily donated the water rights to the Trust Water Rights Program in March 2021. The Evidence of Use documents submitted with the donation form estimates the consumptive use for the 1949 water right and 1974 water right as 2.682 AFY and 0.861 AFY, respectively.

Metering Records:

There were no metering records available from Ecology.

Conclusion

This project was identified by Ecology as a potential acquisition opportunity. A portion of the land was as a golf course, which ceased operations in 2017. The City of Bothell currently owns the property where King County holds a conservation easement. The City of Bothell owns the other portion of the property, managed as a park. Since initial research on the project, the water right holder temporarily donated the water rights to the TWRP.

No metering documents are in the WRTS database to support use of these water rights. The documents the water right holder submitted to Ecology in support of the temporary donation estimate the consumptive use for both water rights as 3.54 acre-feet per year.[3]

The Pre-identified No. 7 water rights have priority dates of 07/26/1949 and 07/01/1974, which are senior to the establishment of the Cedar-Sammamish Basin Instream Resources Protection Program in 1979. These water rights do not have an instream flow provision listed in their supporting documentation.

[3] This is an estimate of consumptive use quantity provided by the water right holder. An extent and validity determination by Ecology would be required to determine the actual quantity available for permanent acquisition.

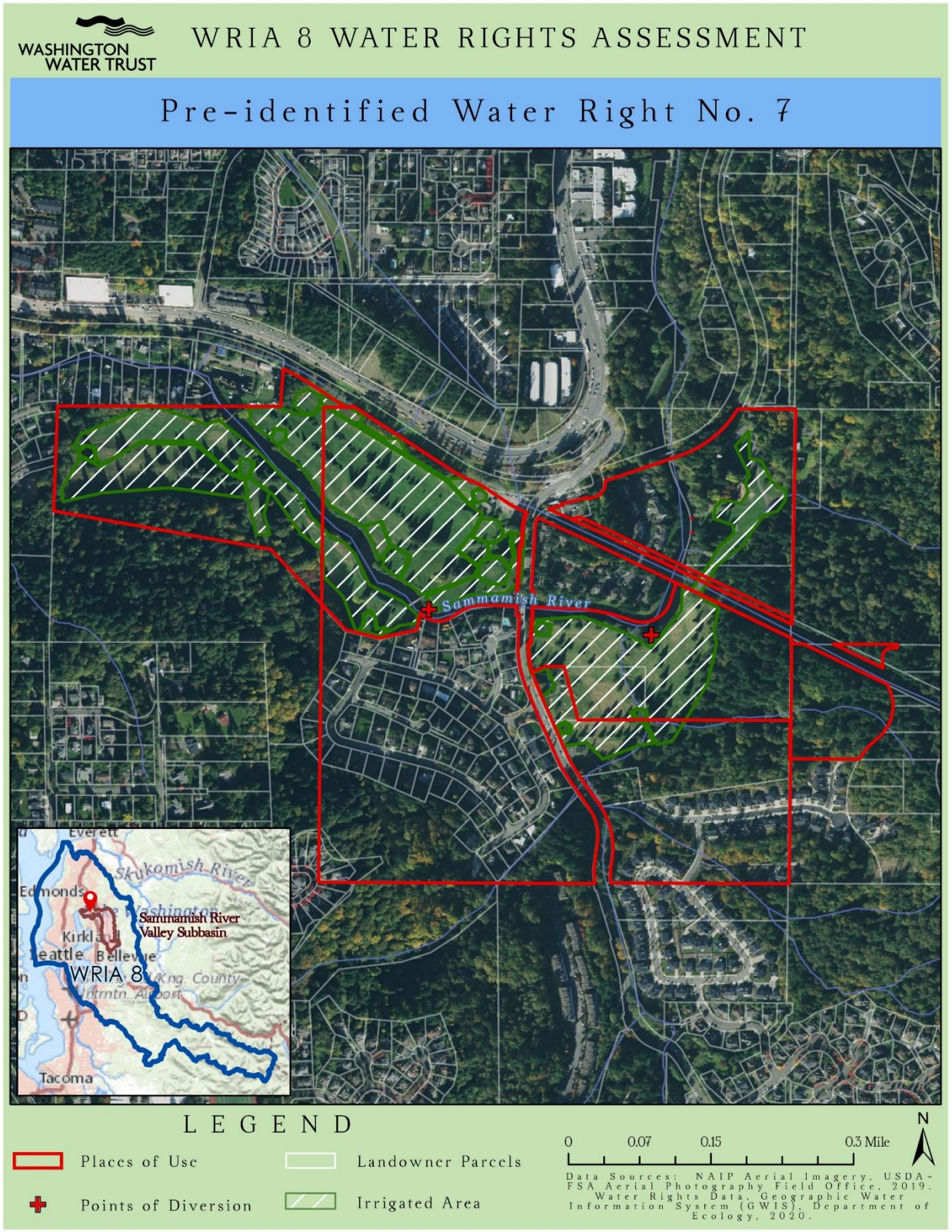

Figure 2: Project Map

WRIA 8 – Water Right Project Opportunity Profile
Sixty Acres Park Water Right Acquisition

Project Summary (8-SRV-W3)

FLOW BENEFIT: Additional 1.0 cfs in Sammamish River which is tributary to Lake Washington.

PRIORITY SUBBASIN: Sammamish River Valley

ESTIMATED OFFSET: 126 AFY consumptive

PRIORITY DATE(S): 7/24/1953, 2/2/1953

SOURCE AND PURPOSE: Surface water for irrigation.

PERIOD OF USE: Seasonally from April 15th – October 1st.

WRIA 8 INSTREAM FLOW RULE (1979): Sammamish River and its tributaries are closed to further consumptive appropriation.[4]

ESA LISTED FISH: Spring/Summer/Fall Puget Sound Chinook Salmon (Threatened), Puget Sound/Strait of Georgia Coho Salmon (Species of Concern), Winter/Summer Puget Sound steelhead (Threatened), Bull Trout (Threatened)

OUTREACH STATUS: Interested

Project Description

The property is comprised of a North and South Park, and is located about 3 miles north of Redmond. There are two surface water rights associated with the property, one associated with the North Park property and one associated with the South Park property. The combined 1.0 cfs and 200 AFY demonstrate the paper water right of the two certificates, but make no determination as to the "wet" water right or the amount actually used for irrigation. The total irrigated land attributed to the two surfaces water rights is 100 acres.

Watershed

The Sammamish River is part of the Sammamish River Valley subbasin. The Sammamish River leaves Lake Sammamish and flows 14 miles before joining Lake Washington. Sammamish River tributaries include: Little Bear Creek, Cottage Lake Creek, North Creek, Swamp Creek, and

[4]Chapter 173-508 WAC

Wildcat Creek. Water temperature and dissolved oxygen levels have been problems in the Sammamish River with increased flow cited as a solution. The Sammamish River and its tributaries were closed to further consumptive appropriation on the September 06, 1979.[5]

Land Use & Ownership

In 1968, King County acquired this property and converted farmland to the Park it is today. The property is currently owned by King County and is administered by the Department of Natural Resources and Parks. According to the King County Assessors, the North Park parcel is 60 acres and the South Park parcel is 34.28 acres. Current land use for both parcels is listed as Vacant (Single-family) with zoning designated as A10 for the North Park and UR for the South Park. According to online sources, the two Parks include twenty-five well-maintained grass fields used for a multitude of sports, activities, and special events. Adjacent to the fields are parking lots, restrooms, and a covered picnic area. King County leases the property and the use of the North Park surface water right to the Lake Washington Youth Soccer Association (LWYSA) for its youth soccer program.

Irrigation delineation estimates as much as 35.5 irrigated acres in the North Park and 24 irrigated acres in the South Park. This estimate excludes the place of use areas that are not used for athletic fields and not owned by King County.

Table 2: Delineated irrigation in each year (2013, 2015, 2017, 2019)

Year	Total Irrigated Acres (Med/High Confidence)
2013	59.5
2015	59.5
2017	59.5
2019	59.5

[5] Chapter 173-508 WAC

Water Right

Table 3: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Certificate (S1-*12464CWRIS)	120	0.6 cfs	7/24/1953	Irrigation	60	Sammamish River
Certificate (S1-*12021CWRIS)	80	0.4 cfs	2/2/1953	Irrigation	40	Sammamish River

These quantities only reflect what is shown on the water right document, and do not represent any beneficial use assessment by Ecology.

Water Right History:

The certificate (S1-*12464CWRIS) with a 7/24/1953 priority date was issued for the purpose of irrigation of 60 acres with a Qi of 0.6 cfs and a Qa of 120 AFY. Water is sourced by a surface water pump from the Sammamish River, which is tributary to Lake Washington. King County acquired this property in 1968 and converted the farmland into a park.

According to Ecology's Water Rights Tracking System (WRTS), King County Natural Resources and Parks submitted a seasonal change application that was accepted by Ecology in 2019. King County proposed a 2020 seasonal transfer of 8 ac-ft. from the currently authorized point of diversion and place of use, to a point of diversion downstream that will serve the county-owned farm, Sammamish River Farm. The Seasonal Change Authorization shall remain in effect until October, 1 2020, unless revoked sooner by Ecology. King County plans to continue to seasonally transfer some portion of this right downstream until recycled water or another feasible water source is available at the Sammamish Farm.

Under an agreement reached in August 2015, King County's Wastewater Treatment Division is committed to permanently supplying LWYSA with up to 24.55 AFY of recycled water through a pipeline from the Brightwater Treatment Plant in Woodinville. The recent use of recycled water for irrigation supply at Sixty Acres Park has therefore reduced the volume of water historically pumped from the Sammamish River, thus freeing up water for the above mentioned transfer.

The certificate (S1-*12021CWRIS) with a 2/2/1953 priority date was issued for the purpose of irrigation of 40 acres with a Qi of 0.4 cfs and a Qa of 40 AFY. Water is sourced by a surface water pump from the Sammamish River, which is tributary to Lake Washington. King County

acquired this property in 1968 and converted the farmland into a park. According to WRTS, there have been no changes made to this right.

There is still debate about whether or not these water rights should be considered municipal water rights, and thus protected from relinquishment. Though their beneficial use (irrigation of a county park) counts as an appropriate beneficial use for a municipal water right, it was not the original purpose of the water right. To be considered a municipal water right, King County would have to officially change the certificate through the Department of Ecology.

Metering Records:

No metering records were available for these rights.

Conclusion

While the sum of the irrigable acres authorized by these water rights documents is 100 acres, the irrigation delineation suggests as much as 59.5 irrigated acres in the most recent 5 year period. The place of use for both certificates extends beyond King County's parcels and covers land that is not being irrigated. Therefore, through an aerial assessment that analyzed irrigation activity in 2013, 2015, 2017, and 2019, the irrigation delineation was determined as the 59.5 acres of athletic fields.

Without available metering records, the consumptive use was calculated in an analysis done by King County. King County's consultants calculated the seasonal average daily irrigation flowrate using an average irrigation rate of 0.33 mgd/100 acres and 75% efficiency or approximately one inch per acre per week.[6] The average annual consumption of water for irrigation was estimated to be 76 acre-feet for the North Park and 50 acre-feet for the South Park.[7] Based on the delineation of 59.5 irrigated acres and King County's calculations, the total estimated quantity available for transaction is 126 AFY. [8]

The Sixty Acres Park water rights were identified King County as a potential source to donate, showing an intent and interest of the property owner in pursuing this project. Follow-up conversations with King County regarding the status of the certificates as municipal rights and validity of the certificates is recommended.

The water rights have priority dates of 7/24/1953 and 2/2/1953, which are senior to the establishment of the Cedar-Sammamish Instream Resources Protection Program in 1979.

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[6] King County Department of Natural Resources and Parks, Wastewater Treatment Division, October 2005, *Reclaimed Water Backbone Project Draft White Paper.*

[7] One (1) acre-foot is 326,000 gallons approximately. The assumed irrigation season comprises 150 days between May and September, annually.

[8] This is only an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

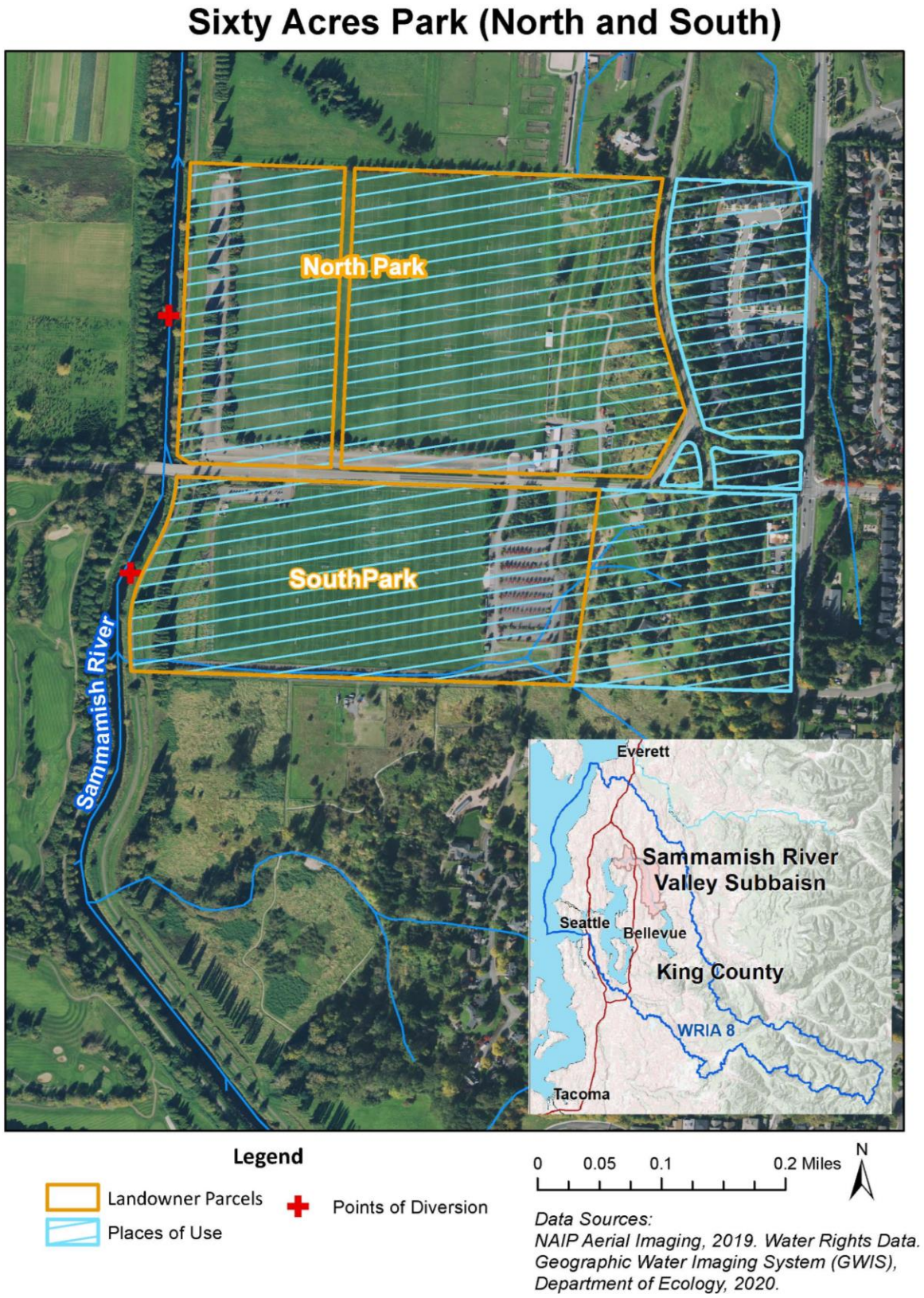


Figure 3: Project Map

WRIA 8 – Water Right Project Opportunity Profile
Pre-identified No. 8 Water Right Acquisition

Project Summary (8-SRV-W4)

FLOW BENEFIT: Additional 0.467 cfs in 7.4 miles of Sammamish River mainstem downstream to Lake Washington.

PRIORITY SUBBASIN: Sammamish River Valley

ESTIMATED OFFSET: 23.43 AFY consumptive

PRIORITY DATE(S): Claimed first use 1910, claimed first use 1974

SOURCE AND PURPOSE: Surface water for irrigation and stockwater.

PERIOD OF USE: Year-round.

WRIA 8 INSTREAM FLOW RULE (1979): Sammamish River is closed to further consumptive appropriations[9]

ESA LISTED FISH: Spring/Summer/Fall Puget Sound Chinook Salmon (Threatened), Puget Sound/Strait of Georgia Coho Salmon (Species of Concern), Winter/Summer Puget Sound steelhead (Threatened), Bull Trout (Threatened)

OUTREACH STATUS: Initial

Project Description

There are three water rights appurtenant to the parcels owned by this entity. These parcels are located within the city limits of Woodinville. Two of the three water right places of use also encompasses an adjacent property that is owned and managed by a separate entity. This project opportunity excludes that portion of that place of use owned by a separate entity, discussed in a separate profile. Shared used of this water right between these two entities may make it difficult to understand how much water has been used under each operation. Prior to this acquisition, these parcels were under common ownership and management with the other parcels within the place of use, and were operated as a farm. The other water right claim appurtenant to this property covers an area that appears to be completely forested. The land under common management for this project opportunity is comprised of five parcels totaling 92.93 acres. Online sources indicate these parcels were purchased by the current owners and

[9] Chapter 173-508 WAC

developed into a winery and vineyard in 1976. Due to proximity to the Brightwater Treatment Plant recycled water central service line, there may be potential for a source switch to recycled water. The cultivation of edible food crops and willingness to use recycled water may create a barrier to a recycled water source switch. There may be landscape irrigation needs on site as well. Washington Water Trust, King County Recycled Water and Washington State University are currently engaged in a project to assess and increase the viability of recycled water as an irrigation source. Any outreach on these water right(s) should defer to the ongoing efforts of the above project, WWT and King County. Given the parcel location within the City of Woodinville, a municipal supply source switch may also be an option. Additional documentation supporting beneficial use will be necessary to more accurately determine potential consumptive offset quantity available. Initial contact with the landowner has been made by King County Recycled Water.

Watershed

The Sammamish River is part of the Sammamish River Valley subbasin. The Sammamish River leaves Lake Sammamish and flows 14 miles before joining Lake Washington. Sammamish River tributaries include: Little Bear Creek, Cottage Lake Creek, North Creek, Swamp Creek, and Wildcat Creek. Water temperature and dissolved oxygen levels have been problems in the Sammamish River with increased flow cited as a solution. The Sammamish River and its tributaries were closed to further consumptive appropriation on September 06, 1979.[10]

Land Use & Ownership

According to the King County Assessor, the current land-use is Industrial (Light) and Vacant (Single-family), and zoned as Industrial and R-4 Residential. The portion of the land under common ownership has been continuously operated as a vineyard/winery since it opened in 1976. Communication with King County Natural Resources indicate the parcels managed by this entity are not enrolled in the King County Farmland Preservation Program. A review of the WSDA 2019 Agricultural Land Use map, identifies no crop type on the property. Irrigation delineation indicates that as much 12.4 acres were irrigated in 2019. Although it is possible that the difference of estimated irrigated acres between years analyzed may be explained as the result of the timing of the aerial photograph, specific water use practices or from sufficient causes for non-use (RCW 90.14.140), which would be best understood through direct conversation with the water user.

[10] Chapter 173-508 WAC

Table 4: Delineated irrigation in each year (2013, 2015, 2017, 2019)

Year	Total Irrigated Acres (Med/High Confidence)
2013	5.1
2015	5.1
2017	5.1
2019	12.4

Water Right

Table 5: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Long Form Claim	24 AFY (claimed)	200 gpm (claimed)	1910 (claimed)	Irrigation, fire protection, stock watering, cleaning barns	12	Unnamed creek
Long Form Claim	26 AFY (claimed)	140 gpm (claimed)	1910 (claimed)	Domestic Supply and Irrigation	-	Spring-fed reservoir
Long Form Claim	7 AFY (claimed)	10 gpm (claimed)	1974 (claimed)	Domestic Supply and Irrigation	7	Spring

These quantities only reflect what is shown on the water right document, and do not represent any beneficial use assessment by Ecology.

Water Right History:

The original claim was filed 12/23/1973 and asserted 200 gpm continuously totaling 24 AFY for the purposes of irrigation of 12 acres, fire protection, stock watering, and cleaning barns. Ecology lists the priority date as “date first use” which according to the claim form is 1910. The water is diverted via headworks installed in a creek. There are no additional documents suggesting changes to this water right.

The second claim was filed 01/23/1974 and asserted 140 gps continuously totaling 26 AFY for the purposes of domestic supply, irrigation, and “milk barn.” Ecology lists the priority date as “date first use” which according to the claim form is 1910. The water is diverted via headworks installed in what is described as a spring-fed reservoir. There are no additional documents suggesting changes to this water right.

The third claim was filed 12/28/1973 and claimed 10 gpm continuously totaling 7 AFY for the purposes of irrigation of 7 acres and domestic supply. Ecology lists the priority date as “date

first use" which according to the claim form is 1974. The water is diverted via headworks. There are no additional documents suggesting changes to this water right.

Metering Records:

Ecology issued an Administrative Order dated 6/7/2002, ordering the water right holder to comply with metering actions described in Chapter 13-173 WAC. Communication with the Ecology Metering Coordinator revealed metering records for these rights were unavailable in the database.

Conclusion

This project was identified by Ecology as a potential acquisition opportunity. Initial conversations have occurred between King County and the landowner. There are three claims appurtenant to this property, all of which present challenges for acquisition. The places of use associated with the 1910 claims encompass property under different ownership and management. It may be difficult to determine to what extent these rights have been exercised by both parties. Additionally, aside from irrigation of 12 acres, these rights assert stock watering, fire protection, and cleaning barns as purposes of use. No metering records were available to indicate water use under these rights. The third water right mapped place of use appears to be completely forested. Irrigation and domestic use are listed as the purposes for this right. No metering records were available to indicate water use under this right. The production portion of the property is currently a vineyard/winery, and has been operated as such since it opened in 1976. There is a possibility that one or both of these rights are used to support wine production and a de facto change of use may have occurred. Ecology will have to make the determination if this is the case.

Four years of irrigation delineations were undertaken (2013, 2015, 2017, 2019) which estimate as much as 12.4 irrigated acres. Although it is possible that the difference of estimated irrigated acres between years analyzed may be explained as the result of the timing of the aerial photograph, specific water use practices or from sufficient causes for non-use (RCW 90.14.140), which would be best understood through direct conversation with the water user. Due to a lack of metering records, WWT utilized these delineations to estimate the potential consumptive use quantity that may be available to serve as an offset. Review of aerial imagery suggests the irrigated portion of the property appears to be primarily grass/turf. The estimate is developed based on the turf/pasture water duty (20.01 inches) found in the Washington Irrigation Guide (Seattle-Tacoma station, Appendix B) and irrigation method is assumed to be sprinkler (75% irrigation efficiency, 10% application efficiency).

- Based on the irrigation delineation of 12.4 acres and assuming turf/pasture, and sprinkler irrigation, 23.43 AFY consumptive is the estimated quantity available for trust water transaction.[11]

The Pre-identified No. 8 water rights have claimed first use priority dates of 1910 and 1974, which is senior to the establishment of the Cedar-Sammamish Basin Instream Resources Protection Program in 1979. These water rights do not have instream flow provisions listed in supporting documentation.

[11] This is only an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

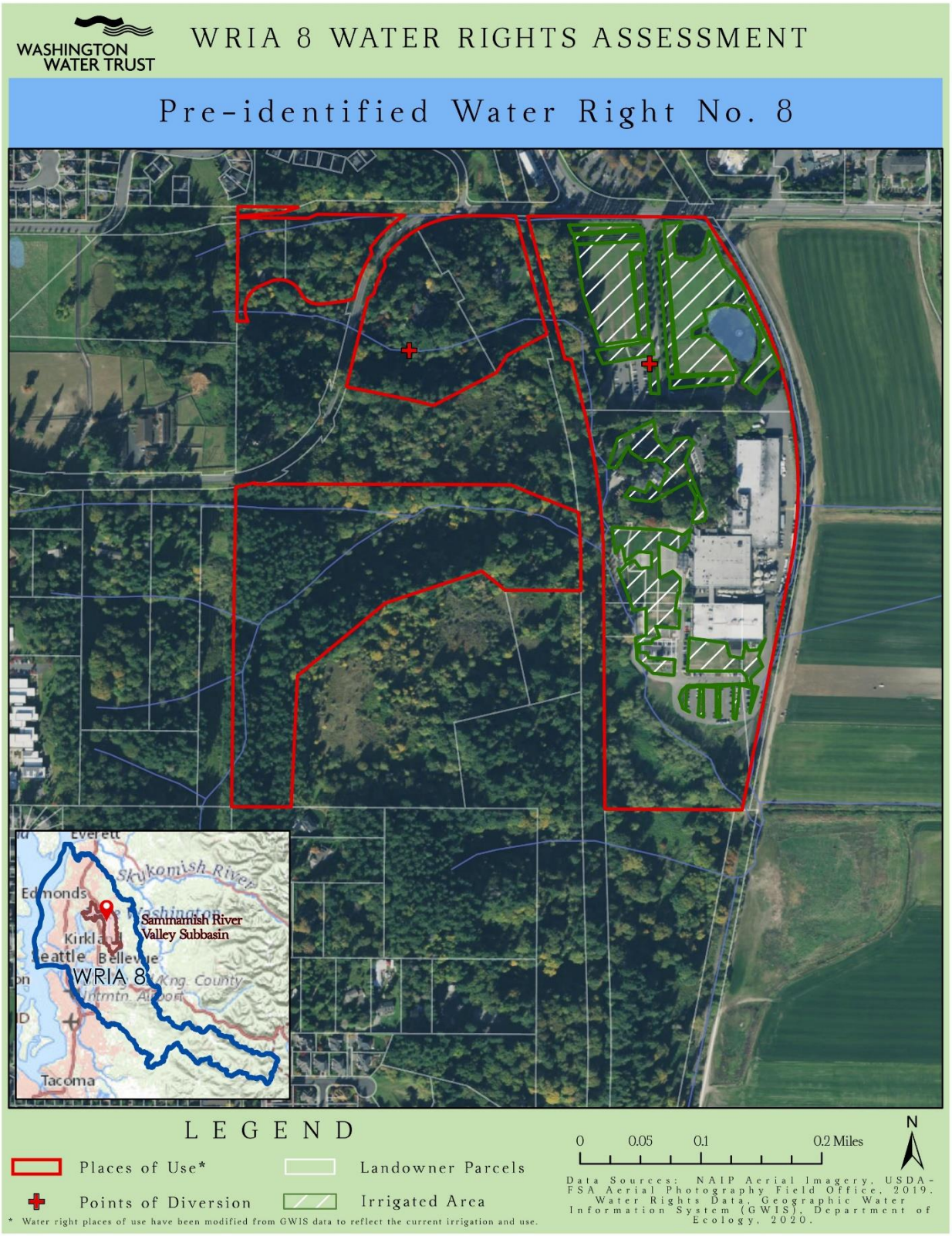


Figure 4: Project Map

WRIA 8 – Water Right Project Opportunity Profile
Sammamish River Valley No. 3 Water Right Acquisition

Project Summary (8-SRV-W5)

FLOW BENEFIT: Additional 1.65 cfs in 7.4 miles of Sammamish River mainstem downstream to Lake Washington.

PRIORITY SUBBASIN: Sammamish River Valley

ESTIMATED OFFSET: 551.83 AFY consumptive

PRIORITY DATE(S): 03/29/1947, 07/09/1965, Pre-1901 (claimed)

SOURCE AND PURPOSE: 1-4) Surface water for irrigation; 5) surface water for irrigation, domestic multiple, and stockwater; 6) surface water for stockwater and irrigation; 7) surface water for irrigation, domestic multiple, and stockwater; 8-14) surface water for irrigation; 15) surface water for irrigation, domestic multiple, and commercial and industrial.

PERIOD OF USE: 1) Seasonally from June – September; 2) seasonally from April 1st – October 31st; 3) seasonally during irrigation season; 4) seasonally from April 1st – October 1st; 5-15) year-round.

WRIA 8 INSTREAM FLOW RULE (1979): Sammamish River is closed to further consumptive appropriation.[12]

ESA LISTED FISH: Spring/Summer/Fall Puget Sound Chinook Salmon (Threatened), Puget Sound/Strait of Georgia Coho Salmon (Species of Concern), Winter/Summer Puget Sound steelhead (Threatened), Bull Trout (Threatened)

OUTREACH STATUS: Initial

Project Description

The property is located approximately 4 miles northwest of the City of Redmond. There are fifteen water right documents with congruent or overlapping places of use, held by the water right holder. Discussions with Ecology revealed that twelve of these are 1997-1998 era claims.

[12] Chapter 173-508 WAC

Pursuant RCW 90.14.068, claims filed during this period are subordinate to any water right (permit, certificate, or claim) filed prior to July 27, 1997. Therefore, these claims are junior to the Cedar-Sammamish instream flow and thus not discussed further in this profile. Additional analysis of these rights would be necessary to determine their project potential. The three remaining rights appurtenant to the property have likely been used to irrigate the property since the farm's establishment prior to 1910, according to online sources. The property is in close proximity to the central service line for recycled water. In previous contact with the land user by Washington Water Trust (WWT), they have expressed interest in learning more about the possibility of switching to recycled water. Additional information regarding the suitability of recycled water and cost associated with the switch to this source are potential barriers to this transaction with this user.

Watershed

The Sammamish River is part of the Sammamish River Valley subbasin. The Sammamish River leaves Lake Sammamish and flows 14 miles before joining Lake Washington. The Sammamish River tributaries include: Little Bear Creek, Cottage Lake Creek, North Creek, Swamp Creek, and Wildcat Creek. Water temperature and dissolved oxygen levels have been problems in the Sammamish River with increased flow cited as a solution. The Sammamish River and its tributaries were closed to further consumptive appropriation on the September 06, 1979.[13]

Land Use & Ownership

These parcels are located in the King County designated Agriculture Production District. Communication with King County Natural Resources indicate three of the four parcels managed by this entity are dually enrolled in the King County Farmland Preservation, and Farm and Ag incentive programs. [14] The fourth parcel is also enrolled in the Farm and Ag incentive program. According to the King County Assessor, the current land-use is Agricultural and the parcels are zoned as A10-Agricultural. The landowner holds four parcels totaling 401.87 acres. The smallest of these parcels is non-contiguous, located in the City of Kirkland jurisdiction, zoned RSA1 and completely forested. No agriculture appears to occur on this parcel. Review of the WSDA 2019 Agricultural Land Use map identifies turf grass as the crop type on irrigated portions of the property. Irrigation delineation suggests as much as 320.6 irrigated acres in 2019. The current operators lease the two larger parcels from the landowners. Underlying one of the water right documents, there is a portion of land owned and managed by a separate entity. At Ecology's request, this property is separately reviewed.

[13] Chapter 173-508 WAC.

[14] https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/rural-regional-services-section/agriculture-program/farmland-preservation-program.aspx

Table 6: Delineated irrigation in each year (2013, 2015, 2017, 2019)

Year	Total Irrigated Acres (Med/High Confidence)
2013	311.3
2015	311.3
2017	314.7
2019	320.6

Water Right

Table 7: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Certificate	-	0.8 cfs	03/29/1947	Irrigation	80	Sammamish River
Certificate	96 AFY	0.4 cfs	07/09/1965	Irrigation	200	Sammamish River
Claim Long Form	24 AFY	0.45 cfs	1910 (claimed)	Irrigation, Fire protection, Stockwatering, Cleaning Barns	12	Sammamish River

These quantities only reflect what is shown on the water right document, and do not represent any beneficial use assessment by Ecology.

Water Right History:

The original certificate has a priority date of 03/29/1947 for the purpose of irrigation of 80 acres, with 0.8 cfs listed as the Qi and no listed Qa. This certificate has a metering order from Ecology, dated 06/04/2002. The source of this right is the Sammamish River with water diverted to the property via a surface water pump.

The second certificate has a priority date of 07/09/1965 for the purpose of irrigation of 200 acres, with 0.4 cfs listed as Qi and 96 AFY listed as the Qa. During the permit period for this certificate, an ROE directed a reduction in the Qa and Qi listed on the application. Certificated quantities were further reduced from those listed in the ROE. This certificate has a metering order from Ecology, dated 06/04/2002. The source for this right is the Sammamish River with water diverted via two surface water pumps.

The long form claim asserts first use as 1910, a purpose of fire protection, stockwatering, cleaning barns, and irrigation of 12 acres, with 0.45 cfs asserted as the Qi and 24 AFY listed as the Qa. This right has a metering order from Ecology, dated 06/07/2002. A portion of this water right place of use is under different ownership and management, and reviewed separately for Pre-identified Water Right No. 8. The source for this right is a creek, which flows to the Sammamish River. Water is diverted from the creek using head works and a gravity system.

Metering Records:

Metering records are available by request from Ecology from 2006-2019. These records indicate water use from four separate diversions. These diversions serve the two certificates discussed above and two 1997-1998 era claims. These diversions are shared and further analysis is necessary to determine quantities used under each right. Meter records report as much as 326.7 AFY of water use during the last 5 years.

Conclusion

This project was identified by WWT as a potential source switch to recycled water. The land operates as a commercial turf farm. Given the non-edible crop type and the property's proximity to the recycled water central service line, this project shows strong potential to receive recycled water. WWT and King County have conducted initial outreach to the operators of this farm. WWT, King County Recycled Water and Washington State University are currently engaged in a project to assess and increase the viability of recycled water as an irrigation source. Any outreach on these water right(s) should defer to the ongoing efforts of the above project, WWT and King County.

The three rights discussed in this profile and the twelve additional 97-98 era claims present a complexity to fully understanding the quantity and validity of water rights appurtenant to this property. Quantities claimed on the 1997-1998 era claims appear excessive (e.g. Qa 36,500 AFY, Qi 50 cfs). Additionally, incomplete metering records provide data for only four of the fifteen rights. Further due diligence is required to fully understand the extent of water use on this property.

Four years of irrigation delineations were undertaken (2013, 2015, 2017, and 2019) which estimate as much as 320.6 irrigated acres. Consistent irrigation across years examined led WWT to utilize irrigation delineations to estimate the potential consumptive use quantity that may be available to serve as an offset. The estimated irrigation acreage was reduced to align with the total irrigated acreage under the three subject water rights. Since the property use is known (turf farm) an estimate is developed based on the turf/pasture water duty (20.01 inches) found in the Washington Irrigation Guide (Seattle-Tacoma station, Appendix B) and irrigation method is assumed to be sprinkler (75% irrigation efficiency, 10% application efficiency).

- Based on the three water rights documents listed above which authorize or assert 292 acres of irrigation, and assuming turf/pasture, and sprinkler irrigation, 551.83 AFY consumptive is the estimated quantity available for transaction.[15]

The Sammamish River Valley No. 3 water rights have priority dates of 03/29/1947, 07/09/1965, and Pre-1901 (claimed), which are senior to the establishment of the Cedar-Sammamish Instream Resources Protection Program in 1979.

[15] This is only an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

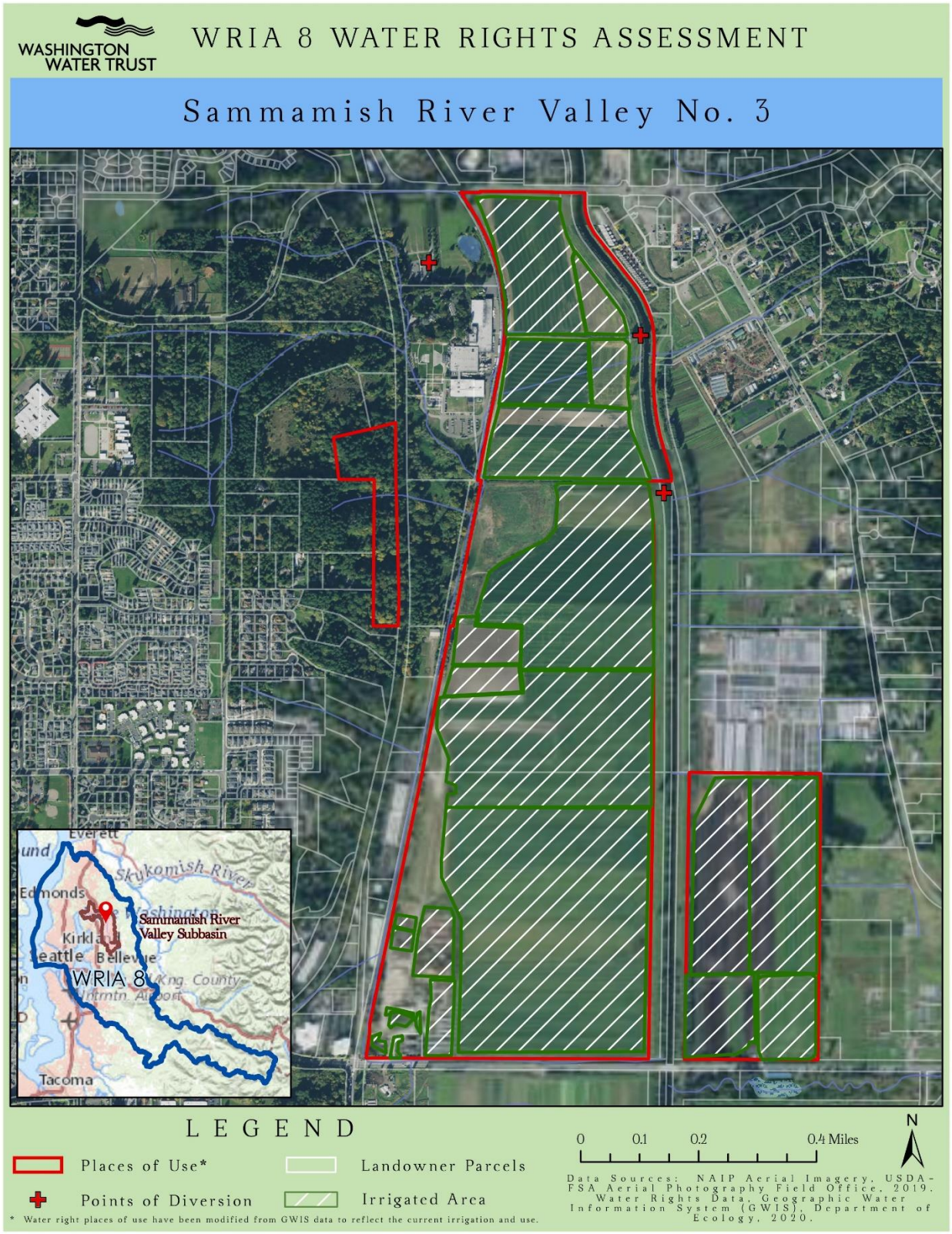


Figure 5: Project Map

Sammamish River Valley Recycled Water Managed Aquifer Recharge

Project Name and Number

Sammamish River Valley Recycled Water Managed Aquifer Recharge (8-SRV-W6)

WRIA 8 WRE Subbasin

Sammamish River Valley

Water Offset

~181 acre-feet/year

Narrative Description

This project involves using recycled water for managed aquifer recharge (MAR). This project would augment stream flows by increasing surficial aquifer discharge to the Sammamish River above what occurs under existing conditions. The project concept includes diverting recycled water from the existing Brightwater recycled water pipeline, which extends from the Brightwater tunnel alignment in Bothell, south through the Sammamish River Valley to Redmond. Brightwater currently distributes reclaimed water from May to October, but recycled water may also be available year-round, if needed. Diverted water would be conveyed from the recycled water pipeline and piped to a constructed MAR facility. This diverted water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to the Sammamish River as re-timed groundwater baseflow. The goal of the project is to increase baseflow to the Sammamish River by recharging the aquifer adjacent to the river and providing additional groundwater discharge to the river through MAR.

The project should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

A specific project site has not yet been identified, however, there are several suitable sites near the existing pipeline and in the WRIA 8 Sammamish River Valley subbasin.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The proposed recycled water MAR facility will result in streamflow benefits to the Sammamish River by diverting and temporarily storing recycled water into the shallow alluvial aquifer. The project is currently conceptual, but anticipates the ability to divert recycled water from the

existing pipeline at a rate of approximately 0.5 cubic feet per second (cfs) for six months (May through October). The goal is to increase streamflow, especially during months when demand for water is highest and surface flows are generally lowest (June through August). The proposed MAR facility will infiltrate recycled water into the shallow aquifer and provide increased baseflow to the Sammamish River and its tributaries, depending on where the facility is sited. The anticipated offset volume for this project is 181 acre-feet (AF) per year. The offset volume is calculated based on the quantity of water infiltrated annually, as described below.

United States Geologic Survey mapping in the area suggests that alluvium deposits are present at the proposed locations (Minard 1983, 1985). United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil maps indicate the sites are underlain by Snohomish silt loam, Tukwila muck, and Earlmont silt loam soils with an average saturated hydraulic conductivity (Ksat) ranging from 0.39 to 1.28 inches per hour (USDA 2020). For planning purposes, Ksat is assumed to be equivalent to infiltration rate. Site-specific data were not available so a safety factor of two was applied to the raw Ksat value to derive a corrected infiltration rate ranging from 0.19 to 0.63 inches per hour. Assuming water will be diverted between May 1 and October 31 every year (183 days), the annual diversion volume is estimated to be 181 AF per year using Equation 1:

Annual Volume = Diversion Rate x Duration of Diversion Equation 1

It is anticipated that the MAR facility would be constructed as a buried infiltration gallery or open pond, but design details will be further developed at a later time. Year-round groundwater baseflow will be added to actual streamflow in the Sammamish River if this project is developed. The temporal distribution and absolute value of those benefits will be estimated during the feasibility study that has to be conducted before a MAR project can proceed to construction and operation. Those streamflow augmentation benefits will continue to discharge to the river after each year's storage window closes because of the lag time of water moving through an aquifer and the distance of the flow path to the river. The rate at which the infiltrated water re-enters the river will vary based on in-situ aquifer parameters that will be tested and modeled during the feasibility study.

It is assumed that a site feasibility study will be conducted pursuant with Appendix B of Ecology's Net Ecological Benefit (NEB) guidance (Ecology 2019a) and Appendix D of the Streamflow Restoration grant application requirements, if funding from Ecology is pursued during a future grant round (Ecology 2019b). All values presented in this project description are for planning purposes and may not represent actual site conditions.

Conceptual-level map and drawings of the project and location.

No potential MAR facility site has currently been identified. The attached map provides an overview of Brightwater, the existing recycled water pipeline, and the surrounding area.

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the Sammamish River and downstream subbasins (including the Greater Lake Washington and Seattle Lake Union subbasins).

Location relative to future PE well demand.

The consumptive use estimate for the WRIA 8 Sammamish River Valley subbasin is 3.2 AF per year (GeoEngineers 2020). Consumptive use estimates for subbasins downstream of the Sammamish River Valley subbasin include the following (GeoEngineers 2020):

- Greater Lake Washington subbasin: 1.8 AF per year.
- Seattle Lake Union subbasin: 0 AF per year.

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the Sammamish River by infiltrating 181 AF per year through the MAR facility to improve baseflow in the Sammamish River. The performance measures will be an increase in baseflow in the Sammamish River, especially during the critical flow period. The increased baseflow should reduce water temperatures in the river.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The Sammamish River and tributaries are inhabited by numerous fish species, including summer steelhead, winter steelhead, Coho Salmon, Dolly Varden/Bull Trout, Pink Salmon, Rainbow trout, summer Chinook Salmon, fall Chinook Salmon, fall Chum Salmon, and Coastal Cutthroat Trout (WDFW 2020). Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration law. MAR is one of the identified project types that could address the new consumptive water use and achievement of NEB. In addition, this project would reduce the amount of treated wastewater that our region sends to Puget Sound and puts water to better use.

The barriers to completion include funding for construction and O&M costs. In addition, the water available for diversion from the Brightwater recycled water pipeline is treated wastewater. The Brightwater plant is an advanced treatment facility that combines standard biological wastewater treatment with membrane filters to produce higher quality water that is seven to ten times cleaner than typical secondary treated wastewater. After disinfection, water is 99 percent cleaner than when it came into the treatment plant. Brightwater recycled water is reused on golf courses, soccer fields and farms, instead of using valuable drinking water for

irrigation, and for environmental projects wherever it is available. However, despite the advanced treatment technology, it is anticipated that water quality will be evaluated and a geochemical compatibility analysis will be conducted to ensure no water quality degradation.

Potential budget and O&M costs.

No specific MAR site has been selected. Currently, recycled water is only available via King County's recycled water pipeline which extends from the Brightwater tunnel alignment in Bothell, south through the Sammamish River Valley to Redmond. King County is in the process of designing and constructing additional storage capacity at Brightwater.

Ultimately, the cost of constructing the project will depend on project location and the conveyance infrastructure required to transport recycled water from existing Brightwater conveyance structures to the MAR facility.

Purchase of reclaimed water from King County would be ongoing and dependent on the negotiated rate. Assuming a rate of $0.26 per hundred cubic feet, which was the average reclaimed water rate in Florida in 2005 (King County Department of Natural Resources and Parks 2008), the potential annual cost for an MAR project that injects 0.5 cfs for a period of 5 months would be approximately $16,850.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the MAR project to maintain the estimated water offset over time and despite changing external conditions (which could include seasonal variation in streamflow, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- The water source would be reliable.
- The rate of diversion would be precisely maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that significantly reduces the project offset.
- Land use changes external to the project site would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter

rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be resilient to the potential impacts of climate change based on the following:

- Project function would not be impacted by summer drought conditions.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the MAR site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase would not impact project function.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Washington Water Trust is a potential sponsor for this project.

Documentation of sources, methods, and assumptions.

Department of Ecology. 2019a. Final Guidance for Determining Net Ecological Benefit. GUID-2094 Water Resources Program Guidance. Publication 19-11-079. July 2019.

Department of Ecology. 2019b. Streamflow Restoration Competitive Grants, 2020: Guidance for project applicants. Publication 19-11-089. Revised December 2019. https://fortress.wa.gov/ecy/publications/documents/1911089.pdf

GeoEngineers, Inc. (GeoEngineers). 2020. WRIA 8 Consumptive Use Estimates. Technical memorandum prepared for Washington State Department of Ecology. November 2020.

King County Department of Natural Resources and Parks. 2008. Reclaimed Water Feasibility Study. March. 185 p.

Minard, J.P. 1985. Geologic Map of the Bothell Quadrangle, Snohomish and King Counties, Washington. USGS Miscellaneous Field Map MF-1747, Scale 1:24,000.

Minard, J.P. 1983. Geologic Map of the Kirkland Quadrangle, Washington. USGS Miscellaneous Field Map MF-1543, Scale 1:24,000.

US Department of Agriculture (USDA), 2020. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Washington State Department of Fish and Wildlife (WDFW). 2020. Salmonscape Mapping of Fish Distribution. http://apps.wdfw.wa.gov/salmonscape/

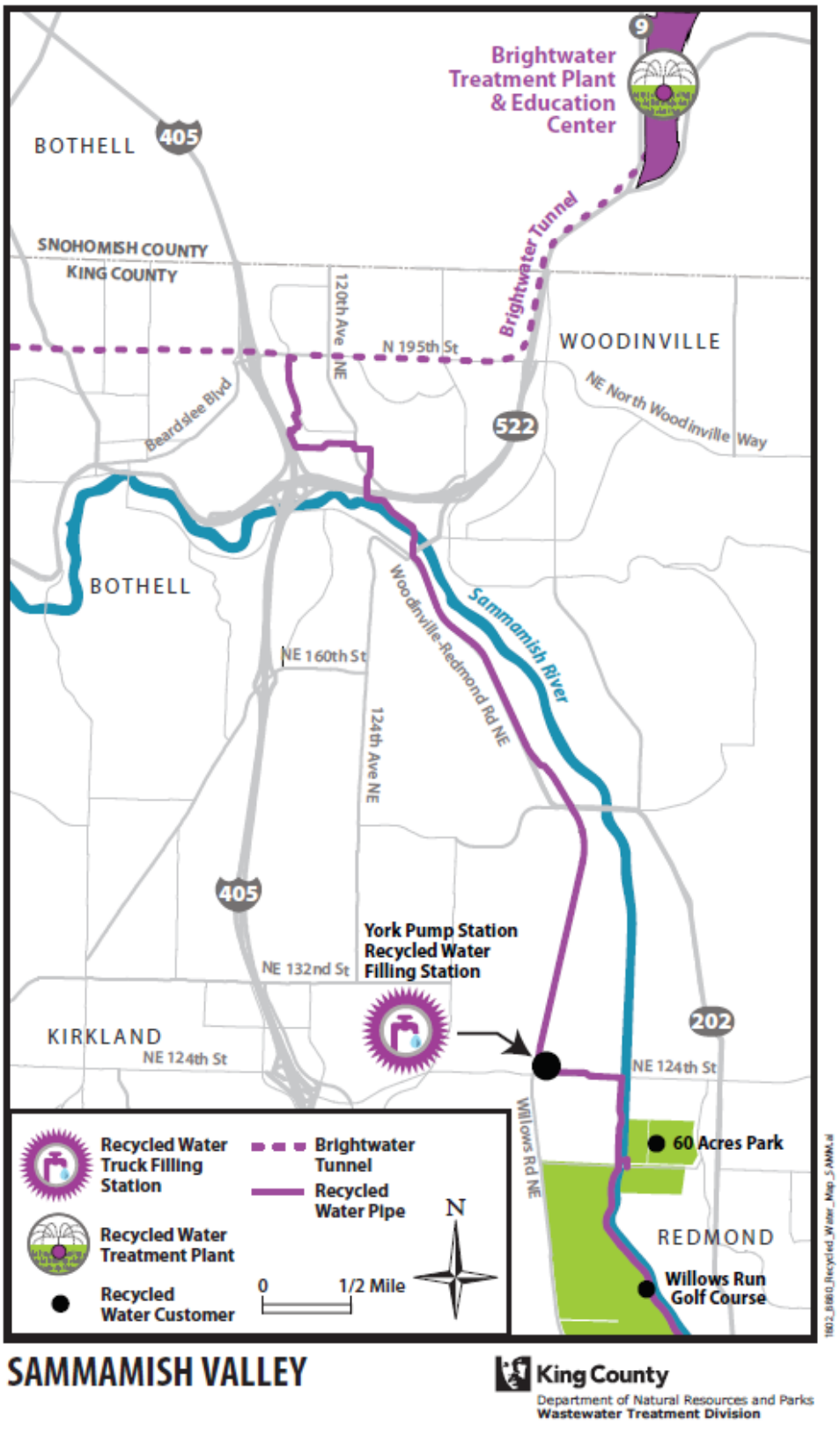


Figure 6: King County Recycled Water Availability Map – Sammamish Valley

WRIA 8 – Water Right Project Opportunity Profile
Pre-identified No. 1 Water Right Acquisition

Project Summary (8-BE-W7)

This water rights acquisition project does not have a detailed project description.

WRIA 8 – Water Right Project Opportunity Profile
Pre-identified No. 4 Water Right Acquisition

Project Summary (8-I-W9)

FLOW BENEFIT: Additional 2.45 cfs in 0.1 miles of East Fork Issaquah Creek, 3 miles of Issaquah Creek, Lake Sammamish, and 14 miles Sammamish River mainstem.

PRIORITY SUBBASIN: Issaquah

ESTIMATED OFFSET: 286 AFY consumptive[16]

PRIORITY DATE(S): 05/16/1974

SOURCE AND PURPOSE: Groundwater for commercial and industrial.

PERIOD OF USE: Year-round.

WRIA 8 INSTREAM FLOW RULE (1979): Issaquah Creek, Lake Sammamish, and Sammamish River are closed to appropriation.[17]

ESA LISTED FISH: Spring/Summer/Fall Puget Sound Chinook Salmon (Threatened), Puget Sound/Strait of Georgia Coho Salmon (Species of Concern), Winter/Summer Puget Sound steelhead (Threatened), Bull Trout (Threatened)

OUTREACH STATUS: Initial

Project Description

The land, and underlying water right, currently support commercial production of dairy products. According to online sources the facility, located in the City of Issaquah's Cultural Business District, has been continuously operated since 1909. As of 7/30/2018, a portion of the annual quantity of the subject water right was temporarily donated to the Trust Water Rights Program. The initial outreach was completed by the Washington Water Trust and the water

[16] The estimated offset is based on the portion of the water right currently donated to the Trust Water Rights Program. As much as 336 afy may be available for donation, which assumes 100% of Qa indicated by metering records is used consumptively.

[17] Chapter 173-508 WAC.

right holder is open to future discussion. Further investigation revealed the water right holder holds a second water right certificate to support operations.

Watershed

Issaquah Creek is within the Issaquah subbasin and a tributary to Lake Sammamish. Issaquah Creek joins Lake Sammamish, which flows into the Sammamish River for 14 miles before joining Lake Washington. Ecology notes that groundwater in the vicinity has direct effect on instream flows and lake levels.

Land Use & Ownership

According to the King County Assessor, the current land-use is listed as Industrial (Gen Purpose) and the land is zoned as CBD (Cultural and Business District) by the City of Issaquah. The land underlying the Pre-identified Water Right No. 4, has been continuously used for production of dairy products since 1909. The property was acquired by its current owners in the early 1960's.

Water Right

Table 8: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Change Application (Withdrawn)	1232 AFY	2.45 cfs	3/1/1999	Fish Propagation	N/A	Groundwater
Trust Water Temporary Donation	286 AFY	0 cfs	7/30/2018	Groundwater Preservation	N/A	Groundwater
Certificate	1232 AFY	2.45 cfs	5/16/1974	Commercial and Industrial	N/A	Groundwater

These quantities only reflect what is shown on the water right document, and do not represent any beneficial use assessment by Ecology.

Water Right History:

The water right certificate of interest was issued for continuous manufacturing at an existing facility. Prior to issuance of this certificate, the facility was served by a surface water right from

the East Fork Issaquah Creek and a groundwater right. Relinquishment of the surface water right was a condition for issuance of the 05/16/1974 groundwater certificate. This certificate is listed as primary and approves an instantaneous quantity of 2.45 cfs totaling 1232 AFY for the purpose of Commercial and Industrial. There was a change application filed 3/1/1999 for this certificate, which was later withdrawn. On 7/30/2018, 286 AFY of this right was temporarily donated to the Trust Water Rights Program for the purpose of groundwater preservation. The water right holder provided metering records with the donation application and noted that 336 AFY were put to beneficial use under this right in the past 5 year period (2013-2017), which may suggest relinquishment of the remaining 896 AFY listed on the certificate. The donation letter requests that 286 AFY be placed in the Trust Water Rights Program and 50 AFY be retained for use. The water right holder retained the full instantaneous quantity and noted on the application that they expect to withdraw the donated portion when plant activities increase to regular levels.

Review of documents associated with the 05/16/1974 certificate revealed the water right holder also holds a second groundwater certificate with a priority date of 04/06/1949. This certificate is listed as primary and approves an instantaneous quantity of 1.11 cfs totaling 405 AFY for the purpose of Commercial and Industrial.

Well Information:

The Ecology Well Report Map contained no information regarding either of the wells serving this right. The ROE for the 1974 right notes that the well was completed in 1937 and is 16 inches in diameter and drilled to a depth of 89 feet. A well report for this right dated 01/16/1996 documents the replacement of the original well completed in 1937. The new well is located 15 feet south of the original well. This well is 16 inches in diameter and was drilled to a depth of 113 feet and completed at a depth of 101 feet. It is noted in the report that the new well is incapable of meeting the certificated instantaneous quantity, and it is recommended that the 1937 well be used as a monitoring well, providing the option for reconstruction to provide increased pumping capacity during summer months.

Metering Records:

Metering records for 2013-2017 were submitted with the donation application. It is noted on this document that there were periods during this time that the well meter failed. Usage for these periods was calculated based on average usage during the same months in different years. As much as 336 acre feet of water use was indicated by these records during this 5-year period. A metering request to Ecology produced no additional metering records.

Conclusion

This project was identified as a potential acquisition opportunity based on a portion of the right being donated to the Trust Water Rights Program. The land use has remained constant since the facility opened in 1909. The 2018 temporary donation of 286 AFY citing a temporary reduction in production quantified total use under this certificate in the most recent 5-year period as 336 AFY. This use history may indicate relinquishment of 896 AFY of the annual

quantity listed on the original certificate. This water right may provide an opportunity for a full or partial transaction.

Potential to return to previous production levels at the facility may create a barrier to permanent acquisition. Additionally, a lack of comprehensive metering documents as well as an understanding of water use practices at this time make it difficult to estimate beneficial use and consumptive quantities. Ultimately, these quantities must be determined by Ecology. Based on the 2018 donation application, 336 AFY (diverted) may be available for transaction. Of this 336 AFY, 286 AFY have been donated to the Trust Water Rights Program through 08/01/2023.

- Based on the water right document which authorizes 1232 AFY (diverted) and the 7/30/2018 donation application suggesting 336 AFY (diverted) of beneficial use at the time of donation, 336 AFY (consumptive) is the estimated quantity available for transaction.[18]

Further due diligence is necessary to determine consumptive quantities associated with this opportunity. The Pre-identified No. 4 water right has a priority date of 05/16/1974, which is senior to the establishment of the Cedar-Sammamish Basin Instream Resources Protection Program (Instream Flow Rule) in 1979. This water right does not have an instream flow provision.

[18] This is only an estimate of consumptive use quantity and assumes 100% consumption for dairy production. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

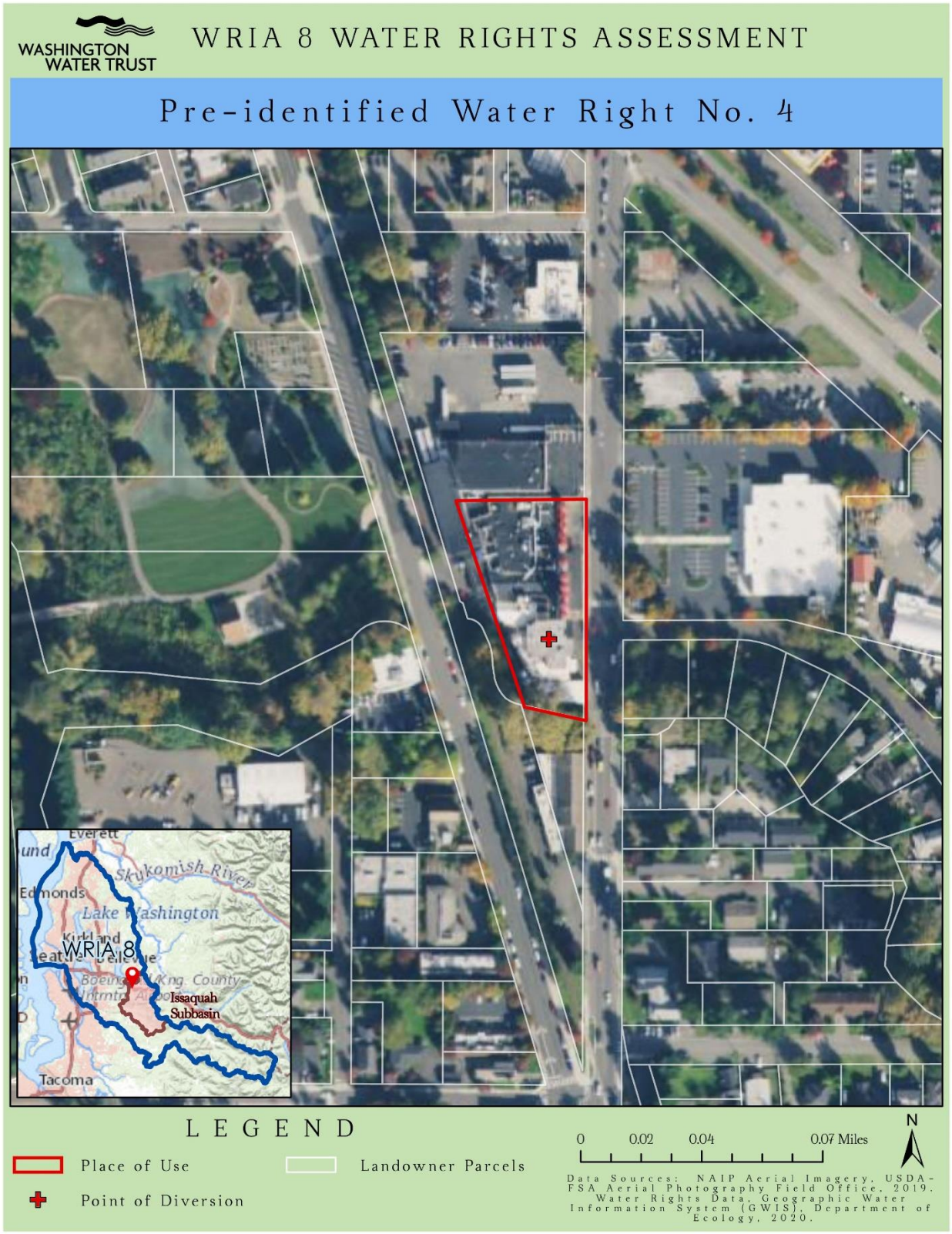


Figure 7: Project Map

Riverbend Mobile Home Park Water Right Acquisition (Pre-identified No. 9)

Project Summary (8-LC-W10)

FLOW BENEFIT: Additional 0.6 cfs in 7.5 miles of the Cedar River mainstem downstream to Lake Washington.

PRIORITY SUBBASIN: Lower Cedar

ESTIMATED OFFSET: 20.079 AFY (consumptive), TBD[19] (perfected), 120 AFY (water right document)

PRIORITY DATE(S): 1/9/1973

SOURCE AND PURPOSE: Groundwater for domestic multiple.

PERIOD OF USE: Year-round.

WRIA 8 INSTREAM FLOW RULE (1979): There is an instream flow established in the Cedar River.[20]

ESA LISTED FISH: Spring/Summer/Fall Puget Sound Chinook Salmon (Threatened), Puget Sound/Strait of Georgia Coho Salmon (Species of Concern), Winter/Summer Puget Sound steelhead (Threatened), Bull Trout (Threatened)

OUTREACH STATUS: Interested

Project Description

The Pre-identified No. 9 water right was included in the WRIA 8 water rights analysis by Ecology request. The land, and underlying water right, were previously used as a mobile home park, and are located 4.5 miles east of the City of Renton. Per communications with Ecology and online records, the property and water right were acquired by King County in 2013. The property was purchased as part of a levee setback and floodplain restoration project. The property change of

[19] At the time of this report no information was available indicating the perfected quantity of this right

[20] Chapter 173-508 WAC

use may provide an opportunity for water rights acquisition. A lack of available metering records create a data gap in determining the portion of the certificate available for transaction. Ecology has been in contact with King County discuss permanent donation of this water right.

Watershed

The Cedar River originates in the Cascade Mountains and flows 45 miles through the Upper and Lower Cedar subbasins to Lake Washington. The Cedar River and its tributaries including Rock Creek and Jones Creek are under restricted appropriation subject to low flow limitations consistent with Chapter 75.20 RCW as of September 06, 1979.[21]

Land Use & Ownership

According to the King County Assessor, the current land-use is listed as Mobile Home Park (18.64 ac) and zoned as RA-5 (Rural Area). There are two parcels in the southeast corner of the water right place of use, which are not part of the mobile home park. These parcels have a current land-use of Single Family (Res Use/Zone) and zoned RA5 (Rural Area 5). The landowner and water right holder also own an adjacent property to the east with a current land use of Vacant (Multi-family) and zoned as RA5 (Rural Area 5). A review of the WSDA 2019 Agricultural Land Use map, identifies no crop type on the property. Irrigation delineation indicates as much as 9.3 acres were irrigated in 2019. These parcels were acquired by King County in 2013 as part of a strategy to address chronic flooding and for floodplain restoration. According to online resources, resident relocation was completed in 2016. Due to the change in use of the property, there may be an opportunity for acquisition of the water right.

Table 9: Delineated irrigation in each year (2013, 2015, 2017, 2019)

Year	Total Irrigated Acres (Med/High Confidence)
2013	0.4
2015	0.5
2017	0
2019	9.3

[21] Chapter 173-508 WAC

Water Right

Table 10: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Certificate	120 AFY	268 gpm	1/9/1973	Domestic Multiple	N/A	Groundwater

These quantities only reflect what is shown on the water right document, and do not represent any beneficial use assessment by Ecology.

Water Right History:

The original water right application was filed 1/9/1973 for continuous community domestic water supply. The initial Report of Examination (ROE) was completed on 4/26/1973 recommended a Qi of 268 gpm and a Qa of 120 AFY for continuous domestic supply for 94 mobile homes and 40 travel trailers. Proof of appropriation was filed 4/14/1975. The certificate was issued 6/30/1975 for the amounts listed in the ROE. It was noted in the ROE that the works were completed prior to the submission of the application. The source of this water right is a well. No applications related to changing this water right are documented in Ecology's Water Rights Tracking System.

Well Information:

The proof of appropriation documentation indicates that the approximate completion date of the well and first use of the water occurred in 1957. The well is 10 inches in diameter and was completed at an estimated depth of 28 feet. Review of Ecology's Well Construction and Licensing tool indicate no additional information is available.

Metering Records:

Communication with the Ecology revealed that no metering records are available for this well.

Conclusion

This project was identified by Ecology as a potential acquisition opportunity. The previous land use was a mobile home park which appears to have fully ceased operations in 2016, making the water potentially available for acquisition. The lack of metering records make beneficial use difficult to quantify. Four years of irrigation delineations were undertaken (2013, 2015, 207, 2019) suggesting as much as 9.3 acres of irrigation occurred as recent as 2019.

Proof of appropriation was filed August 14, 1975. Per RCW 90.03.015(4)(a), this water right meets the criteria for a Group A water system (over 15 connections). Therefore, this right may not be subject to relinquishment as a municipal water right.[22] Determining the portion of the 120 AFY authorized on the certificate that is available for transaction will require a determination of extent and validity by Ecology. Four years of irrigation delineations were undertaken (2013, 2015, 2017, 2019) which indicate areas as much as 9.3 acres were irrigated. Due to lack of meter records, WWT utilized the irrigation delineations and the WRIA 8 Consumptive Use Estimate for indoor consumptive use to estimate the potential consumptive use quantity that may be available to serve as an offset. The irrigation estimate was based on the turf/pasture water duty (20.01 inches) found in the Washington Irrigation Guide (Seattle-Tacoma, Appendix B) and irrigation method assumed to be sprinkler (75% irrigation efficiency, 10% application efficiency).

- Based on an estimated 60 gpd per person domestic use (10% consumptive), 2.73 people per household, and assuming full occupancy of the mobile home park (134 residences[23]), and 9.3 acres of delineated irrigation and assuming pasture/turf and sprinkler irrigation, 20.079 AFY consumptive use is the estimated quantity available for transaction.[24]

- The Qa listed in on the water right document is 120 AFY. Without further examination, it is unclear what portion of this quantity has been perfected.

The Pre-identified Water Right No. 9 has a priority date of 01/09/1973, which is senior to the establishment of the Cedar-Sammamish Basin Instream Resources Protection Program in 1979. This water right does not have instream flow provisions included in the ROE.

[22] RCW 90.14.140

[23] The ROE issued 01/09/1973 reported 94 mobile homes and 40 travel trailers.

[24] This is an estimate only, actual indoor use in mobile homes may be less. An extent and validity determination would be required to determine the quantity available for acquisition.

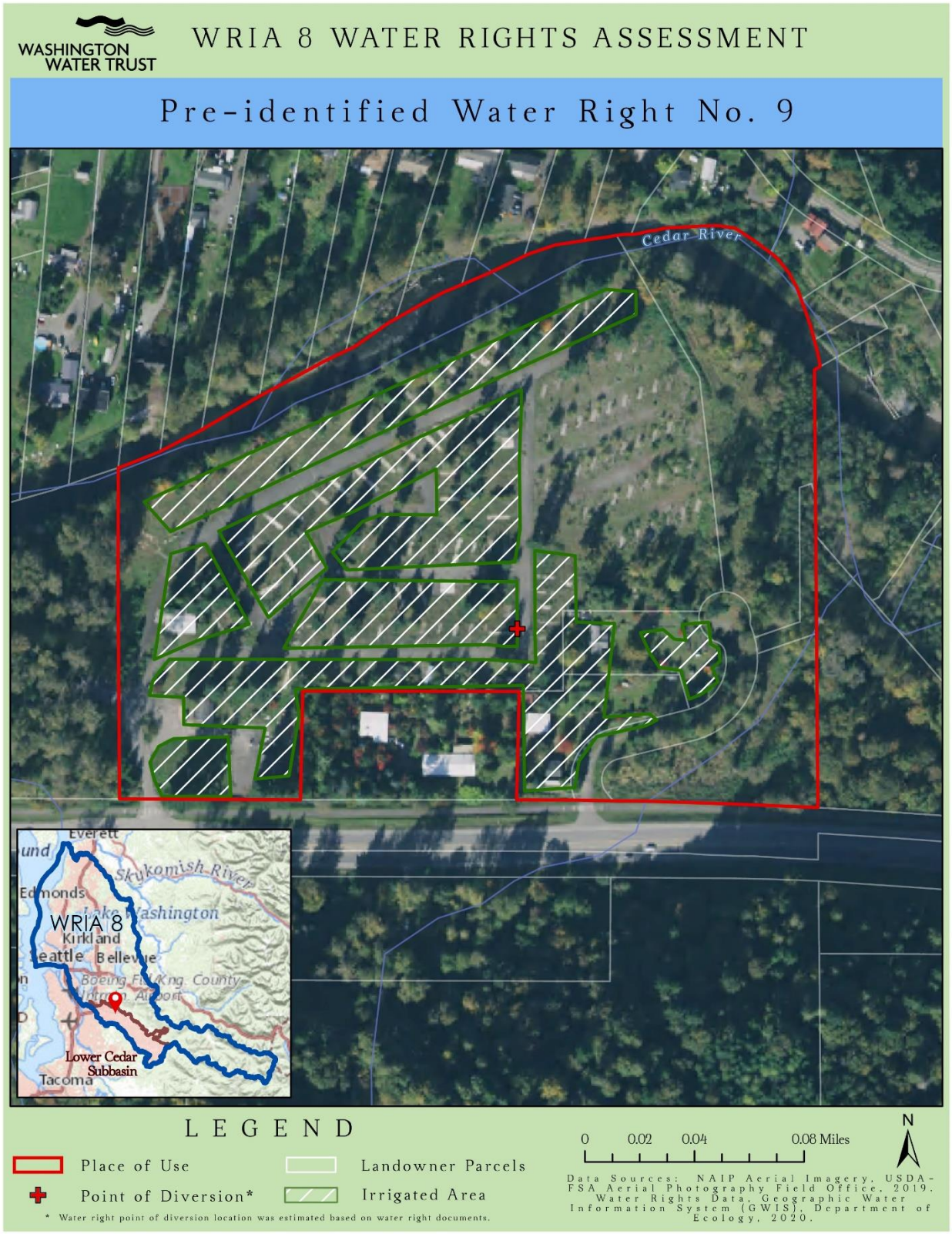


Figure 8: Project Map

WRIA 8 – Water Right Project Opportunity Profile
Pre-identified No. 5 Water Right Acquisition

Project Summary (8-LC-W11)

This water rights acquisition project does not have a detailed project description.

North Creek Beaver Dam Analog and Log Jam Installation Project

Project Name and Number

North Creek Beaver Dam Analog and Log Jam Installation Project (8-SN-H12)

WRIA 8 WRE Subbasin

Swamp/North

Narrative Description

In partnership with the City of Everett and Snohomish Co. Parks, Adopt-A-Stream Foundation (AASF) will install 16-beaver dam analogs (BDA) and logjams at 3 locations in the upper 2.5 miles of North Creek. These 3-locations are in the upper third of the main stem of North Creek that flows from South Everett to Bothell and the Sammamish River. Installation of BDAS and logjams in the headwaters of this heavily urbanized stream will improve habitat for all aquatic life and a wide range of wildlife. These features will reduce peak winter flows and increase groundwater recharge improving summer flows. AASF will also contact 162 landowners between site locations to inform them that the purpose of the project is to increase the water table, channel complexity, species diversity, and salmonid habitat. Each landowner will be encouraged to consider making riparian improvements where North Creek flows through their property. This project will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize the North Creek as spawning and rearing habitat. Chinook and steelhead are protected under the under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The installed series of beaver analogs and log jams will improve the habitat for all aquatic life and a wide range of wildlife; reduce peak storm flows and channel scouring; and increase sediment deposition. The restoration actions will improve the function of North Creek's hyporheic zone at the 3 locations and allow stream flows to move laterally into soils adjacent to the stream channel that will slowly release back into the channel when rainfalls decrease. Salmonid spawning and rearing habitat will improve.

A map and drawings of the project location.

Site 1 is within an 80-acre park, Site 2 is a 6.16-acre natural area and Site 3 is a 5.08-acre natural area (see attached Site Plan). Site photos are also included at the end of this document.

Description of the anticipated spatial distribution of likely benefits.

The project proposes to install beaver analogs and logjam features at three locations within the upper 2.5-miles of North Creek. These installed features will provide immediate and direct habitat benefits at those location and, water quality/quantity benefits downstream.

Performance goals and measures.

Installed BDAs and logjams will result in reduced channel down-cutting and sediment aggradation at three North Creek headwater locations and increased groundwater, channel complexity and salmonid habitat.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

A primary objective of this project is to reduce peak winter flows and the duration of time that the headwaters of North Creek are dry in the summer so it can again be suitable habitat for salmonid spawning and rearing. Specific species that have been documented within this section of North Creek are: Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout. Chinook and steelhead are priority species, protected under the ESA.

Identification of anticipated support and barriers to completion.

One site is on property owned by Snohomish Co. Parks, Rec. and Tourism, and two sites are City of Everett property. They and the downstream cities of Mill Creek and Bothell have issued letters of support. In addition, WDFW Habitat Biologist Miles Penk has determined that this is a "fish enhancement project" and that drawings submitted with the grant application are sufficient for the required JARPA.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost is anticipated to be up to $94,193.

Anticipated durability and resiliency.

Each of the 3 publicly owned project locations are heavily wooded natural areas. The 16 installed structures will recruit woody debris long after project completion. It is anticipated that this will be a very durable and resilient project.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Adopt-A-Stream Foundation. Sponsor contact: Tom Murdoch, tomm@streamkeeper.org. The sponsor is ready to proceed when funded.

Documentation of sources.

None

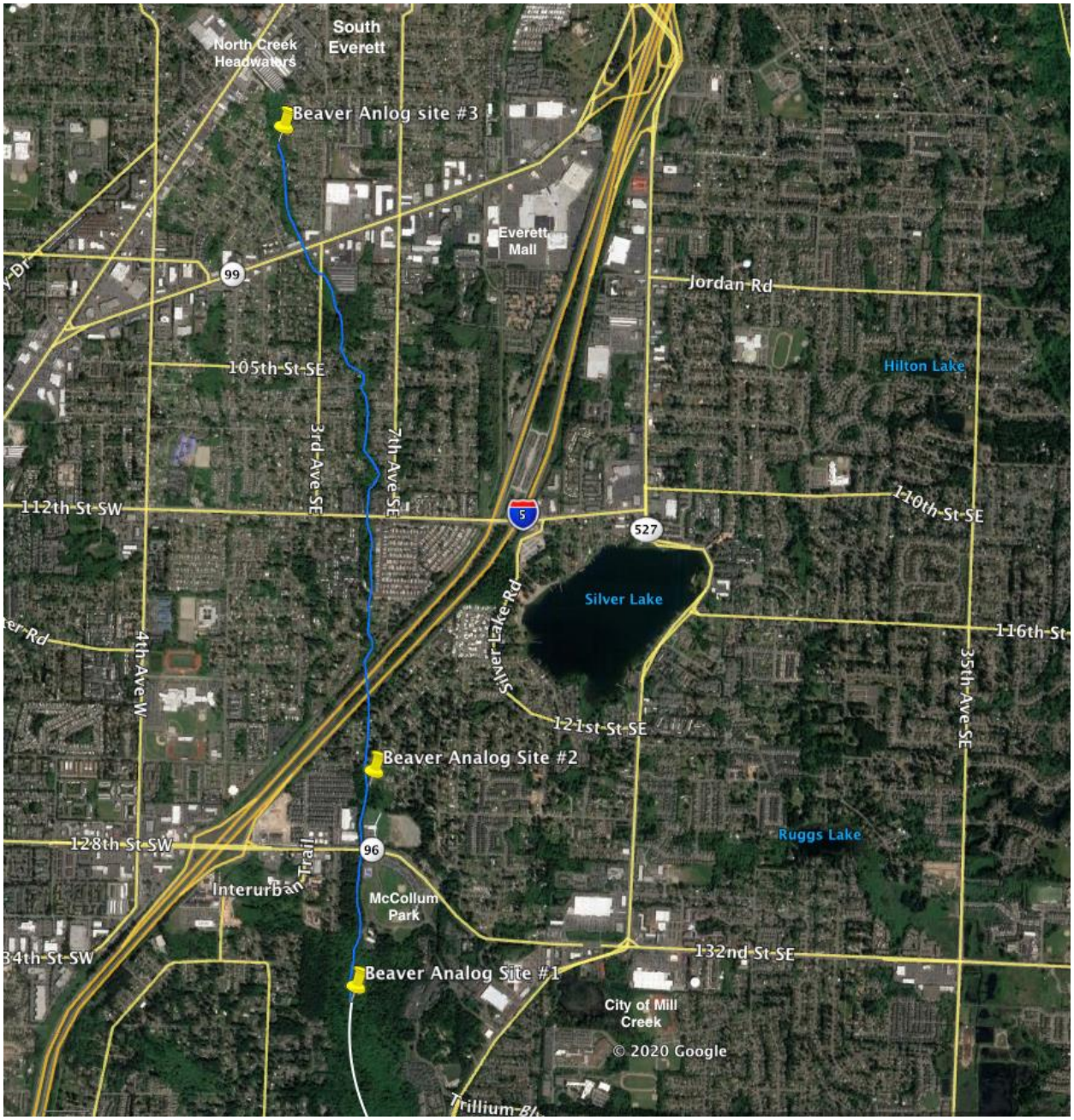


Figure 9: Site Plan for North Creek Beaver Dam Analog and Log Jam Project. Site 1 is in Snohomish County's McCollum Park; Sites 2 and 3 are located in natural areas owned by the City of Everett.

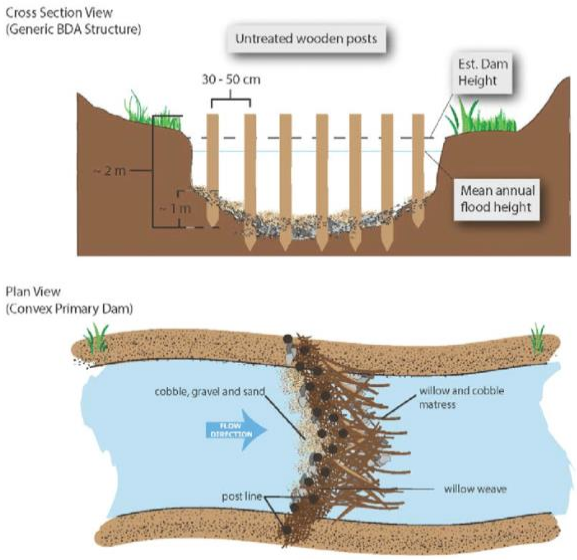

Photographs 1 and 2. Site 1: channel-spanning logjams and BDA's will be installed in the 14-foot wide channel to reduce scour down cutting that is up to four feet deep on both sides of the channel as shown on the right.

Photograph 3. Site 2 bank erosion up to 2-feet in depth that will benefit from logjams and BDA's.

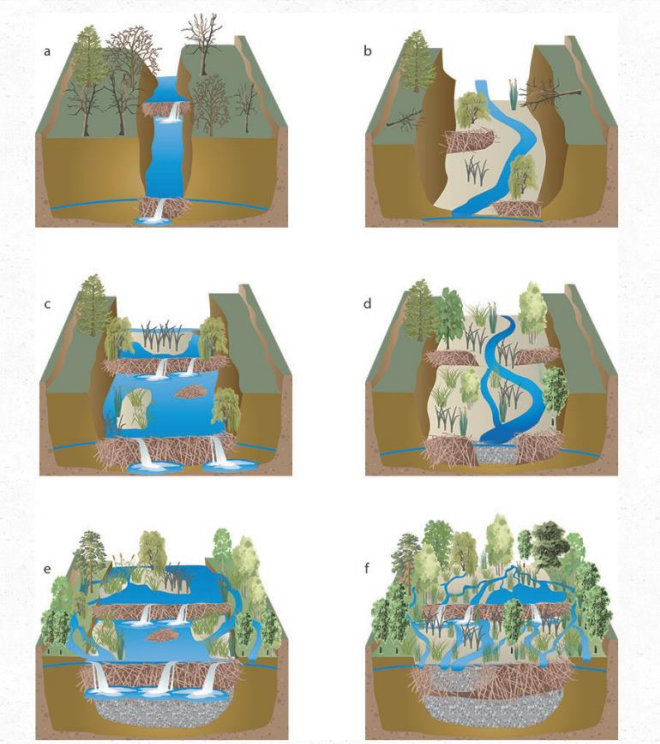

Photograph 4 (left). Riparian intrusion from residential structure just upstream from Site 2 (photograph taken March 25, 2020).

Photograph 5 (right). Site 3 includes great material for construction of BDA's and channel spanning logjams (photograph taken March 25, 2020).

Basic Beaver Dam Analog design



Over time the effects should resemble the graphic below:



WRIA 8 – Project Description
Canyon Park Business Park Redevelopment

Project Name and Number

Canyon Park Business Park Redevelopment (8-SN-H13)

WRIA 8 WRE Subbasin

Swamp/North

Narrative Description

The City of Bothell is rezoning the Canyon Park business park area to include mixed use. The project is in very early phases and specific information is not yet available. The project would support redevelopment of the Canyon Park business park, potentially reducing overall impervious surface area, and would include stormwater improvements and potentially restoration and/or wetland enhancements along North Creek.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The project sponsor assumes they will increase dead and live storage under any scenario, which will decrease stormwater runoff flow rates, increase water quality benefit through retrofitting and enhancing the existing storm system, and increase effective wetland areas through restoration and enhancement.

The project would include improvements to the existing stormwater system, including additional detention and infiltration. LID techniques could be incorporated into the design to provide additional infiltration and impervious surface reduction. Redevelopment will trigger water quality and flow control requirements, so only treatment exceeding those requirements would count toward offsets. Based on hydrologic modeling of stormwater infiltration for several projects in King and Snohomish counties, infiltration could transfer on the order of 1 acre-foot per acre of contributing area from surface runoff to groundwater, delaying contribution to streamflow. Magnitude of infiltration offset would depend on infiltration rates at the site as well as the amount of infiltration area added above and beyond required stormwater treatment. Wetland enhancements could also provide some (likely small) storage benefit.

Conceptual-level map and drawings of the project and location.

See Canyon Park area map at the end of the project description.

Description of the anticipated spatial distribution of likely benefits.

North Creek through and downstream of Canyon Park.

Performance goals and measures.

For stormwater, retrofit area treated, infiltration footprint, infiltration rates. For wetland, stream length restored, wetland water levels.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Historically, North Creek supported runs of Chinook, Sockeye, kokanee, and Coho Salmon and steelhead and Coastal Cutthroat Trout. From 1997 to 2015, volunteers with the Salmon Watcher Program recorded salmon observations at various locations in North Creek. Volunteers consistently saw Chinook, Coho, kokanee and Sockeye in the creek. Less commonly spotted were Chum Salmon. The Canyon Park segment of North Creek features multiple wetlands. Channel and habitat structure through this portion of the creek is generally degraded compared to properly functioning conditions.

Identification of anticipated support and barriers to completion.

The owners, developers, and property managers are very interested in working together on a combined regional facility. While this project is not yet listed in Bothell's Capital Facilities Plan, there is an ongoing retrofit program with partnerships that would meet this criteria. The City does not currently own and operate this regional pond, so would need permission to expand the existing private pond or would create features downstream within the right-of-way on city-owned property. If storage of the existing pond is expanded, dam safety regulations from Ecology may be triggered if the total capacity exceeds 10 acre feet. For wetland/stream restoration and enhancement, options would be discussed with the permitting agencies to see what is needed.

Potential budget and O&M costs.

To be determined. The budget for a feasibility study would likely be around $150,000 depending on what monitoring is needed. Funding for design and construction would include regional pond, ditch, and swale redesign, wetland/stream enhancement and restoration, and low impact development features to provide additional flow control and water quality benefit for existing development. The O&M costs would be absorbed by the City Stormwater Utility while a covenant would be placed on any private systems to require the private property owners to maintain all improvements as needed.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).

- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

This project will be designed to the highest stormwater criteria for flow control and water quality treatment. This area was originally designed in the 1980's, so there is very minimal flow control and water quality existing onsite. Any designs will also include additional flood storage capacity, so this system would be anticipated to increase durability and resiliency within the Canyon Park Subarea.

Project sponsor(s) (if identified) and readiness to proceed/implement.

City of Bothell would be the project sponsor.

Documentation of sources.

Original plat documents and drainage reports for subarea development

Past and current Bothell Surface Water Design Manuals

Canyon Park Subarea

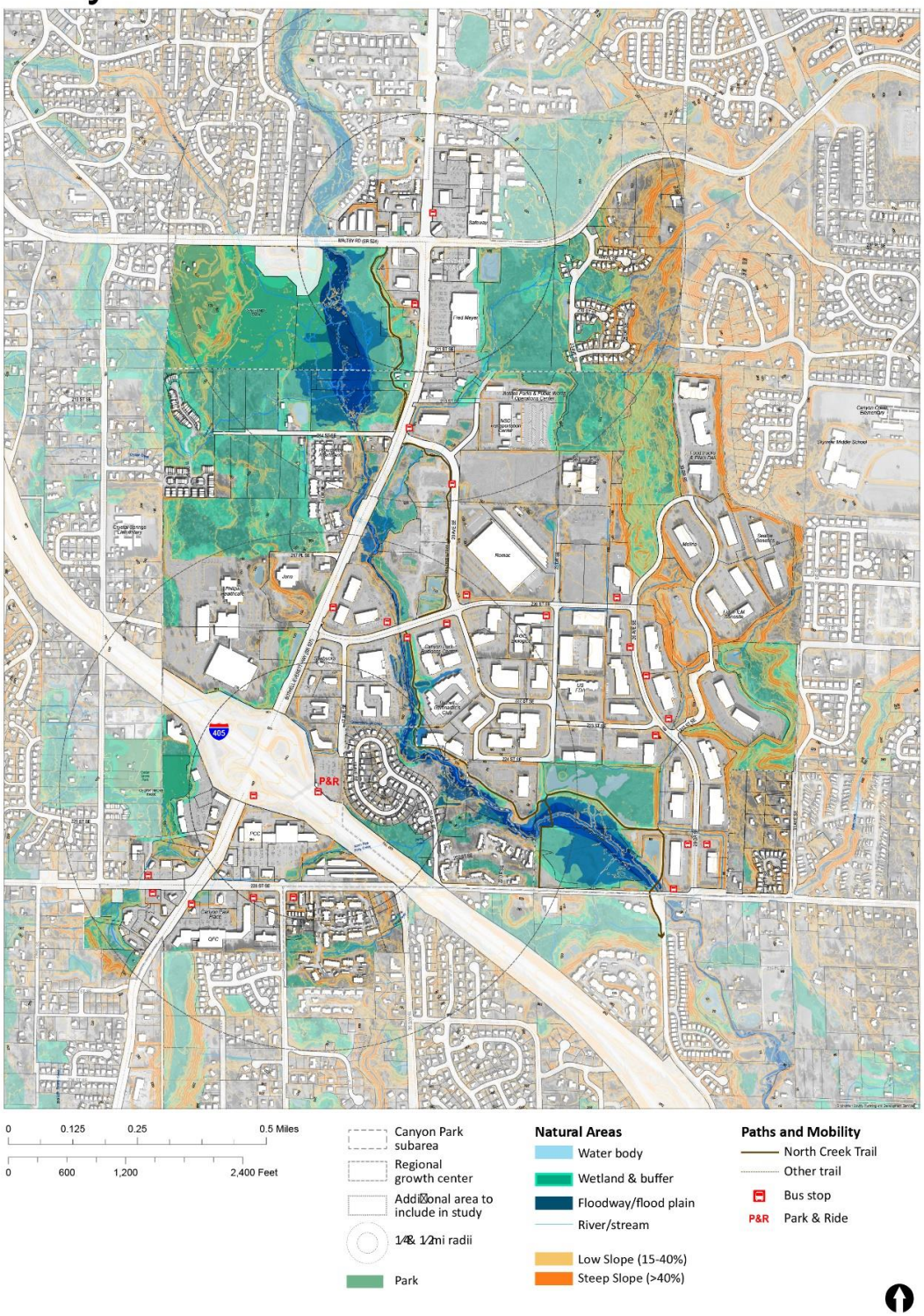


Figure 10: Canyon Park Subarea Overview

WRIA 8 – Project Description
Cutthroat Creek Restoration at Carousel Ranch

Project Name and Number

Cutthroat Creek Restoration at Carousel Ranch (8-LB-H14)

WRIA 8 WRE Subbasin

Little Bear

Narrative Description

This project includes stream, riparian, and upland restoration on Cutthroat Creek at Carousel Ranch, a tributary to Little Bear Creek within the Little Bear subbasin in Woodinville, Washington. The project will implement improvements along 870-feet of Cutthroat Creek. Restoration actions include large wood debris (LWD) placement to increase hydraulic diversity and structure and to build/maintain channel grade at the new Maltby Area Community Park. This project will restore stream habitat, native vegetation, protect and restore water temperature, provide active erosion abatement, and control invasive vegetation. These restoration actions will also benefit Little Bear Creek downstream.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize Cutthroat Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the stream, riparian and upland habitats associated with Cutthroat Creek. Installation of LWD has several ecological functions including increasing hydraulic diversity, managing flows, creating deeper pools that provide refugia for fish, preventing bank erosion, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Shade from installed riparian vegetation will moderate water temperature, reduce evaporation and create habitat. The project area has moderate communication with the groundwater table and contributes to a high infiltration area along the confluence of Little Bear Creek and Cutthroat Creek.

For this project, two concepts have been proposed depending on funding available to complete.

Concept A includes traditional channel restoration including wood placement to increase hydraulic diversity and structure and build/maintain channel grade throughout Zone 1 (see Figure 11). This includes bank stabilization/erosion management along the steep left bank portion of Cutthroat Creek from approximate station 0+50 to 1+50.

Concept B includes elements in addition to Concept A (see Figure 12). This concept includes aggressive floodplain grading and instream wood placement from culvert to 400 feet upstream of culvert to the high-quality wetland area. The goal would be to spread flow, reduce shear stress, and engage floodplain to convert to wetland function with a smaller defined low-flow channel. Additionally, this concept includes targeted wood placement, from approximate station 4+00 to the upstream parcel boundary, to induce scour and create covered pool habitat. Concept B incorporates groupings of brush wood to function as small jams relative to the creek, providing cover and habitat enhancement.

A map and drawings of the project location.

For each concept, the project site is shown in relation to surrounding physical features on the attached Site Plans.

Description of the anticipated spatial distribution of likely benefits.

The project proposes to restore 870 feet of Cutthroat Creek at Carousel Ranch, which will also benefit the Little Bear Creek downstream.

Performance goals and measures.

The goal for this project is to shift the stream from an alluvial condition to a wetland condition, from approximately 400 to 800 feet upstream of the culvert, in anticipation of reduction in sediment mobility. Water quality is expected to improve with reduction of erosion and temperature as a direct benefit of increased shading. The control of sediment transport and reduction and maintenance of reduced temperatures are beneficial to the mainstem of Little Bear Creek that provides direct benefit for improvement to Chinook habitat. In addition, increased riparian vegetation and cover will likely improve B-IBI (Benthic Index of Biotic Integrity) scores.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize Cutthroat Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the ESA. LWD and restoration of riparian vegetation will directly benefit prey availability, spawning success as well as survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

A Centennial Clean Water Fund (CCWF) application is a candidate source of support for either Concept A or Concept B. The Streamflow Restoration funding is another applicable funding opportunity for this project.

Barriers to completion include funding for preliminary and full design, and construction. Since the parcel is owned by Snohomish County Parks Division, this location is accessible for construction and presents no additional costs to Snohomish County for property acquisition.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are estimated at $330,000 in 4-year work plan and between $412,000 to $669,000 in Little Bear Plan.

Anticipated durability and resiliency.

The current stream condition includes aggradation at several locations with identifiable knickpoints that would be addressed with proposed design concept elements. Spreading flow reduces shear stress and reduces sediment transport currently a problem in the lower portion of the project area. Engaging the floodplain to convert to wetland function with a smaller defined low-flow channel will ensure reduction of potential for future sediment transport.

Resiliency of the project has key components that are focused on sediment transport reduction and maintenance of in-channel water volume during drought years. Expanding the wetland footprint and spreading flow will reduce eroding streambanks and aggradation of the stream channel during high flows. Spreading flow increases the footprint of open water along with wetland expansion potentially interacting with the groundwater table.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Snohomish County. Sponsor contact: Elisa Dawson, Elisa.Dawson@co.snohomish.wa.us. The sponsor is at the conceptual design stage and ready to proceed with design immediately.

Documentation of sources, methods, uncertainties, and assumptions.

A conceptual plan was completed for this site with development of two concepts to accommodate for available funding. This project is a component of a larger effort to identify and prioritize five projects in the Little Bear Creek watershed. Citation for this report is as follows:

Snohomish County. 2018. Instream Projects: Final Report of Task 2.07.2 of the Little Bear Creek Basin Plan, A Final Watershed-Scale Stormwater Plan. Prepared by Northwest Hydraulic Consultants Inc. Snohomish County Surface Water Management Division, Everett, WA. 42p.

A single design uncertainty was identified as moderate in the ranking process of potential projects sites. Overhead power lines near the culvert traverse the project area and were determined to be of moderate concern when considering proposed restoration improvements. In ranking of potential project locations, this project was ranked highest priority for implementation.

Assumptions include agreement with Snohomish County Parks Division to expand the footprint on this County-owned property to include this restoration project along with the planned

Maltby Area Community Park. Parks Division and the project sponsor are in agreement to move forward with addition of the restoration project. Park implementation is expected to begin as early as May 2021. This restoration project occupies the northwest corner of this Carousel Ranch property.

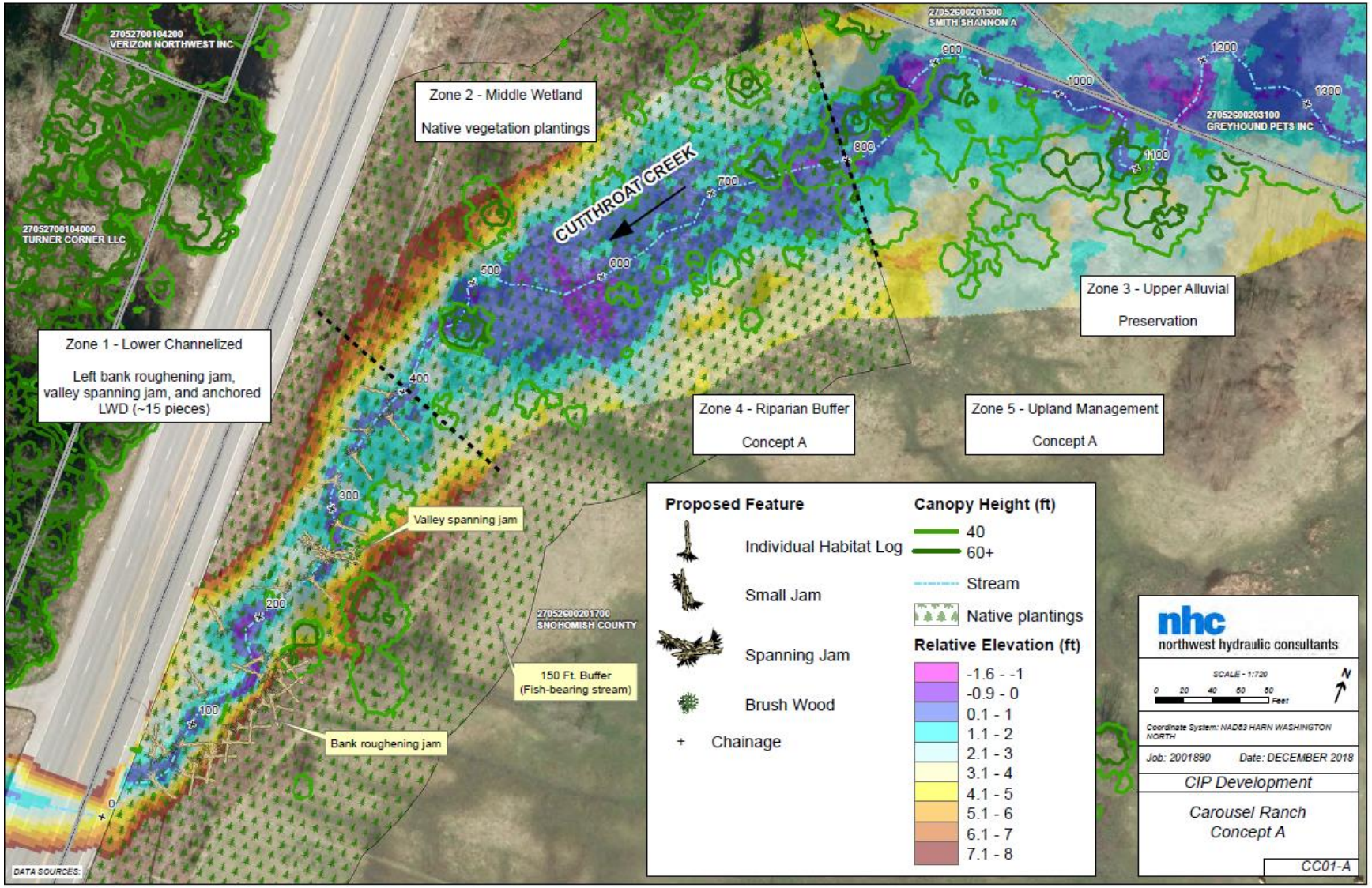


Figure 11: Site Plan for Carousel Ranch Concept A

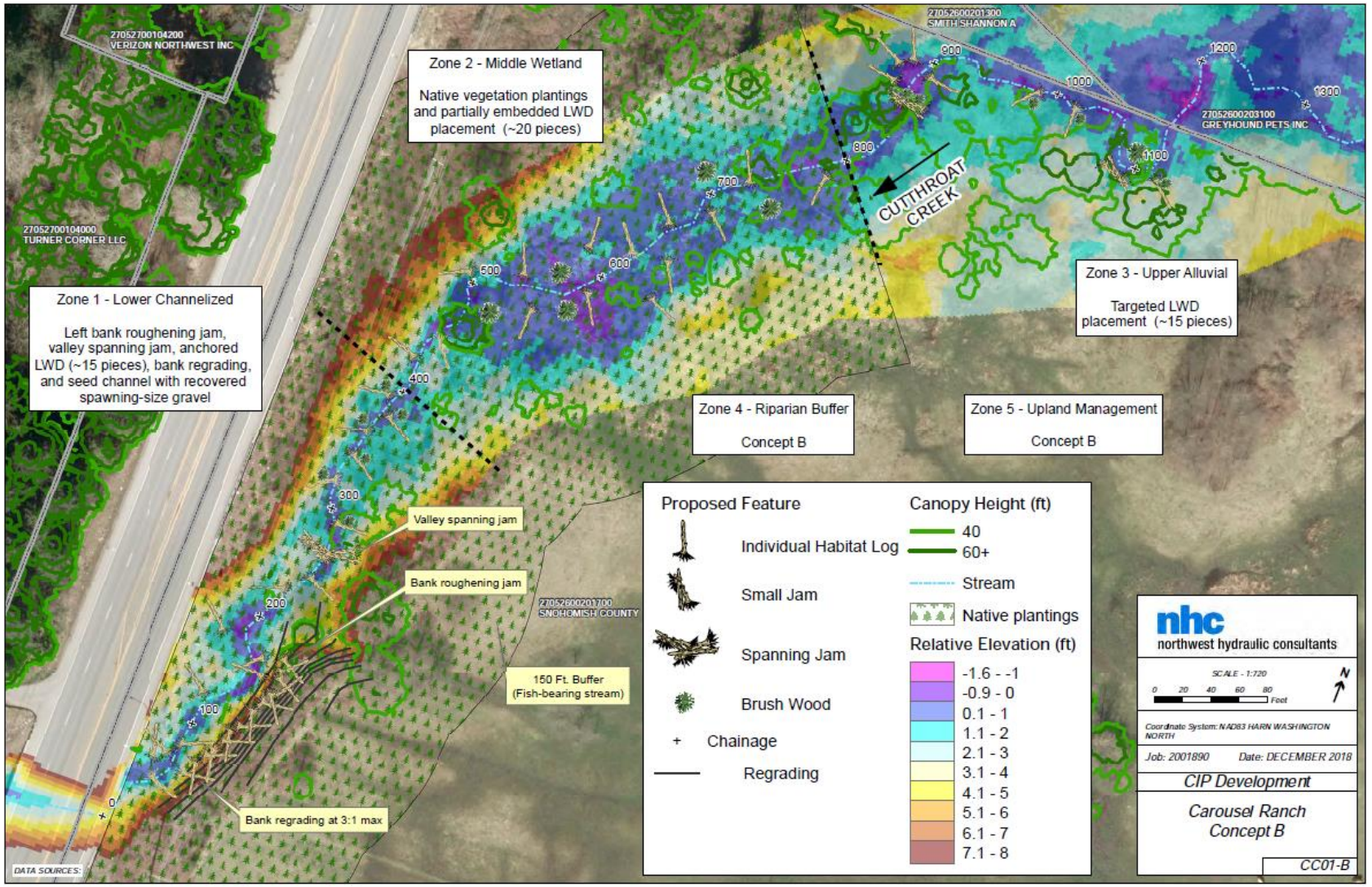


Figure 12: Site Plan for Carousel Ranch Concept B

WRIA 8 – Project Description
Little Bear Instream Projects

Project Name and Number

Little Bear Instream Projects (8-LB-H15)

WRIA 8 WRE Subbasin

Little Bear

Narrative Description

This project includes multiple sites along Little Bear Creek located in the Little Bear subbasin in Woodinville, Washington. A total of four sites along Little Bear Creek are proposed for restoration. The four sites and the proposed restoration actions are:

- LB02 (Little Bear Creek at 228th Street SE): Improve riparian cover and hydraulic diversity with large woody debris (LWD) placement instream. Add riparian buffer zone. Include a modified log jack (angled log pile) at head of sediment bar to encourage persistent flow split (dividing flow between two or among more channels) and roughened right bank to improve eroding conditions. Increase meander length.
- LB03 (Little Bear Creek near 224th Street SE): Floodplain reconnection and riprap removal. Add LWD and incorporate small training (encouraging flow away from areas prone to erosion) features
- LB05 (Little Beak Creek at Trovas HOA at 196th Street SE): Stabilize eroding tributary and improve hydraulic diversity by adding instream wood and more riparian planting.
- LB06 (Little Bear Creek at Lightfoot): Riparian planting and removal of invasives, incorporate wood in-channel.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Little Bear Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the stream and riparian habitats associated with Little Bear Creek. Installation of LWD has several ecological functions including increasing hydraulic diversity, managing flows, creating deeper pools that provide refugia for fish, preventing bank

erosion, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Shade from installed riparian vegetation will moderate water temperature, reduce evaporation and create habitat. Residence time of water in the channel during low flow months is expected to increase with pool formation and recharge groundwater where conditions exist.

A map and drawings of the project location.

This project proposes restoration actions at four sites along Little Bear Creek in Woodinville, Washington. The project site is shown in relation to surrounding physical features on the attached series of Site Plans included at the end of this document (Figures 13 through 20).

Description of the anticipated spatial distribution of likely benefits.

The project proposes restoration actions at four different locations along Little Bear Creek. Two conceptual plans have been proposed for each of the projects: LB02, LB03, LB05, and LB06. Concept selection depends on funding available to implement each project. See attached site plans (end of document) for spatial distribution of benefits.

Performance goals and measures.

LB02

Large woody debris in Concept A may lead to a moderate increase of Chinook habitat quality due to increased instream cover and hydraulic complexity. Adding riparian plantings will improve shading and thereby maintain and reduce instream temperatures, providing direct benefit to Chinook habitat. The wood jam in Concept B will create and support lower velocity refugia habitat.

LB03

Both concepts are expected to increase habitat quantity and quality and reduce roadway-related contaminant inputs. These projects will create substantial additional spawning and rearing area for Chinook near high-value beaver-dammed pond rearing habitat. Woody debris incorporation would improve bed material gradation and hydraulic diversity for Chinook habitat uplift.

LB05

Arresting tributary erosion will reduce sediment load and help improve water quality and Chinook spawning habitat. Increasing LWD along the mainstem would provide hydraulic complexity and cover, providing Chinook habitat uplift.

Riparian restoration would provide shading to reduce stream temperatures, enhance natural wood recruitment, and provide food sources for Chinook and other aquatic species. Woody debris incorporation would improve bed material gradation, cover, and hydraulic diversity for Chinook habitat uplift.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Little Bear Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the ESA. LWD and restoration of riparian vegetation will directly benefit prey availability, spawning success as well as survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

A Centennial Clean Water Fund (CCWF) application is a candidate source of support for either Concept A or Concept B for each of the Little Bear Creek projects. The Streamflow Restoration funding is another applicable funding opportunity when two or more of these projects are bundled in order to increase the combined groundwater contribution estimate that meets the minimum annual goals. Areas along Little Bear Creek are known to have high infiltration rates to groundwater.

Barriers to completion include funding for preliminary and full design, and construction. Parcels in the project areas are either County-owned or owned by the Washington State Department of Transportation (WSDOT). WSDOT and USACE have been updated on the County's proposed projects, where applicable, and are in agreement with project concepts.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are estimated by restoration site are:

- LB02: $153,000 - $167,000
- LB03: $246,000 - $298,000
- LB05: $170,000-$270,00
- LB06: $69,000 - $109,000

Anticipated durability and resiliency.

Little Bear Creek project locations are deficient in the variety of habitat types that support Chinook Salmon; spawning and rearing among the most important. Outmigrants are affected by warm water temperatures during their migration to larger rivers. Reduction of road runoff into

some of the project areas as well as re-establishing riparian areas that serve as barriers to pollutant introduction to these reaches are central themes.

Retention of water for earlier life stages is important on the mainstem and establishing a variety of hydraulic habitats will enhance survivability of several life stages. The mainstem of Little Bear Creek has substantial sediment transport mediated by winter stormflows and catastrophic summer stormflow events. Burying of benthic habitat is a significant barrier for Chinook Salmon life cycle completion. These projects, sometimes working in tandem, have a greater effect on achieving goals and in maintaining suitable habitat.

Resiliency of these projects is increased by key components that are focused on sediment transport reduction, maintenance of in-channel water volume during drought years and maintenance of low water temperatures. Hydraulic diversity promotes reduction in erosion of streambanks and aggradation of the stream channel during high flows. Spreading flow out increases the footprint of open water potentially allowing interaction with the groundwater table.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Snohomish County. Sponsor contact: Elisa Dawson, Elisa.Dawson@co.snohomish.wa.us. The sponsor is at the conceptual design stage and ready to proceed with design immediately.

Documentation of sources, methods, uncertainties, and assumptions.

A conceptual plan was completed for this site with development of two concepts to accommodate for available funding. This project is a component of a larger effort to identify and prioritize five projects in the Little Bear Creek watershed. Citation for this report is as follows:

Snohomish County. 2018. Instream Projects: Final Report of Task 2.07.2 of the Little Bear Creek Basin Plan, A Final Watershed-Scale Stormwater Plan. Prepared by Northwest Hydraulic Consultants Inc. Snohomish County Surface Water Management Division, Everett, WA. 42p.

Design uncertainties were identified for each of the Little Bear Creek mainstem projects. Uncertainties were ranked based on specific issues identified at each of the property locations. Those uncertainties are listed below:

LB02

Design Uncertainty: Concept A is **Low** (no identified issues with design elements). Concept B requires further investigation of adjacent parcels and infrastructure for impacts in the floodplain (**Moderate**). Concept C has the same concerns as Concept B and would require work on private land. (**Moderate to High** uncertainty).

LB03

Design Uncertainty: Concept A includes removal of riprap off bed which would cause the creek to be lessstable. Removing riprap creates slight risk of down cutting in the channel upstream that is an area known to have beaver activity and is beneficial to water storage and groundwater recharge (**Moderate** uncertainty). Concept B would result in less flow in this location and would be a situation that is less risky. Concepts return the channel to its natural condition and would encourage continuing beaver activity. This WSDOT property is in Year 9 of monitoring on this mitigation site and would be enhanced by implementation of these concepts. Project implementation would occur after the final year of required mitigation monitoring.

LB05

Design Uncertainty at this location in Little Bear Creek involves determining source of erosion and coordination with property owner to mitigate transport to Little Bear Creek (uncertainty is determined to be **Moderate** at this location).

LB06

There are no identifiable design uncertainties at this proposed project location (uncertainty is determined to be **Low**).

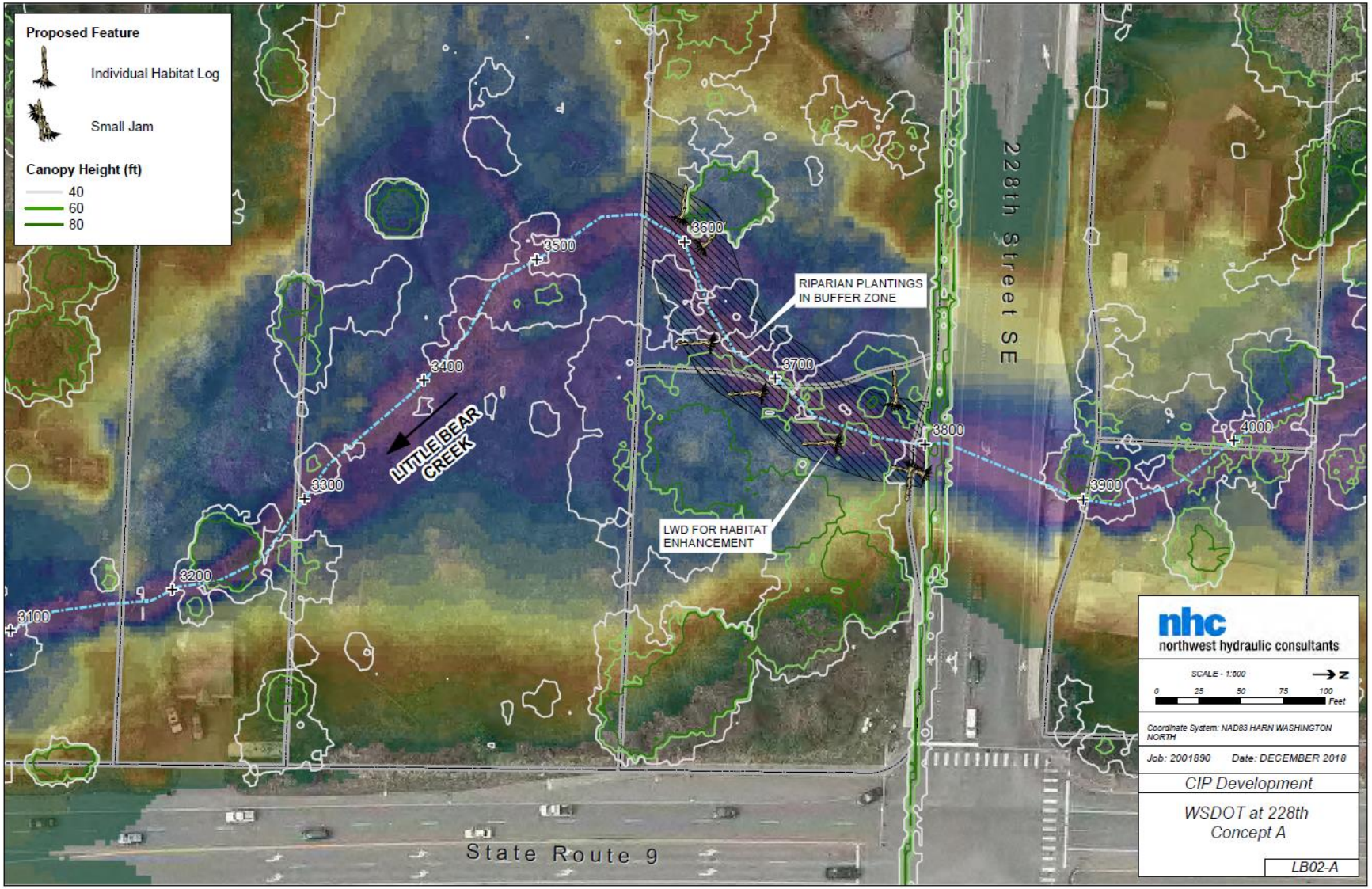


Figure 13: Site Map for Little Bear Instream LB02 Concept A

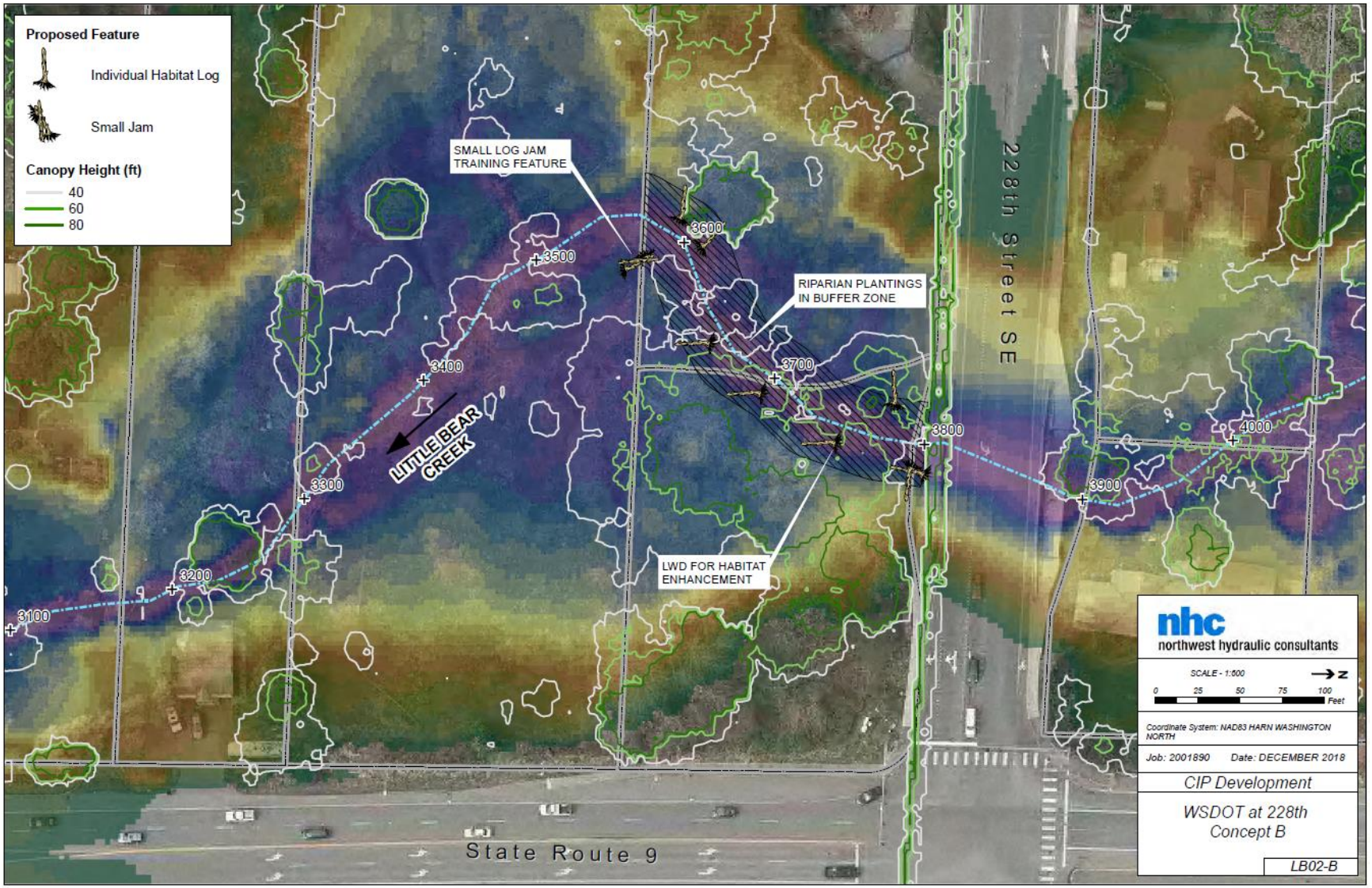


Figure 14: Site Map for Little Bear Instream LB02 Concept B

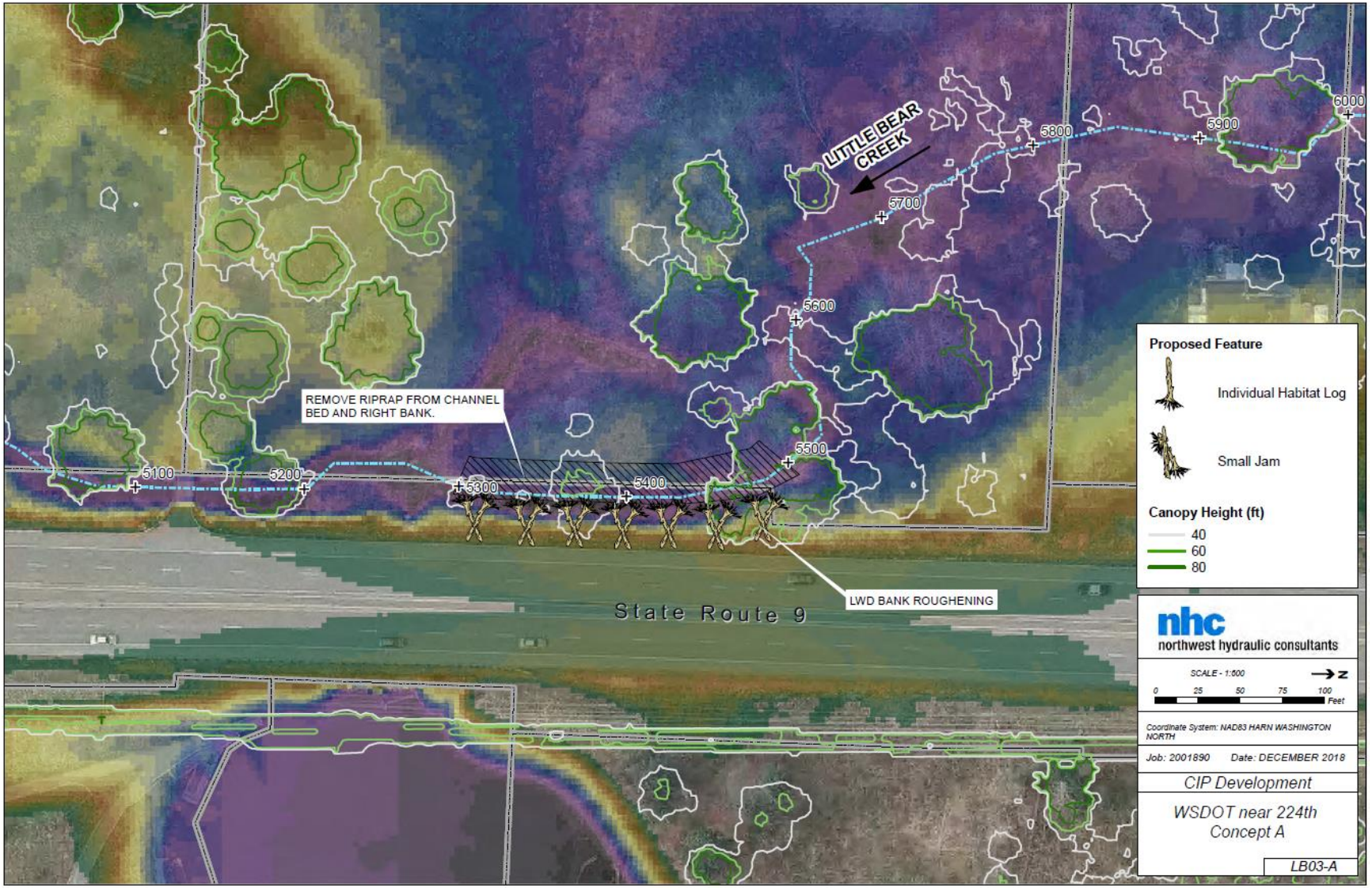


Figure 15: Site Map for Little Bear Instream LB03 Concept A

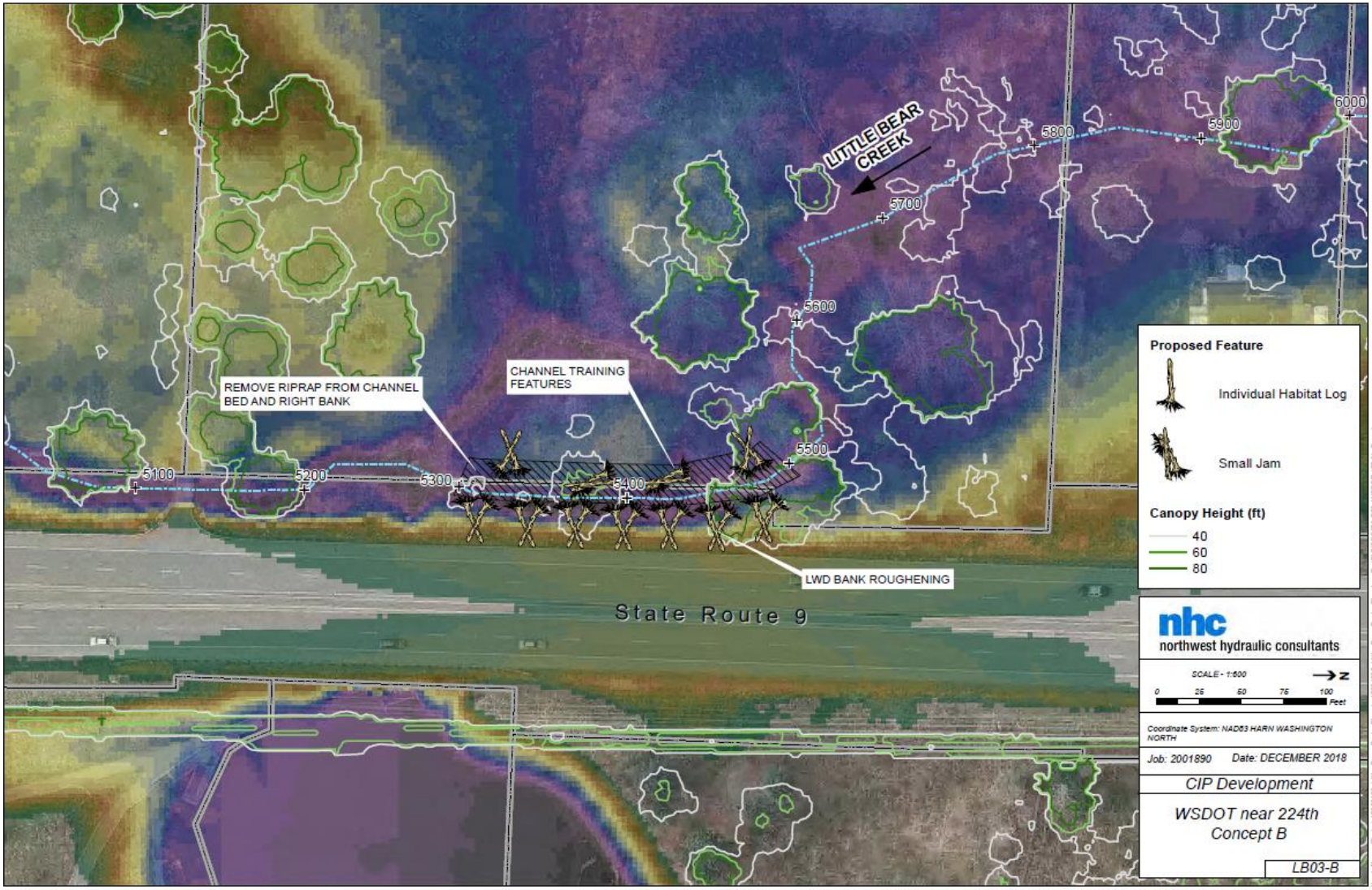


Figure 16: Site Map for Little Bear Instream LB03 Concept B

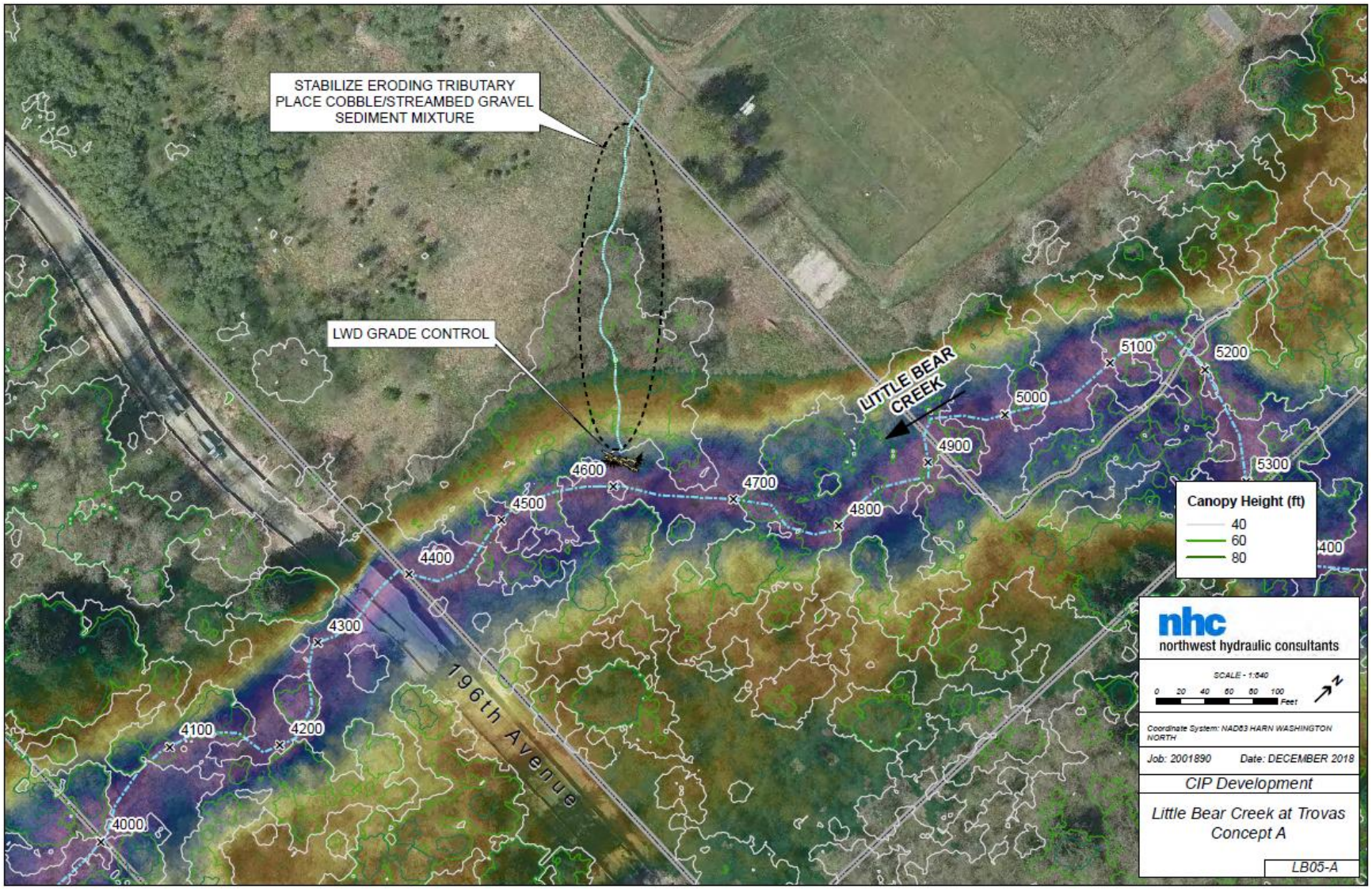


Figure 17: Site Map for Little Bear Instream LB05 Concept A

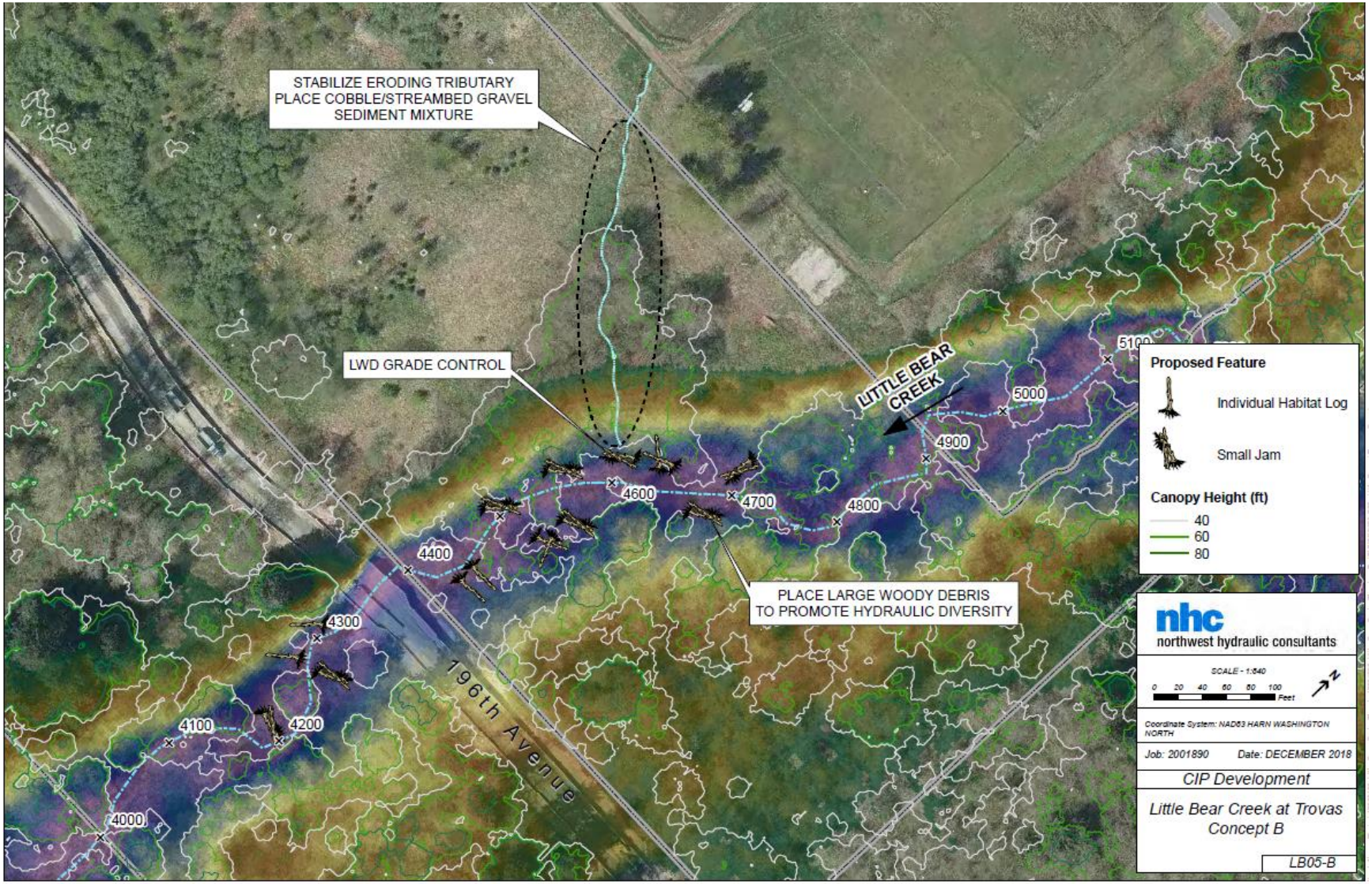


Figure 18: Site Map for Little Bear Instream LB05 Concept B

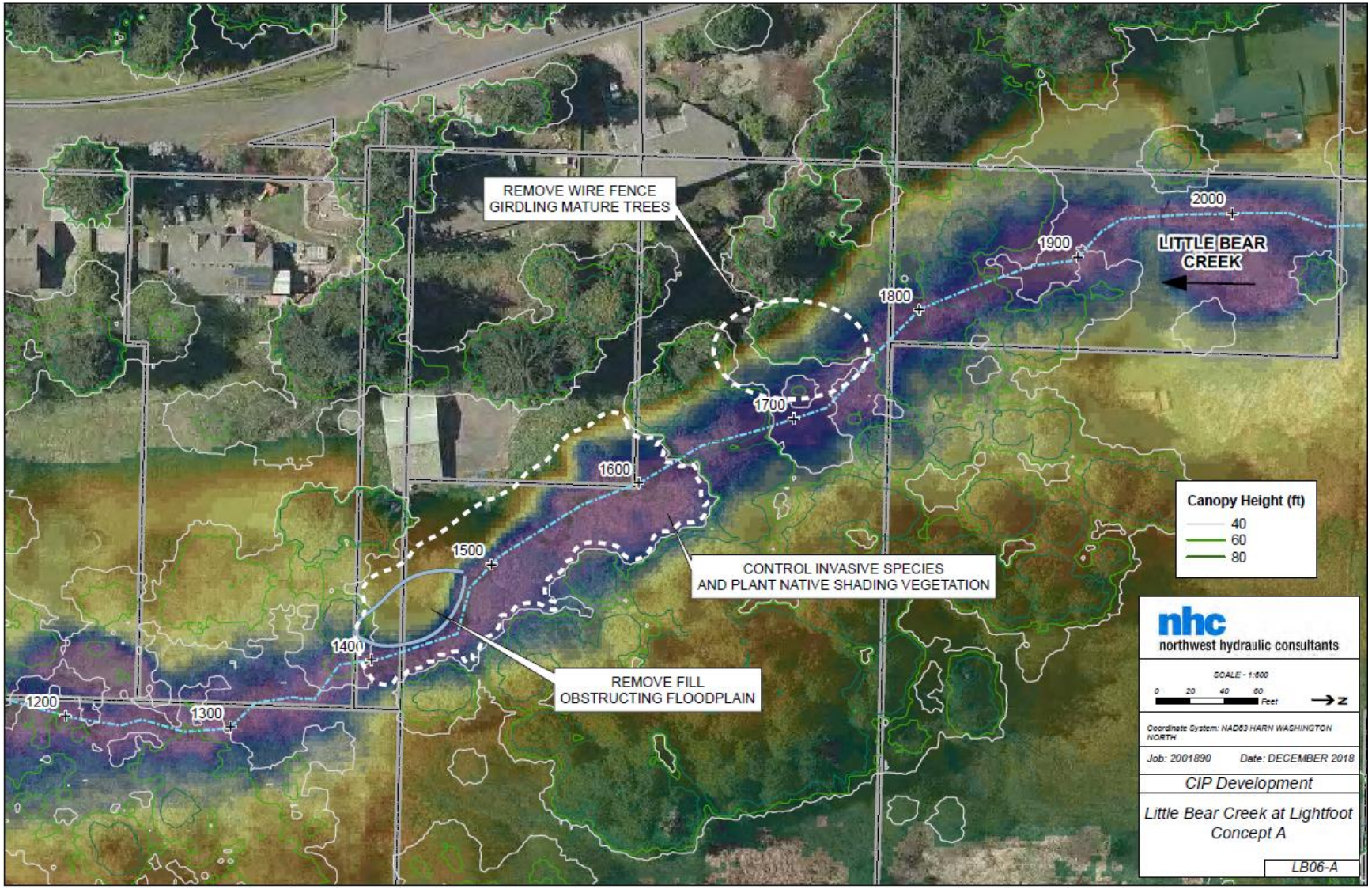


Figure 19: Site Map for Little Bear Instream LB06 Concept A

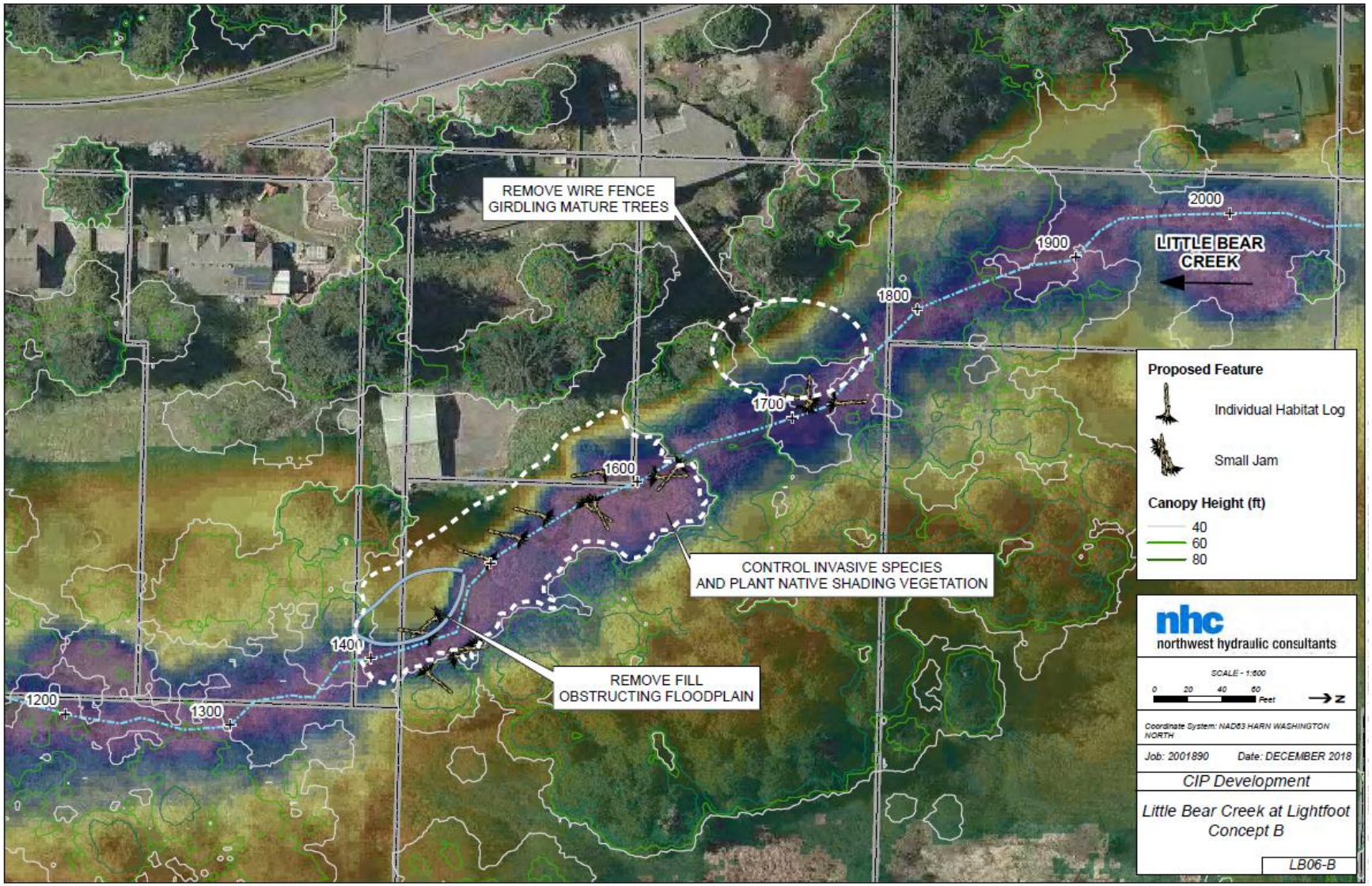


Figure 20: Site Map for Little Bear Instream LB06 Concept B

WRIA 8 – Project Description

Silver Firs Stormwater Pond Retrofits

Project Name and Number

Silver Firs Stormwater Pond Retrofits (8-LB-H16)

WRIA 8 WRE Subbasin

Little Bear

Narrative Description

Snohomish County has identified several potential stormwater retrofit projects in the Little Bear Creek basin, including two stormwater pond infiltration retrofits in the Silver Firs subdivision. The two ponds are part of the existing stormwater drainage system; each receives surface storm runoff from about 125 acres of residential development. Retention of stormwater in these ponds are expected to increase infiltration capacity.

The first pond (County CIP site 10) is located in Silver Firs Sector 3 Division 7. The project would involve expanding the existing pond by deepening and increasing pond infiltration potential. This would add 1.09 acre-feet (af) of storage and increase infiltration. The second pond (CIP site 16) is located in Silver Firs Sector 7. This project would increase the existing pond volume by deepening and increase pond infiltration potential. This would add 2.0 af of storage. Neither existing pond was designed as an infiltration facility, but infiltration has been observed to occur. The difference between existing infiltration and infiltration after retrofits would provide water offset.

Preliminary modeling and conceptual design have been performed and the projects are included on the County CIP list.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

HSPF modeling was conducted as part of Snohomish County's retrofit analysis to quantify benefits of proposed projects. The HSPF model was used to estimate the average annual offset volumes for the two pond projects. The modeling analysis assumed existing infiltration at 1.2 inches per hour for both ponds, doubling to 2.4 inches per hour with modifications.

At Site 10, the model showed a net increase of 38 af/year of infiltration. Additional infiltration at Site 16 was estimated to be 7 af/year. A minimum annual offset can be estimated by looking at just the driest years in the simulated record. Using the 10 driest years from the 63-year

simulation (based on annual precipitation), the minimum annual offset can be estimated as 25 af/year for Site 10 and 2 af/year for Site 16.

Conceptual-level map and drawings of the project and location.

The Silver Firs development is located at the north end of the Little Bear Creek basin. Previous

groundwater studies and watershed modeling (Golder, 2005; King County, 2005; Snohomish County, 2017) suggest that groundwater at the pond sites and tributary areas flows east to the Snohomish River. See Figure 23 for a project location map.

Description of the anticipated spatial distribution of likely benefits.

Based on previous groundwater studies and watershed modeling (Golder, 2005; King County, 2005; Snohomish County, 2017), it is believed that groundwater in this area flows east to the Snoqualmie River, rather than locally to Little Bear Creek. Thus, water offsets from enhanced infiltration would accrue to WRIA 7 rather than WRIA 8. However, reductions in peak streamflows and stream flashiness would benefit Little Bear Creek.

The closest mapped streams in WRIA 7 to the pond locations are Thomas Creek (approximately 5,000 feet to mapped headwater) and Larimer Creek (approximately 5,500 feet to mapped headwaters). Both streams drain through lowland agricultural drainage systems to the Snohomish River in the vicinity of Ebey Slough. The importance of groundwater to nearby stream channels during the low flow season is coupled to the large areal extent of wetlands along the mainstem of Little Bear Creek. Given these natural recharge sources in Little Bear Creek sustain much of the summer low flow, equally important is the groundwater recharge received by WRIA 7 streams from the proposed stormwater pond retrofits.

Small streams like Larimer Creek, shown in Figure 21 that maintain cold-water refugia throughout the summer have groundwater contribution from beneath thick clay layers that border the edges of the stream. Upper Thomas Creek, shown in Figure 22 has gentle streamside slopes with a thick aggregate of organic materials and soil beneath which groundwater enters the stream. Lower Thomas Creek, shown in Figure 23 maintains cold-water refugia and higher flows. The channel appears to have greater habitat diversity with flows that maintain these conditions. This underscores the importance in maintaining connection with groundwater during low flows and groundwater recharge during high flows. Like Larimer Creek, the summer low flow water temperature is unusually cold. When considered together, these small feeder streams to larger rivers represent important sources of cold groundwater refugia to migrating summer salmonids. Migration of groundwater to these streams may begin during the wet season and reach the WRIA 7 streams during the dry season.

Figure 21: Larimer Creek

Figure 22: Thomas Creek

Performance goals and measures.

Performance goal is to infiltrate as much water from the ponds as possible. Infiltration is difficult to measure directly; proxy measures include area treated, pond water levels, and pond outlet discharges.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The Little Bear Creek system is an important resource for fish and the following salmonid species are known to be present in the basin: Chinook, Sockeye, kokanee, and Coho Salmon. The WRIA 8 Chinook Salmon Recovery Plan notes that the estimated number of Chinook Salmon spawning in Little Bear Creek averaged 11 fish for many years up to 1998. Coastal

Cutthroat Trout and steelhead/Rainbow trout have also been observed. Anadromous salmon and trout access almost all of this system, though there are some significant passage barriers to adults during periods of low stream water flows, and to juveniles during high flows.

Identification of anticipated support and barriers to completion.

This project is currently listed in Snohomish County's Little Bear Creek Basin Plan and Snohomish County intends to implement the project, when funding is available.

Potential budget and O&M costs.

CIP Site 10: $600,000 design & construction

CIP Site 16: $815,000 design & construction

Both locations have existing stormwater ponds, so operation and maintenance costs are unlikely to change significantly.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency

and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Snohomish County Department of Conservation and Natural Resources. Snohomish County has identified two stormwater pond retrofit projects in the northern part of the Little Bear Creek basin. The project is currently listed on the County's Capital Improvement Project list and the County would be ready to proceed with design and construction upon funding.

Documentation of sources.

Golder and Associates, 2005. *Little Bear Creek Hydrogeologic Overview*. Prepared for Jones and Stokes and Snohomish County.

King County, 2005. *Brightwater Treatment System Environmental Impact Statement*. Available online: http://www.kingcounty.gov/environment/wtd/Construction/North/Brightwater/Background/Env-Review.aspx

Snohomish County, 2016. Little Bear Creek Basin Planning: Current Conditions Assessment Report.

Snohomish County, 2017. Little Bear Creek Basin Plan. Appendix B: Watershed Modeling Report.

Snohomish County, 2019. Stormwater Treatment CIPs: Final Report of Task 2.07.1 of the Little Bear Creek Basin Plan.

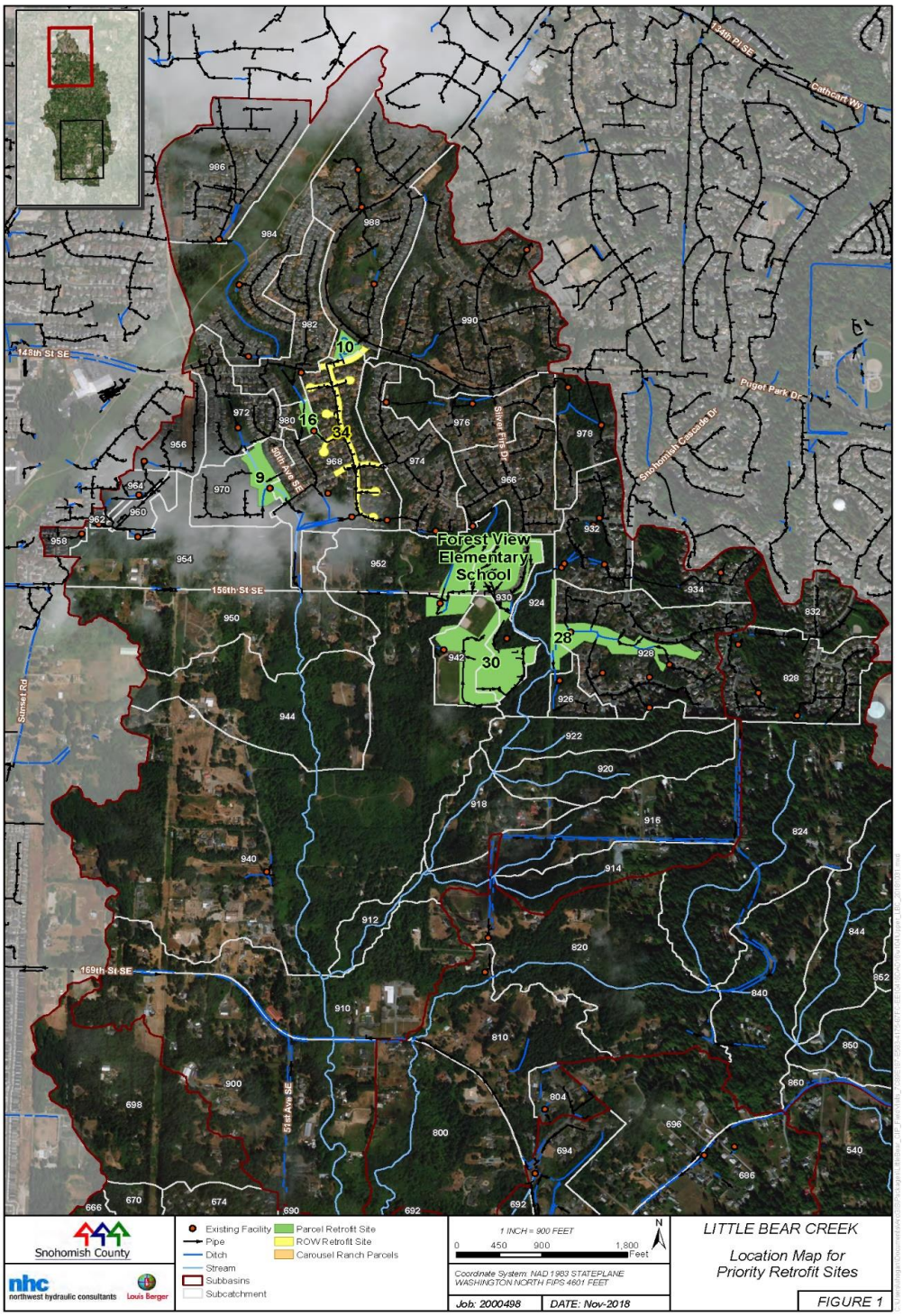


Figure 23: Silver Firs Stormwater Retrofit Site Location

WRIA 8 – Project Description

East Side Wayne Sammamish/Waynita Restoration

Project Name and Number

East Side Wayne Sammamish/Waynita Restoration (8-SRV-H17)

WRIA 8 WRE Subbasin

Sammamish River Valley

Narrative Description

This project includes restoration of the eastside of the former Wayne Golf Course property, which is formerly the back nine and covers 31.6 acres. The project is located within the WRIA 8 Sammamish River Valley subbasin. This property includes 1,000 linear feet of the south bank of the Sammamish River, along with the mouth and lower reach of Waynita Creek. Restoration approach is dependent on results from a feasibility study but could include: enhancing Waynita Creek habitat at the mouth, Sammamish floodplain restoration, improving riparian conditions, and creating cold water refuge.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, Bull Trout, Rainbow Trout, Largemouth Bass, and resident Cutthroat Trout that utilize the Sammamish River and Lake Sammamish as rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore 1,000 linear feet of the south bank of the Sammamish River along with the mouth and lower reach of Waynita Creek. These restoration actions are designed to enhance the habitat at the mouth of Waynita Creek with the Sammamish River, restore floodplain function of the Sammamish River, improve riparian conditions, and create cold water refuge for fish species.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan.

Description of the anticipated spatial distribution of likely benefits.

The project proposes to restore 1,000 linear feet of the south bank of the Sammamish River along with the mouth and lower reach of the Waynita Creek, located in Kenmore, Washington.

Performance goals and measures.

All performance goals will be based off results from the feasibility study and conceptual design but may include: linear feet of cool water refuge in relation to Sammamish River, linear feet of day-lighted tributary, acres of buffer added, large wood additions, and acres of invasive vegetation removal.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, Bull Trout, Rainbow Trout, Largemouth Bass, and resident Cutthroat Trout that utilize the Sammamish River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the ESA. Restoring floodplain function and improving riparian habitat will have numerous benefits including benefitting prey availability for fish species, water quality and water quantity.

Identification of anticipated support and barriers to completion.

Anticipated support includes King County, WRIA 8 Salmon Recovery Council, King County Flood Control District, and City of Bothell Parks Department. Currently phase I (feasibility study and conceptual design) is expected to be fully funded. The City will seek further funding for final design and construction of the preferred restoration alternative. The final restoration alternative chosen for construction will need to be approved by City Council. This site is also a public park and the final restoration will need to balance recreation with ecological restoration goals. Potential barriers to completion would be lack of grant funding for future phases.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost will be dependent on the preferred restoration alternative chosen. Depending on the selected restoration alternative, total costs could be up to $7 million.

Anticipated durability and resiliency.

Once the construction phase is completed, post restoration maintenance and monitoring will need to be conducted for plant survival, invasive maintenance, and potential in-stream channel monitoring. Most likely invasive vegetation control will be continual on-site after construction. All maintenance and monitoring activities will be determined after the preferred restoration alternative is selected.

Project sponsor(s) (if identified) and readiness to proceed/implement.

City of Bothell. Sponsor contact: Chris Hall, chris.hall@bothellwa.gov. The sponsor is at the ready to begin a feasibility study to develop conceptual restoration design.

Documentation of sources.

None

Figure 24: Site Plan for the East Side Wayne Sammamish/Waynita Restoration Project

WRIA 8 – Project Description
Reconnection of Wetland 38

Project Name and Number

Reconnection of Wetland 38 (8-SRV-H18)

WRIA 8 WRE Subbasin

Sammamish River Valley

Narrative Description

This project proposes to reconnect Wetland 38 with the Sammamish River, located within the Sammamish River Valley subbasin at the south end of the City of Woodinville, Washington. This project would need to evaluate whether reconnecting the wetland to the river would affect the hydrology of the wetland and potentially drain the wetland feature. The project does have the potential to provide an additional source of cold water to the river to augment streamflow and reduce temperature simultaneously. There are other adjacent projects already working to address water temperatures and flow in the river both through riparian restoration and reconnecting Derby Creek and cool water inputs on the opposite bank and just upstream of this site.

Connecting this wetland with the Sammamish River has the potential to benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize Sammamish River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will reconnect a wetland feature, known as Wetland 38, with the Sammamish River which will improve hydrologic conditions and provide refugia for fish and vegetation and nutrients for insects and invertebrates which are a prey source for fish. Reconnecting the wetland with the river will potentially provide another source of cool water directly to the Sammamish.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan.

Description of the anticipated spatial distribution of likely benefits.

The project proposes to connect Wetland 38 with the Sammamish River, which will benefit the fish species that spawn and rear within this section. Connecting the Sammamish River with Wetland 38 will also have downstream water quality and water quantity benefits.

Performance goals and measures.

Performance goals and measures will be based on area of wetland reconnected to the river, number of pieces of wood placed in the wetland to provide refugia habitat, area of refugia habitat created, number of trees and shrubs planted around the reconnected wetland, and water temperature at the outlet of the wetland where it enters the river.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize the Sammamish River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the ESA. Connecting Wetland 38 with the Sammamish River has significant benefits to juvenile salmonids by directly benefitting prey availability, spawning success, as well as survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

The project is identified in the Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Salmon Conservation Plan as potential habitat restoration for the Sammamish River. Assuming the project could reconnect the wetland to the Sammamish River without draining the wetland, the WRIA 8 Salmon Recovery Council would likely support the project as salmon habitat restoration.

Potential barriers include approval from current property owner and funding for implementation. One recent development is there is a change in usage of the wetland area of the property by the current owner's tenants that may make it more available for restoration.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are currently unknown.

Anticipated durability and resiliency.

The durability and resiliency of the project depends on project feasibility and design.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Mid Sound Fisheries Enhancement Group. The sponsor is ready to proceed with basic scoping and reconnaissance. Additional feasibility analysis would be possible if funding was available. The sponsor is visiting the site regularly to implement riparian restoration on the river shoreline adjacent to the wetland site and has the necessary landowner contact information to initiate conversations.

Documentation of sources.

None

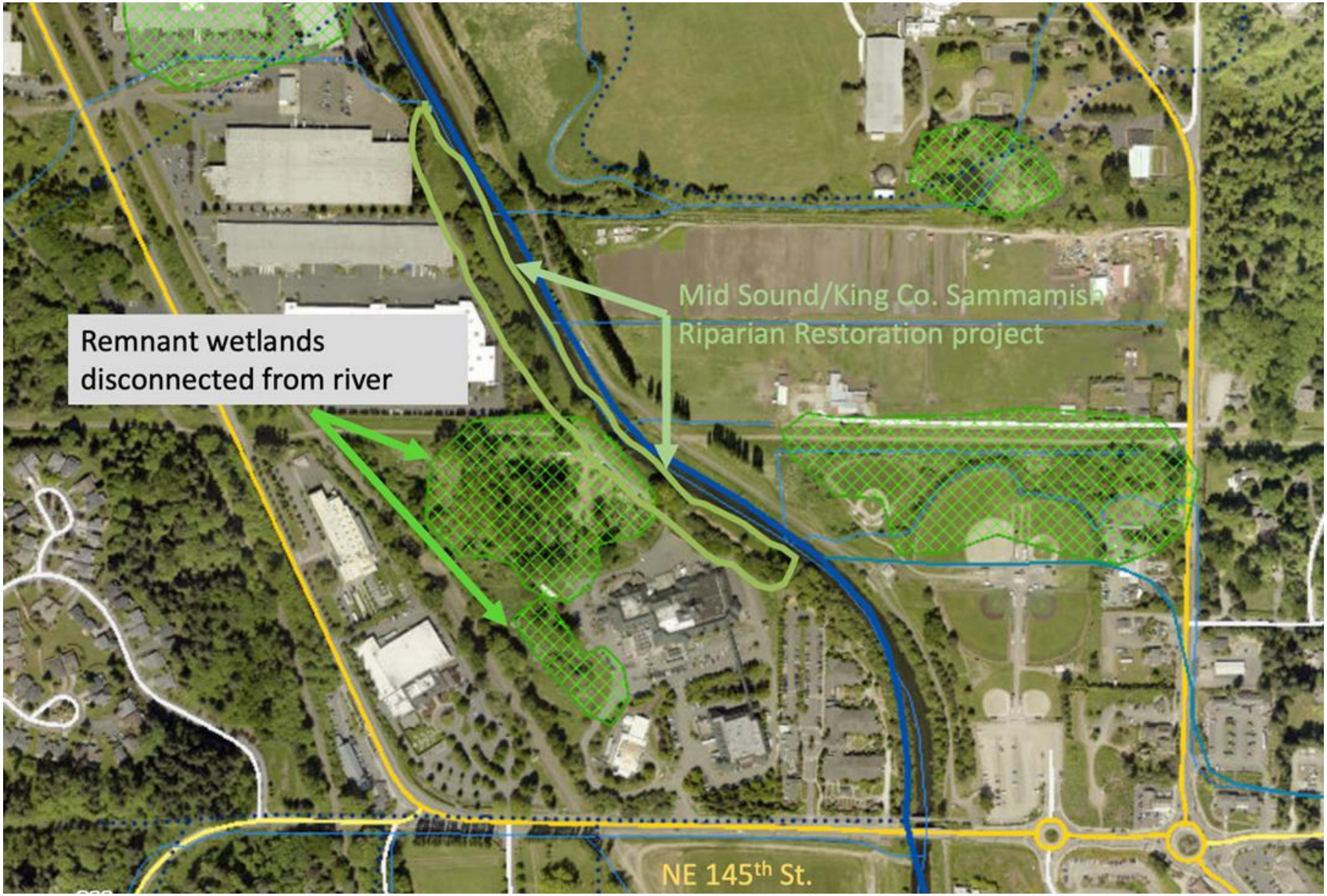


Figure 25: Site Map for Reconnection of Wetland 38 Project

Seawest Granston/Middle Bear Creek Natural Area Restoration

Project Name and Number

Seawest Granston/Middle Bear Creek Natural Area Restoration (8-BE-H20)

WRIA 8 WRE Subbasin

Bear/Evans

Narrative Description

King County is proposing enhancements to the Seawest Granston Reach of Bear Creek within the Bear/Evans subbasin in Cottage Lake, Washington. This project proposes the addition of woody debris, creation of off-channel habitats, and revegetation of the floodplain and riparian areas. This project will restore up to 3,300 lineal feet of stream and approximately 32 acres of wetland and riparian areas in this reach of Bear Creek. Given the scale of this project, it will provide the Middle Bear reach with a significant amount of improved salmonid habitat.

The goal of this project will be to increase the volume and availability of off-channel habitat for juvenile salmonids and to increase overall channel complexity and habitat quality. To accomplish this, the project design will implement a "Stage Zero" strategy to push the channel plan form from a single-threaded channel towards an anastomosing plan form with multiple channels and off-channel features. This strategy will include adding woody debris and beaver dam analogue structures to the mainstem channel and potentially excavating side channels, backwater channels and/or pilot channels within the floodplain. It is expected that these measures will raise baseflow and groundwater elevations in the surrounding floodplain to more frequently inundate off-channel features, many of which already exist and more of which may be created by excavation. This project will also provide increased storage capacity and may augment streamflow and help to moderate stream temperature during critical low flow periods.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Bear Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

This project will restore up to 3,300 lineal feet of stream and approximately 32 acres of wetland and riparian areas in this reach of Bear Creek. It is expected that the proposed restoration

measures will raise baseflow and groundwater elevations in the surrounding floodplain to more frequently inundate off-channel features, many of which already exist and more of which may be created by excavation. This project will also provide increased storage capacity and may augment streamflow and help to moderate stream temperature during critical low flow periods.

King County is conducting a current conditions assessment, including streamflow data collection and monitoring the project site groundwater table. The project footprint will not change.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the Site Plan below. The project is in predesign phase and site plans are not currently available.

Figure 26: Seawest Granston/Middle Bear Creek Natural Area Restoration

Description of the anticipated spatial distribution of likely benefits.

This project will restore up to 3,300 lineal feet of stream and approximately 32 acres of wetland and riparian areas in this reach of Bear Creek. Given the scale of this project, it will provide the Middle Bear reach with a significant amount of improved salmonid habitat.

Performance goals and measures.

1. Provide instream structure and provoke sorting of the substrate by adding woody debris.

2. Increase connection with the floodplain and activate existing habitat features by raising water elevation several inches.

3. Decrease instream water temperatures at the downstream end of the reach by planting the riparian areas with native species and, possibly, by grading new features in the floodplain that increase groundwater exchange.

4. Enhance the ecological functions of the existing Class 1 wetland by replanting degraded areas with appropriate native species.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize the Bear Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the ESA.

Creation of side channels, backwater channels and/or pilot channels within the addition of woody debris and beaver dam analogue structures will provide hydraulic complexity in addition to benefitting prey availability for fish species, water quality and water quantity.

Identification of anticipated support and barriers to completion.

This project is supported by the WRIA 8 Salmon Recovery Council and King County. There are no known barriers to completion, although the project footprint will benefit from a conservation easement on one property not yet attained.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit, and construct the project is $1,440,000.

Anticipated durability and resiliency.

This project will reconnect the creek with its floodplain through the creation of side channels that will provide additional conveyance capacity and enhance and maintain floodplain processes and riparian health. Additions of instream large wood, and potentially beaver dam analogs will also aid in hyporheic exchange. Ecosystem benefits and hydrologic outcomes are expected to endure and help to ameliorate stream temperatures by lowering them during critical low flow periods.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County. Sponsor contact: Denise Di Santo, ddisanto@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources.

None

WRIA 8 – Project Description
Little Bit Restoration

Project Name and Number

Little Bit Restoration (8-BE-H21)

WRIA 8 WRE Subbasin

Bear/Evans

Narrative Description

This project includes restoration of Bear Creek along the Little Bit Reach, within the Bear/Evans subbasin in Redmond, Washington named for its proximity to the Little Bit Therapeutic Riding Center facilities near NE 106th. This reach is about 650 feet long and situated between two other reaches owned by King County, both locations of recent restoration efforts.

King County is proposing similar enhancements to the Little Bit Reach, including addition of woody debris, excavation of off-channel habitats and revegetation of the floodplain and riparian areas. The channel within this reach also runs against the Avondale Road NE embankment for about 250 feet, which prevents natural channel migration and morphology and compromises riparian functions. The goal of this project will be to increase the volume and availability of off-channel habitat for juvenile salmonids and to increase overall channel complexity and habitat quality. To accomplish this, the project design will add woody debris and incorporate elements such as excavated side channels, backwater channels and/or pilot channels within the floodplain.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Bear Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

The project footprint will not change. Hydrologic modeling will be completed to assess design alternatives and ability to meet project goals and objectives. The project is expected to be constructed in 2023.

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

This project will restore up to 650 feet of Bear Creek within the Little Bit Reach to connect to recent restoration projects performed by King County. The project proposes to add woody debris, create off-channel habitat and revegetate the floodplain and riparian areas. These restoration actions will increase the volume and availability of off-channel habitat for juvenile salmonids and increase overall channel complexity and habitat quality. To accomplish this, the

project design will add woody debris and incorporate elements such as excavated side channels, backwater channels and/or pilot channels within the floodplain.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan.

Description of the anticipated spatial distribution of likely benefits.

This project will restore up to 650 feet of Bear Creek within the Little Bit Reach. This restoration will connect two recent restoration efforts performed by King County and provide a significant stretch of restored stream with improved salmonid habitat.

Performance goals and measures.

1. Constraints to channel migration and habitat forming processes will be removed or minimized from 800 linear feet of Bear Creek.
2. Missing structure in the form of woody debris will be restored to the 800 linear feet of Bear Creek to create more complex and diverse instream habitat.
3. A more effective buffer will be established between Avondale Road NE and the channel of Bear Creek.
4. 2.7 acres of riparian habitat will be enhanced by removing or suppressing invasive species and planting with native trees and shrubs.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Bear Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the ESA.

Creation of side channels, backwater channels and/or pilot channels within the addition of woody debris and beaver dam analogue structures will provide hydraulic complexity in addition to benefitting prey availability for fish species, water quality and water quantity.

Identification of anticipated support and barriers to completion.

This project is supported by WRIA 8 Salmon Recovery Council. There are no known barriers to completion.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit and construct the project is $1,000,000.

Anticipated durability and resiliency.

This project will reconnect the creek with its floodplain through the creation of side channels that will provide additional conveyance capacity and enhance and maintain floodplain processes and riparian health. Additions of instream large wood will also aid in hyporheic exchange. Ecosystem benefits and hydrologic outcomes are expected to endure over time under low and high flow conditions.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County. Sponsor contact: Denise Di Santo, ddisanto@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources.

None

Figure 27: Site map for Little Bit Restoration Project

WRIA 8 – Project Description

Bear Creek Water Quality Enhancement Projects

Project Name and Number

Bear Creek Water Quality Enhancement Projects (8-BE-H22)

WRIA 8 WRE Subbasin

Bear/Evans

Narrative Description

King County has a planning project underway to prioritize 3 subbasins for further investigation of future stormwater retrofit projects. These investigations will work to identify and prioritize potential Water Quality Capital Improvement Projects within the prioritized subbasins.

The current planning project will leverage the Bear Creek Watershed Management Study (King County 2018) to prioritize subbasins and identify sites for Water Quality Capital Improvement Projects within the prioritized subbasins. Future project types have not yet been defined but would be targeted at water quality treatment, stream shading/temperature reduction, and or enhanced flow control of storm runoff.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

Projects to be determined by the study so potential offsets cannot be determined at this time. Infiltration retrofits or enhancements could be expected to redirect on the order of 10 to 100 acre-feet per year from surface runoff to groundwater, delaying contribution to streamflow.

Conceptual-level map and drawings of the project and location.

The map at the end of the description shows the portion of Bear Creek considered in the Bear Creek Watershed Management Study (Figure 28). Project locations have not been determined.

Description of the anticipated spatial distribution of likely benefits.

Depends on project location(s). Benefits anticipated to occur to portions of Bear Creek and its tributaries within King County.

Performance goals and measures.

To be determined.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Bear Creek currently supports a wide range of salmonids including Chinook, Sockeye, Coho, kokanee, steelhead and Coastal Cutthroat. Moreover, Bear Creek has been identified as one of two high priority habitats to restore for Chinook Salmon recovery (known as "Tier 1" habitat) by the Water Resource Inventory Area 8 (WRIA 8) Salmon Conservation Plan, covering the Greater Lake Washington Watershed. The Washington Department of Ecology identified Bear Creek as a targeted watershed for stormwater retrofit planning due to its high ecological integrity.

Identification of anticipated support and barriers to completion.

To be determined.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency

and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County is the likely project sponsor. Projects have not yet been identified so are at least several years from implementation.

Documentation of sources.

King County. 2018. Bear Creek Watershed Management Study. Prepared by Timothy Clark, Sevin Bilir, Jeff Burkey, Jessica Engel, Eric Ferguson, Claire Jonson, Josh Kubo, Scott Miller, Jen Vanderhoof, and Mark Wilgus, Water and Land Resources Division. Seattle, Washington.

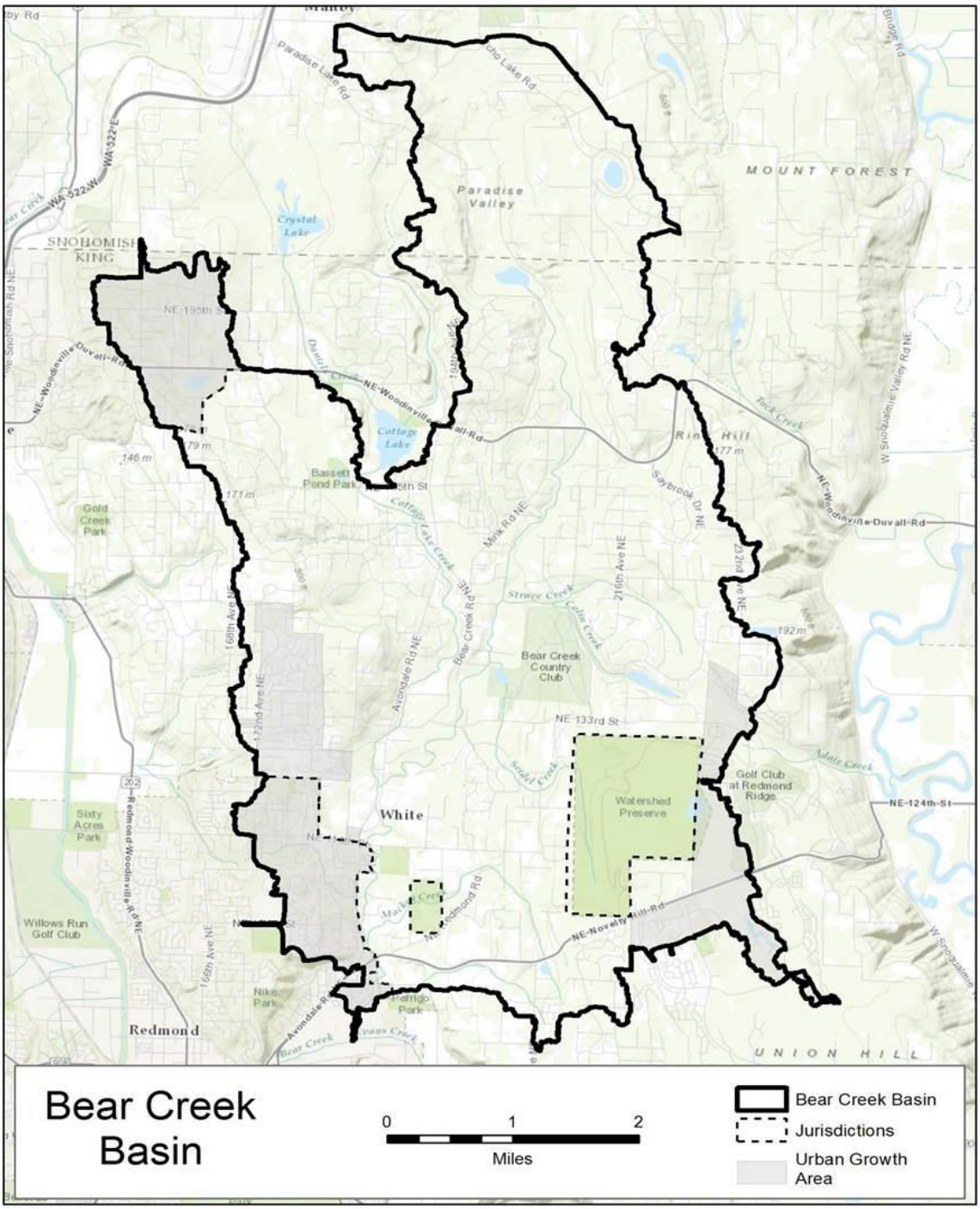


Figure 28: The portion of Bear Creek considered in the Bear Creek Watershed Management Study

WRIA 8 – Project Description
Lake Washington Institute of Technology Stormwater Infiltration Vault

Project Name and Number

Lake Washington Institute of Technology Stormwater Infiltration Vault (8-GLW-H23)

WRIA 8 WRE Subbasin

Greater Lake Washington

Narrative Description

The Lake Washington Institute of Technology (LWIT) Infiltration Vault would provide water quality treatment and subsequent infiltration of stormwater for 23.4 acres of contributing area. It was developed through the Totem Lake Stormwater Retrofit Planning Effort, a watershed scale plan that investigated opportunities for stormwater retrofit projects. The project will infiltrate stormwater before it reaches Totem Lake and subsequently Juanita Creek, a salmon bearing stream in Kirkland.

The stormwater system within the 23.4 acres of contributing area is already established and gravity flows through or nearby to this parking lot. The two separate pipe systems that flow here would be connected to the vault treatment and infiltration system through to-be-constructed short sections of pipe. The vault will be sized to accommodate the treatment and infiltration of the stormwater, up through and including a 50-year storm event. Because of the large area available, the vault will be sized as large as is feasible based on budget constraints.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The project is at the conceptual design phase. The LWIT Infiltration Vault project is anticipated to include two vaults, beginning with a pre-treatment vault, followed by an infiltration vault. These vaults would be constructed underneath an existing parking lot and would clean and infiltrate stormwater from 23.4 acres. The infiltration vault will be sized totaling 15,000 square feet by 10.5 feet deep live storage (assuming 2 in./hr. infiltration rate). A similar project within Kirkland, *132nd Square Park* with 48.5 acres of contributing area, has been designed to achieve an annual infiltration volume of approximately 70 acre-feet. This project is expected to be similar in size and scope, and based on the *132nd Square Park* results, anticipates an annual infiltration volume of approximately 33.8 acre-feet. The actual infiltration volume achieved will be dependent on geotechnical exploration beneath the proposed facility.

Currently Kirkland is a Phase II permittee under the NPDES Stormwater Permit. Retrofitting stormwater systems installed before stormwater regulations became required for most development projects is not required through this permit. This treatment, infiltration, and flow control would be voluntary and beyond existing stormwater requirements. This project will ensure flow control and water quality to meet *2016 King County Stormwater Drainage Manual requirements and City of Kirkland Policy D-10, the Addendum to the King County Stormwater Drainage* Manual.

Stormwater will be treated with flow control facilities (infiltration vault), and water quality facilities (pre-treatment vault). This vault will either allow for sediment to settle out by reducing flow or will include cartridges which force stormwater to be filtered through media. Both techniques remove suspended solids which are known to contain nutrients, pesticides, heavy metals, and volatile chemicals, such as petroleum products.

Conceptual-level map and drawings of the project and location.

See map on last page of project description (Figure 29).

Description of the anticipated spatial distribution of likely benefits.

The retrofit projects are designed using design practice per the Ecology manual to restore hydrology of the stream and watershed. Improvements in this stormwater system will benefit the Totem Lake tributary of Juanita Creek and Totem Lake and its associated wetland complex as well.

Performance goals and measures

The performance goal is to infiltrate as much stormwater runoff as feasible given site constraints. See the Stormwater Retrofit Analysis for Juanita Creek Basin in the Lake Washington Watershed (King County, 2012) report for further details.

Target flows will be meeting the ECY08 target. Target water quality will be to provide the Basic Water Quality Treatment for all pollution generating impervious surface (PGIS).

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The Totem Lake Tributary to Juanita Creek supports Coho and Resident Cutthroat Trout and the mainstem of Juanita Creek additionally supports winter steelhead, Sockeye, and Fall Chinook.

Identification of anticipated support and barriers to completion.

Support from Lake Washington Institute of Technology is critical to the success of the project; this will be sought early in the design phase. Funding for the project, particularly considering COVID-19 budget impacts, is likely the primary barrier to completion of the project.

Potential budget and O&M costs.

Budget and O&M costs will be approximately $2.5M per retrofit plan in FY2015 USD, or $2.71M in FY2020 USD considering inflation.

Anticipated durability and resiliency.

The infiltration facilities are typically designed with a 25-year lifespan and will be maintained by the City of Kirkland maintenance crews while viable.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.

- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Project is in conceptual design phase. Project sponsor not yet identified.

Documentation of sources.

King County, 2012. *Stormwater Retrofit Analysis for Juanita Creek Basin in the Lake Washington Watershed. Ecology Grant: G0800618.* King County Department of Natural Resources and Parks, Water and Land Resources Division, Seattle, WA.

City of Kirkland, 2015. *Totem Lake/Juanita Creek Basin Stormwater Retrofit Conceptual Design Plan*. City of Kirkland, Storm & Surface Water Division, Kirkland, WA. https://www.kirklandwa.gov/Assets/Public+Works/Public+Works+PDFs/Surface+Water/Surface+Water+Grants/Totem+Lake+Stormwater+Retrofit+Final+Report.pdf

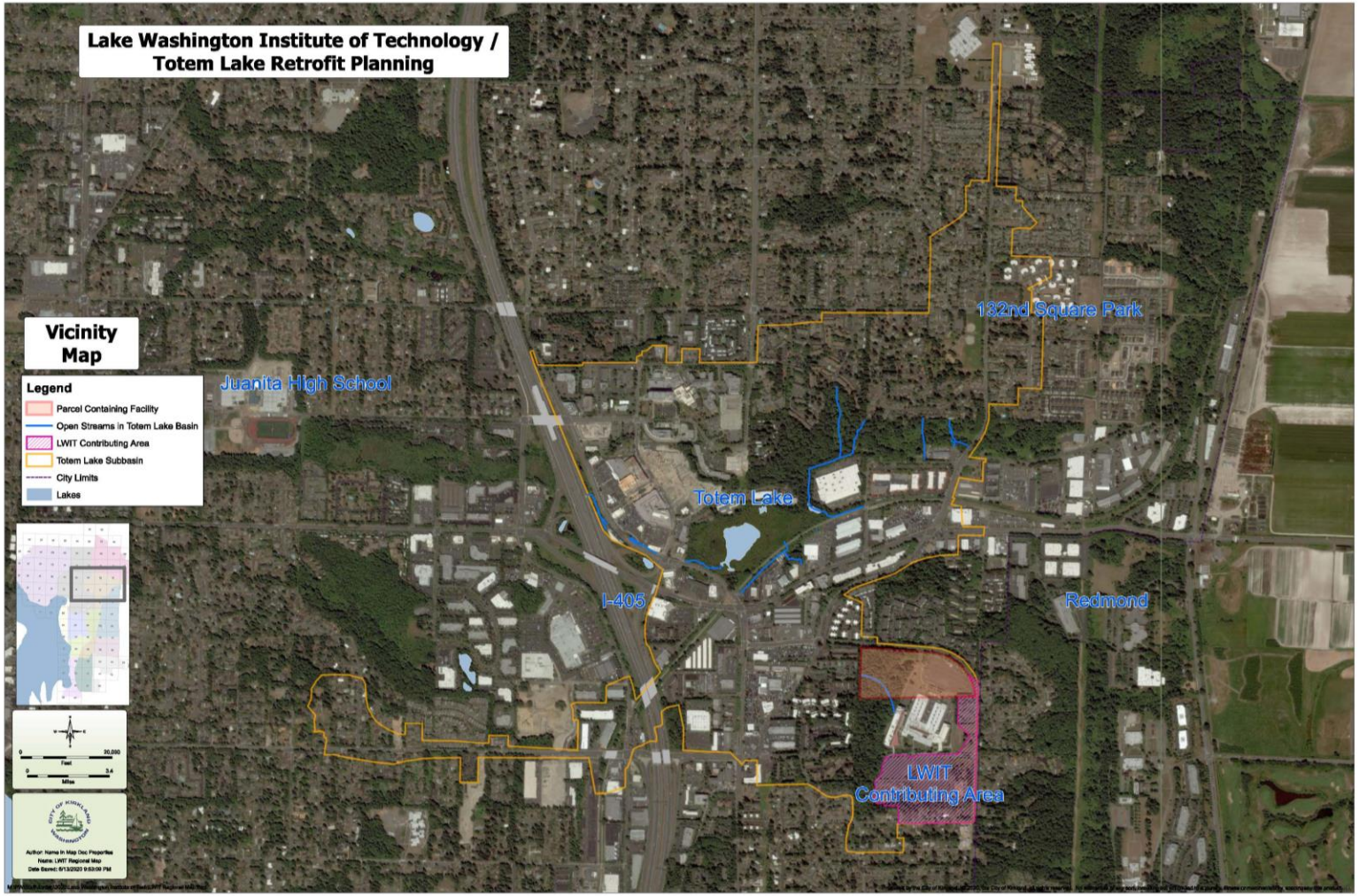


Figure 29: Overview of LWIT Infiltration Vault Project

WRIA 8 – Project Description
Juanita/Cedar Creek Stormwater Retrofit Planning

Project Name and Number

Juanita/Cedar Creek Stormwater Retrofit Planning (8-GLW-H24)

WRIA 8 WRE Subbasin

Greater Lake Washington

Narrative Description

The Juanita/Cedar Creek Stormwater Retrofit Implementation project will conduct stormwater design permitting and construction of three water quality treatment and/or flow control facilities for Cedar Creek, a 588-acre subbasin of the Juanita Creek Watershed. Infiltration is the preferred method of stormwater management, and the lower portion of this basin appears to have geology to support this type of project. Stormwater retrofit facilities will contribute to stream restoration efforts that include installation of a fish passable culvert.

The projects will likely use new and existing storm infrastructure typical of urban right of way (catch basins with grate, curb inlets, drainage pipes, etc.).

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

Retrofit planning is underway in this basin, and includes geotechnical exploration, engineering feasibility analysis, and public engagement. The top 6 sites/facilities have been identified, and the top three out of this list of sites will be selected in fall of 2021 based on public engagement. The 30% designs and an implementation plan will then be developed for the projects by the first half of 2022. The facilities will treat and infiltrate to Ecology standards to the degree possible, and excess flows will bypass the facilities. A similar project underway within Kirkland (132nd Square Park retrofit) is designed to achieve an annual infiltration rate of 70 acre-feet/year with a contributing area of approximately 50 acres. The Cedar Creek retrofit projects will be much smaller because of basin topography (contributing areas of 5-10 acres each), but will infiltrate where feasible, resulting in replenishment of groundwater.

This retrofit project will voluntarily improve existing stormwater infrastructure, most of which was built before modern stormwater standards were in place, and in an area that is unlikely to redevelop in a way that would require new stormwater detention and water quality measures.

Conceptual-level map and drawings of the project and location.

See map on last page of project description (Figure 30).

Description of the anticipated spatial distribution of likely benefits.

Cedar Creek/Juanita Creek.

Performance goals and measures

The performance goal is to infiltrate as much stormwater runoff as feasible given site constraints.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

A habitat restoration plan for Cedar Creek is currently being co-developed with this project to guide decision-making on future retrofit facilities. The project will complement installation of fish passable culverts on Juanita Creek at 100th Avenue NE and at NE 137th Place – City projects which are currently in design and construction.

Identification of anticipated support and barriers to completion.

Funding for construction of the identified projects, particularly considering budget impacts related to the COVID-19 pandemic, is likely the primary barrier to their completion.

Potential budget and O&M costs.

Based on experience from previous projects within Kirkland, capital costs will be approximately $1.5M - $2.0M for each of the three retrofit projects, for a total of $6 million in 2020 US dollars. O&M costs are approximately $5000 per year for each facility, for a total of $15,000 in 2020 US dollars.

Anticipated durability and resiliency.

Stormwater retrofit facilities are typically designed with a 25-year lifespan and will be maintained by the City of Kirkland maintenance crews.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).

- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

City of Kirkland is the project sponsor. An Ecology grant (Stormwater Financial Assistance Program) is being used to fund the planning effort, which will produce three 30% designs for retrofit projects. Additional funding will be needed to complete designs and construction.

Documentation of sources.

Ecology SFAP grant agreement available upon request. 2012 King County retrofit study available at: https://www.kingcounty.gov/services/environment/watersheds/cedar-river-lake-wa/documents/juanita-creekstormwater-retrofit.aspx

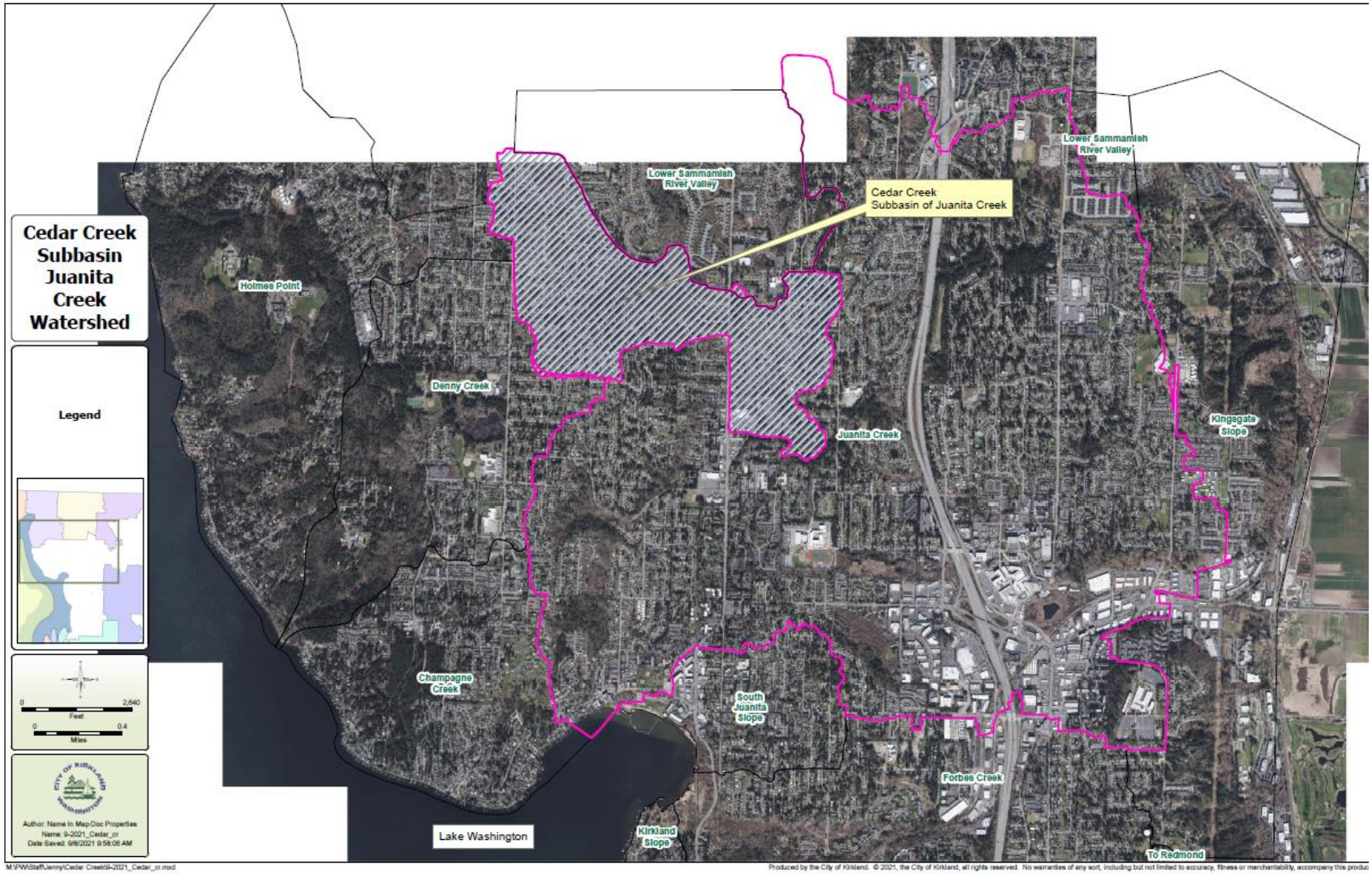


Figure 30: Overview of Juanita/Cedar Creek Stormwater Retrofit Implementation

WRIA 8 – Project Description
Forbes Creek / North Rose Hill Basin Stormwater Retrofit

Project Name and Number

Forbes/North Rose Hill Stormwater Retrofit (8-GLW-H25)

WRIA 8 WRE Subbasin

Greater Lake Washington

Narrative Description

The Forbes Creek Watershed within the City of Kirkland comprises 1837 acres that drain to Lake Washington. The creek now receives 2-year flows that are approximately 10 times higher than under pre-developed conditions. Kirkland received an EPA NEP grant in 2016 to identify and perform preliminary design work on 3 stormwater retrofit facilities to improve the creek's water quality and hydrology. The stormwater facilities were designed to 30% in Phase 1 of the project, which was completed in 2019. Additional funding is needed to take the projects to full design and construction.

The projects will likely use new and existing storm infrastructure typical of urban ROW (catch basins with grate, curb inlets, drainage pipes, etc.).

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

Once built, the stormwater retrofit facilities are expected to provide 0.39 millions of gallons total of storage and treatment for the water quality flowrate of 2.04 cfs from 50.2 acres. These estimates were calculated by a consultant and details are available upon request. The facilities are designed to infiltrate as much water as feasible, but infiltration rates are currently unknown. Stormwater will be treated per the Ecology stormwater manual or equivalent.

This retrofit project will voluntarily improve existing stormwater infrastructure, most of which was built before modern stormwater standards were in place, and in an area that is unlikely to redevelop in a way that would require new stormwater detention and water quality measures.

Conceptual-level map and drawings of the project and location.

See map on last page of project description (Figure 31).

Description of the anticipated spatial distribution of likely benefits.

Forbes Creek

Performance goals and measures

The performance goal of the retrofit facilities is to provide water quality treatment of 50.2 acres of storm runoff, and infiltration or flow control to the maximum extent feasible.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Forbes Creek is classified as a Tier 3 stream by WRIA 8. The facilities will improve water quality and reduce flows to meet the Ecology 8% flow duration standard for the 50.2 acre catchment area.

Identification of anticipated support and barriers to completion.

Funding for the project, particularly considering COVID-19 budget impacts, is likely the primary barrier to completion of the project. Ecology has provided funding for design and construction of Site 2 via the Stormwater Financial Assistance Program (Grant WQC-2021-KirkPW-00058). Funding is still needed for Sites 1 and 5.

Potential budget and O&M costs.

Based on experience from previous projects within Kirkland, budget and O&M costs will be approximately $1.5M - $2.0M per retrofit plan in 2020 US dollars. Given recent Ecology funding for Site 2, remaining need is approximately $5 million in 2021 dollars.

Anticipated durability and resiliency.

Stormwater retrofit facilities are typically designed with a 25-year lifespan and are maintained by the City of Kirkland maintenance crews while viable.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).

- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

City of Kirkland is the project sponsor. Phase I of the project was completed with Ecology grant funding. Phase II & III are currently unfunded.

Documentation of sources.

Ecology NEP grant agreement available upon request.

City of Kirkland, 2019. Forbes/North Rose Hill Stormwater Retrofit Planning Project – grant deliverables. Ecology National Estuary Program Grant: WQNEP2016-KirkPW-00010.

King County, 2012. Stormwater Retrofit Analysis for Juanita Creek Basin in the Lake Washington Watershed. Ecology Grant: G0800618. King County Department of Natural Resources and Parks, Water and Land Resources Division, Seattle, WA. https://www.kingcounty.gov/services/environment/watersheds/cedar-river-lake-wa/documents/juanita-creek-stormwater-retrofit.aspx

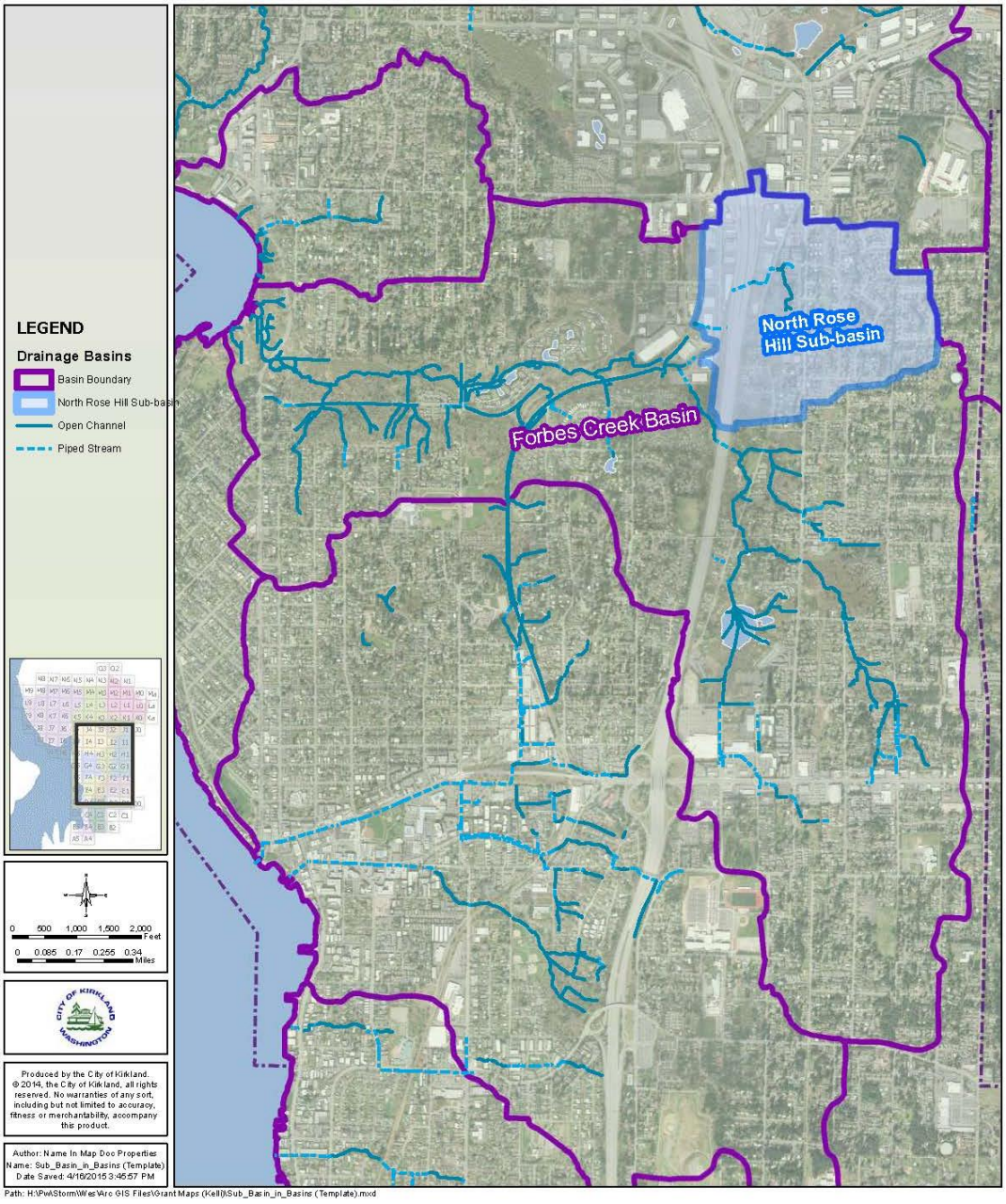


Figure 31: Overview of Drainage Basins for Forbes/North Rose Hill Stormwater Retrofit Project

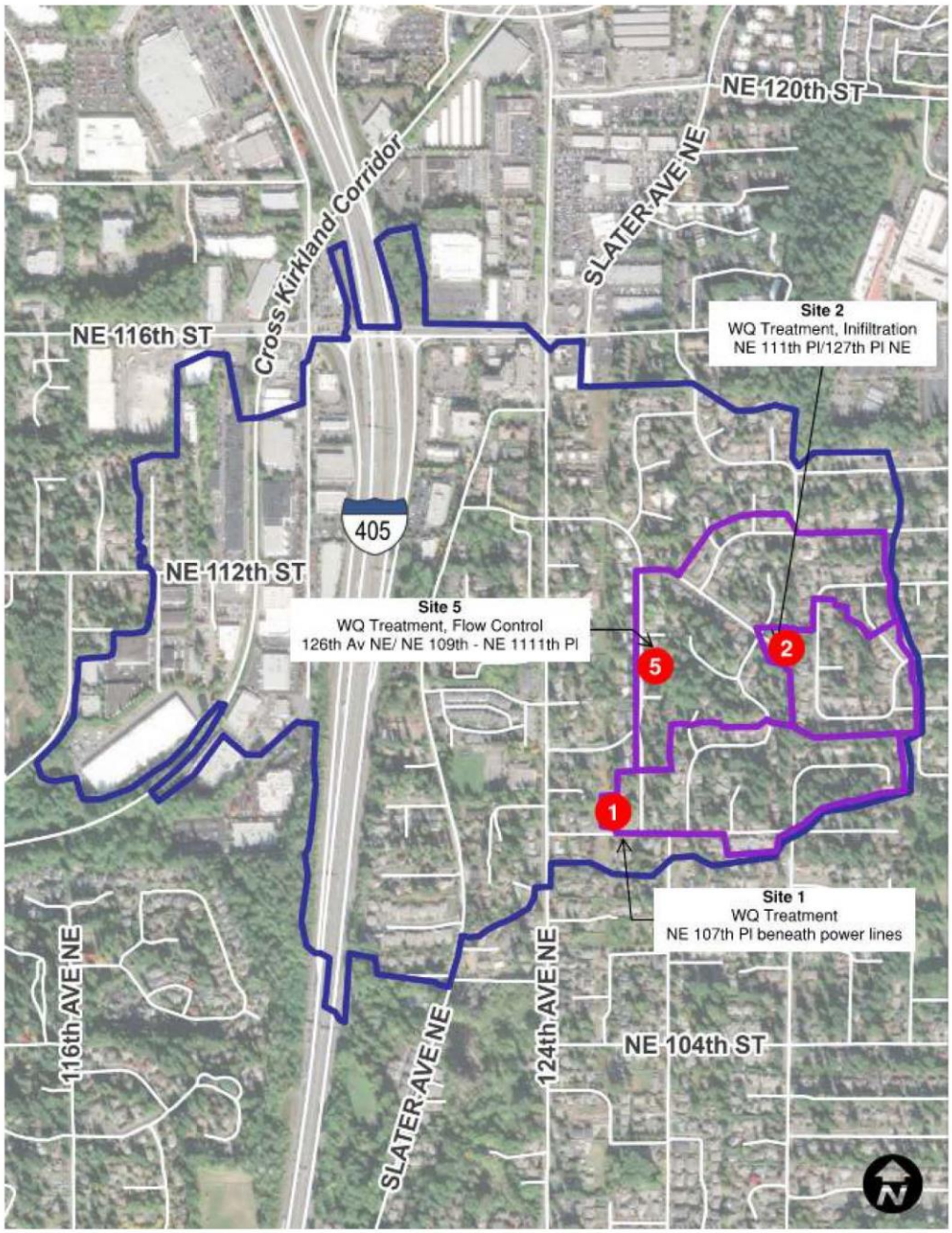


Figure 32: Sites 1, 2 and 5 of the Forbes/North Rose Hill Stormwater Retrofit Project

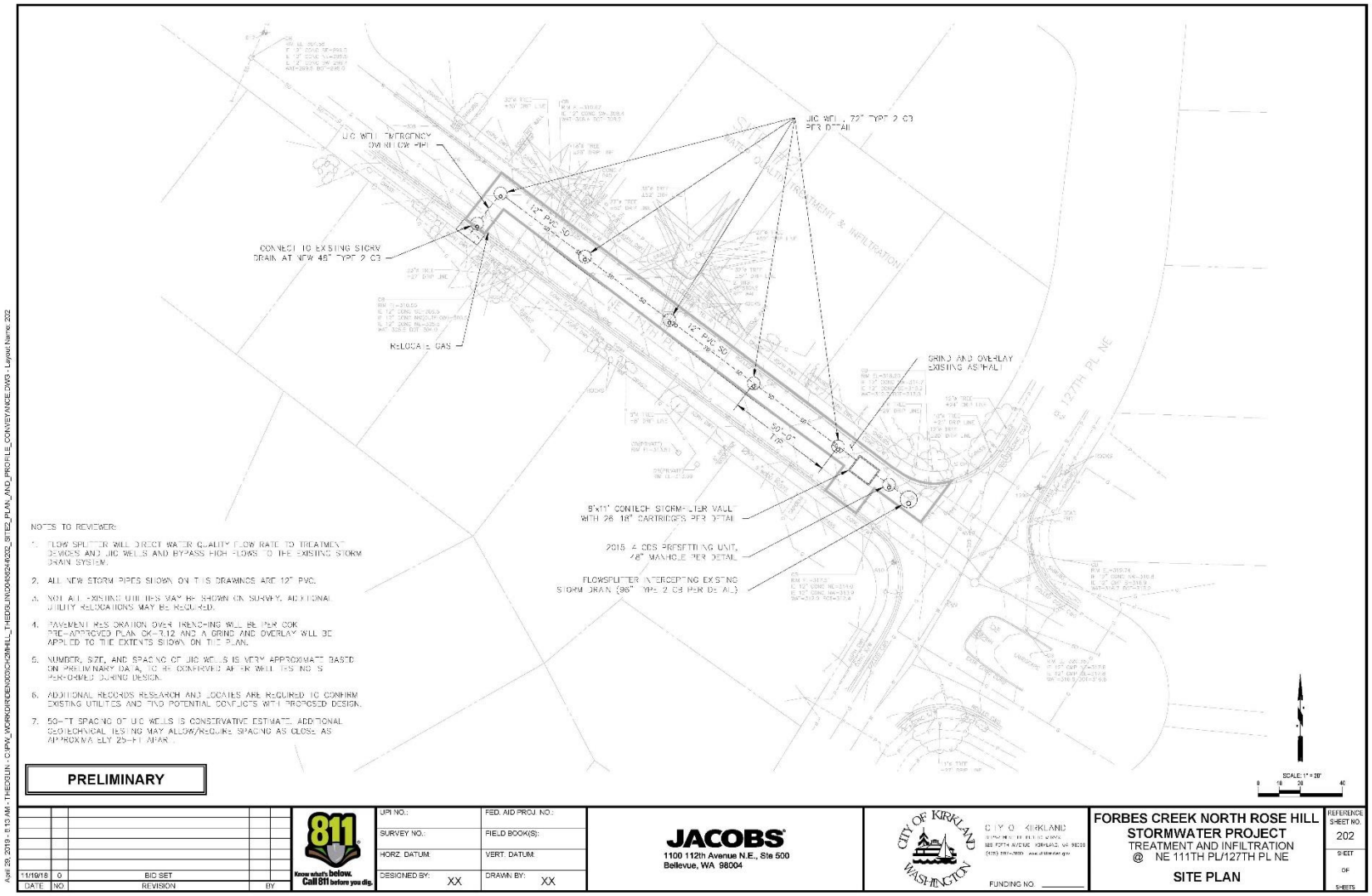


Figure 33: Preliminary Site Plan for Site 2 - Forbes/North Rose Hill Stormwater Retrofit

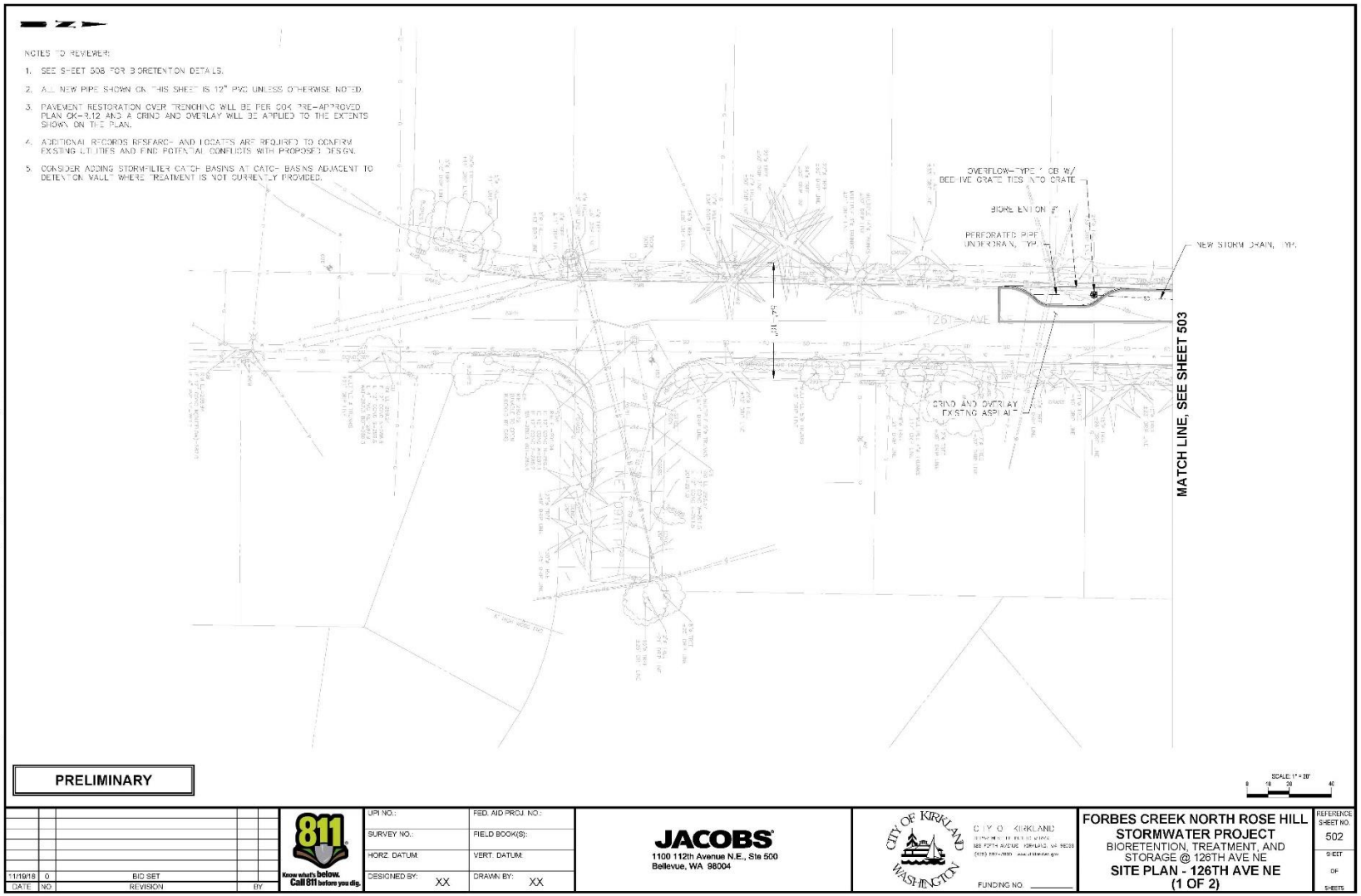


Figure 34: Preliminary Site Plan for Site 5 - Forbes/North Rose Hill Stormwater Retrofit

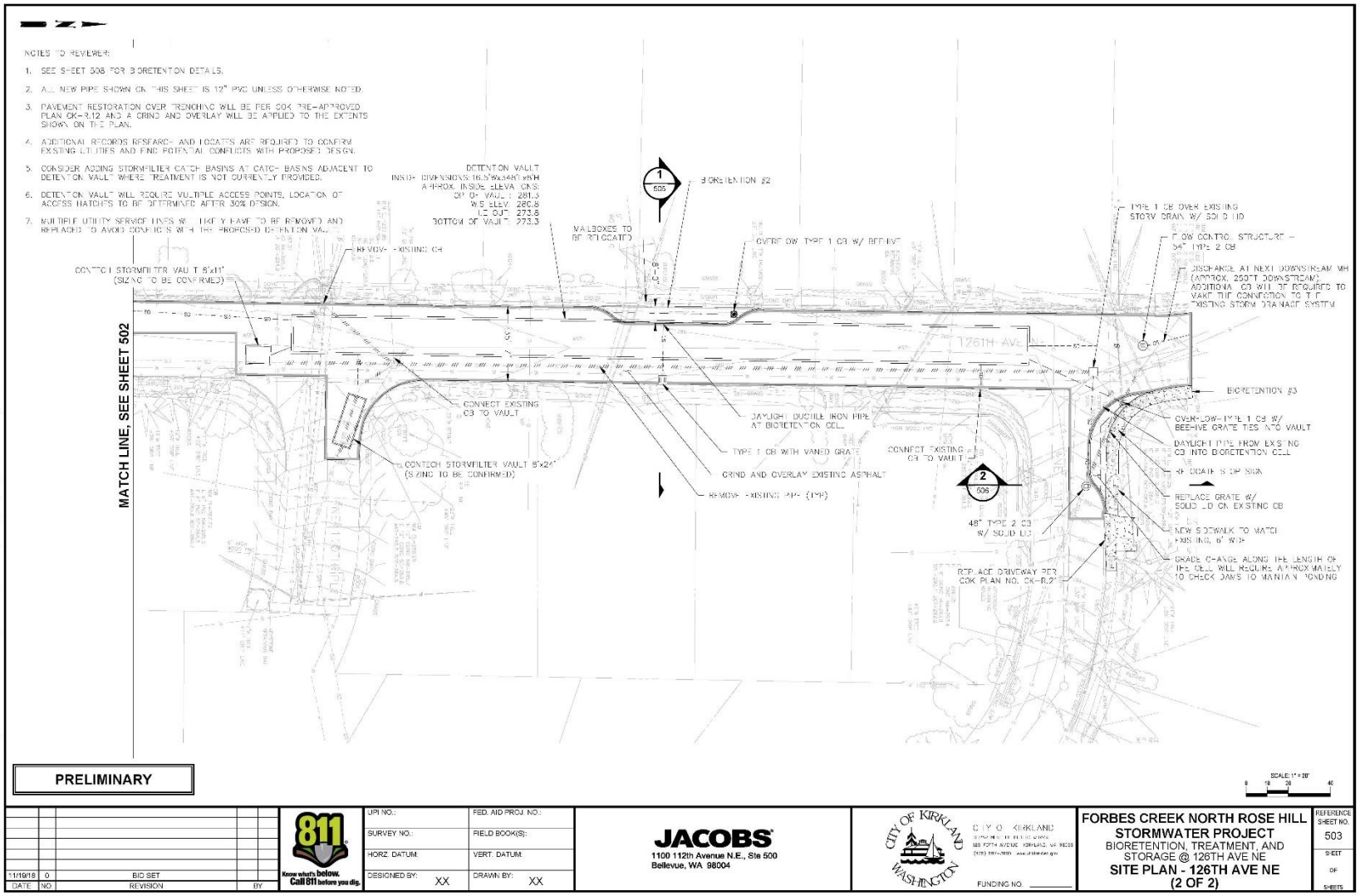


Figure 35: Preliminary Site Plan for Site 5 - Forbes/North Rose Hill Stormwater Retrofit

WRIA 8 – Project Description

High Woodlands Stormwater Retrofit

Project Name and Number

High Woodlands Stormwater Retrofit (8-GLW-H26)

WRIA 8 WRE Subbasin

Greater Lake Washington

Narrative Description

The City of Kirkland (City) will site and size stormwater retrofit facilities within the High Woodlands sub-basin of Juanita Creek. Retrofit facilities in this 431-acre basin will contribute to improved flows and water quality in the overall Juanita Creek Watershed as envisioned in King County's 2012 Juanita Retrofit Study. Stormwater retrofit facilities will contribute to stream restoration efforts that include installation of a fish passable culvert at I-405/NE 145th Street to be installed by WSDOT by 2025.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

Planning will quantify the overall need for flow control and water quality facilities, and will identify sites and 30% designs for up to 3 facilities. Infiltration is thepreferred stormwater management method. The project will include geotechnical exploration to identify and size infiltration projects such as infiltration wells or infiltration vaults. Although specific information is not yet available for projects in this basin, a similar project within Kirkland, *132nd Square Park* with 48.5 acres of contributing area, has been designed to achieve an annual infiltration volume ofapproximately 70 acre-feet. A rough estimate for this subbasin is that the three projects would togetherserve a similar area.

There are currently no requirement for stormwater retrofit of existing development. In order to make as much progress as possible toward restoration of pre-development hydrologic conditions, this project will to the degree feasible apply flow control and water quality treatment requirements of the 2016 King County Stormwater Drainage Manual to the tributary area for the project.

Stormwater will be intercepted and stored by re-routing or initiating stormwater connections (storm drainage lines, curb cuts, etc.), and/or flow control facilities (detention tank, vault, etc.). Stormwater will be treated by water quality facilities (wetvault, UIC, proprietary treatment, etc.). Facilities will meet the Basic and/or Enhanced level of treatment as noted in the 2016 King County Stormwater Drainage Manual

Conceptual-level map and drawings of the project and location.

See map on last page of project description.

Description of the anticipated spatial distribution of likely benefits.

This project focuses on the High Woodlands sub-basin of the Juanita Creek Watershed. Juanita Creek drains to Lake Washington, part of the Lake Washington/Cedar/Sammamish Water Resources Inventory Area (WRIA) 8. The project channel extent for hydrologic analysis and stream protection and enhancement includes the reach from the culvert at the intersection of 111th Avenue NE and NE 141st Street upstream to a stormwater inlet on 119th Avenue NE near the intersection with NE 148th Street.

Performance goals and measures

The performance goal is to infiltrate as much stormwater runoff as feasible given site constraints. See the Stormwater Retrofit Analysis for Juanita Creek Basin in the Lake Washington Watershed (King County, 2012) report for further details.

Target flows will be meeting the ECY08 target. Target water quality will be to provide the Basic Water Quality Treatment for all pollution generating impervious surface (PGIS). Metrics found in December 2019 Preliminary Hydraulic Design Report (WSDOT, 2019).

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Restoration of the pre-development hydrologic regime through stormwater management is one aspect of an overall stream restoration program that also includes installation of fish passable culverts (Kirkland recently replaced the culvert at 111th Ave NE/NE 141st Street, and WSDOT will be replacing the culvert at I-405 and NE 145th Street by 2025), instream physical habitat restoration, and water quality improvement efforts such as spill control/cleanup and public education. Taken as a whole, this program has the goal of restoring salmon populations in Juanita Creek.

Identification of anticipated support and barriers to completion.

Community outreach will be part of the planning process – identified stormwater projects must provide ancillary benefits where possible, and must be designed to incorporate community interests and concerns. Funding for the project, particularly considering COVID-19 budget impacts, is likely the primary barrier to construction of the projects identified via this planning effort.

Potential budget and O&M costs.

Based on experience from previous projects within Kirkland, it is likely that projects to serve 10-20 acres of tributary area will cost on the order of $2 million, for a total of $6 million for the

three projects identified via this planning process. Operation and Maintenance costs for water quality treatment and infiltration facilities of this size are generally in the order of $5,000 per year each, for a total of $15,000 per year for three facilities.

Anticipated durability and resiliency.

The infiltration facilities are typically designed with a 25-year lifespan and will be maintained by the City of Kirkland maintenance crews while viable.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.

- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

This project is currently supported by funds from the Kirkland Surface Water Utility (i.e. local funds).

Documentation of sources.

King County, 2012. *Stormwater Retrofit Analysis for Juanita Creek Basin in the Lake Washington Watershed. Ecology Grant: G0800618.* King County Department of Natural Resources and Parks, Water and Land Resources Division, Seattle, WA.

WSDOT, 2019. *I-405 MP 21.94 Juanita Creek: Preliminary Hydraulic Design Report*. Washington Department of Transportation, Headquarters Hydraulics Office, Olympia, WA.

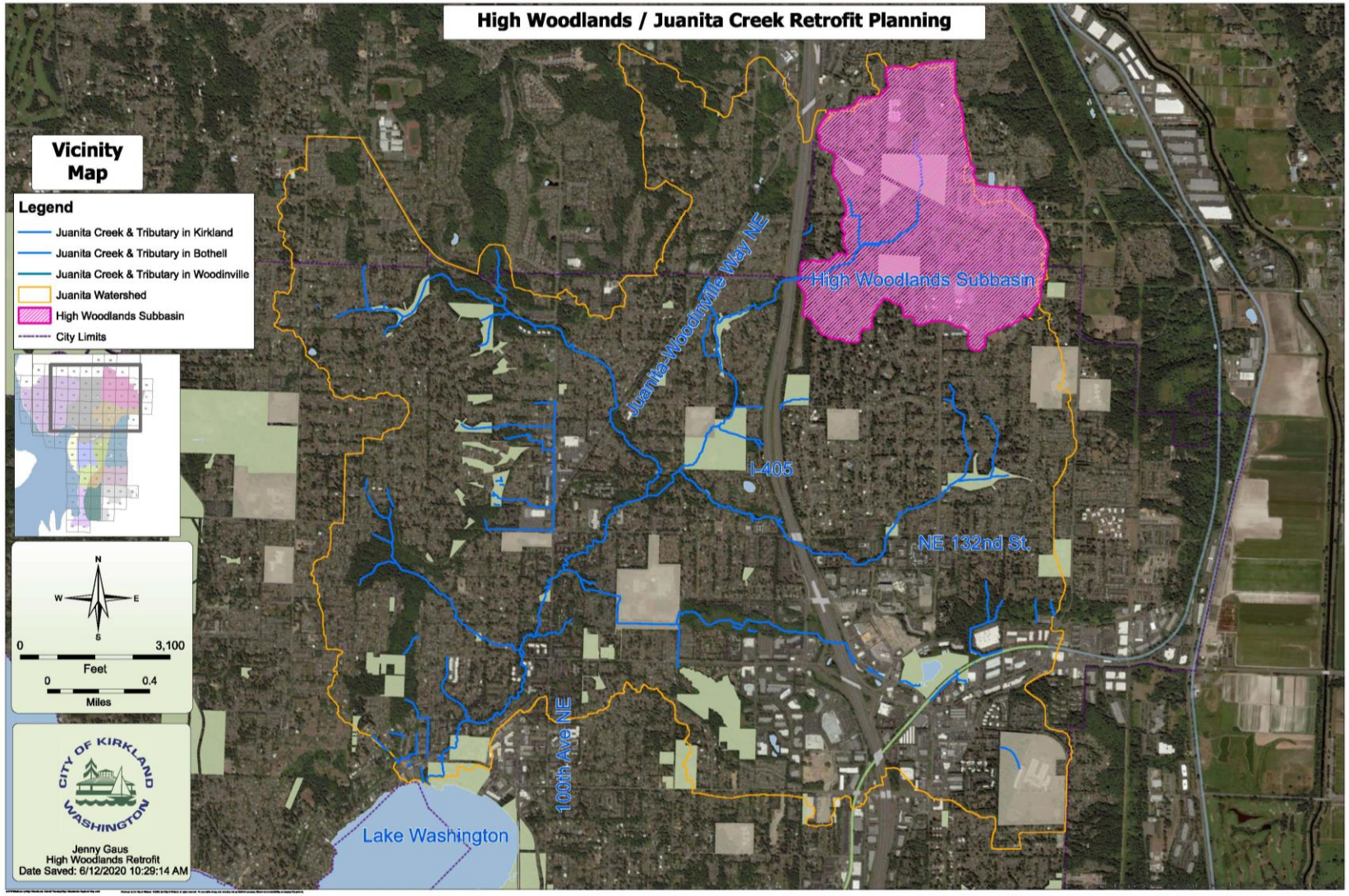


Figure 36: High Woodlands Stormwater Retrofit Overview Map

Spinney Homestead Park Stormwater Retrofit Planning and Construction

Project Name and Number

Spinney Homestead Park Stormwater Retrofit Planning and Construction (8-GLW-H27)

WRIA 8 WRE Subbasin

Greater Lake Washington

Narrative Description

The Spinney Homestead Park Stormwater Retrofit Planning and Construction Project (project) will conduct stormwater retrofit planning, design development, and facility construction at Spinney Homestead Park. The stormwater from 32 acres that surround the park is conveyed by pipes and flows untreated into Forbes Creek. The park is situated ideally in the Forbes Watershed landscape to receive this re-routed stormwater, treat and infiltrate or detain as much of the stormwater as possible. Excess flows will bypass the facility.

Currently a stormwater system flows to the south side of the park and outlets to Forbes Creek. This system would be rerouted into the park and managed through the retrofit facility. The project has completed a 30% design which includes a water quality facility and an infiltration vault.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The project is currently designed to 30%. The facility will be an infiltration vault of 15,060 square feet with approximately 8 feet of live storage and an infiltration rate of 8.5 inches/hour. A similar project within Kirkland, *132nd Square Park* with 48.5 acres of contributing area, has been designed to achieve an annual infiltration volume of approximately 70 acre-feet. This project is expected to be similar in size and scope, anticipating an infiltration volume of approximately 46.2 acre-feet. This expectation is highly dependent on geotechnical exploration beneath the infiltration facility.

Currently Kirkland is a Phase II permittee under the NPDES Stormwater Permit. Retrofitting stormwater systems installed before stormwater regulations became required for most development projects is notrequired through this permit. This treatment, infiltration, and flow control would be voluntary and beyond existing stormwater requirements. This project will ensure flow control and water quality to meet *2016 King County Stormwater Drainage*

Manual requirements and *City of Kirkland Policy D-10, theAddendum to the King County Stormwater Drainage Manual*.

Stormwater will be treated by flow control facilities (detention tank, vault, etc.), and/or water quality facilities (wetvault, UIC, proprietary treatment, etc.). Both techniques remove suspended solids which are known to contain nutrients, pesticides, heavy metals, and volatile chemicals, such as petroleumproducts.

Conceptual-level map and drawings of the project and location.

See map on last page of project description.

Description of the anticipated spatial distribution of likely benefits.

The retrofit projects are designed using standard design practices to benefit the overall environmental health of Forbes Creek through reduction of runoff and removal of pollutants, but specific habitat improvements are not considered.

Performance goals and measures

The performance goal is to infiltrate as much stormwater runoff as feasible given site constraints. See the King County's Stream Report Webpage for further details.

Target flows will be meeting the ECY08 target. Target water quality will be to provide the Basic Water Quality Treatment for all pollution generating impervious surface (PGIS).

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

One of the predominant issues of stormwater is that it changes local hydrology to increase the speed and height of peak flows following a rain event. These quicker, larger flows can be extremely erosive for creeks that had once been surrounded by forest. Forbes Creek supports Coho Salmon and steelhead.

Identification of anticipated support and barriers to completion.

Funding for the project, particularly considering COVID-19 budget impacts, is likely the primary barrier to completion of the project.

Potential budget and O&M costs.

Based on experience from previous projects within Kirkland, capital costs will be approximately $4.2M - $5.2M for each of the retrofit facility in 2020 US dollars. O&M costs are approximately $5,000 per year in 2020 US dollars.

Anticipated durability and resiliency.

The infiltration facilities are typically designed with a 25-year lifespan and will be maintained by the City of Kirkland maintenance crews while viable.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.

  Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.

- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

The Kirkland City Council has funded up to 30% design. Project currently looking to apply for grant funding.

Documentation of sources.

"Stream Report." *Stream Report - King County*, 2 Nov. 2016, green2.kingcounty.gov/streamsdata/watershedinfo.aspx?Locator=0456.

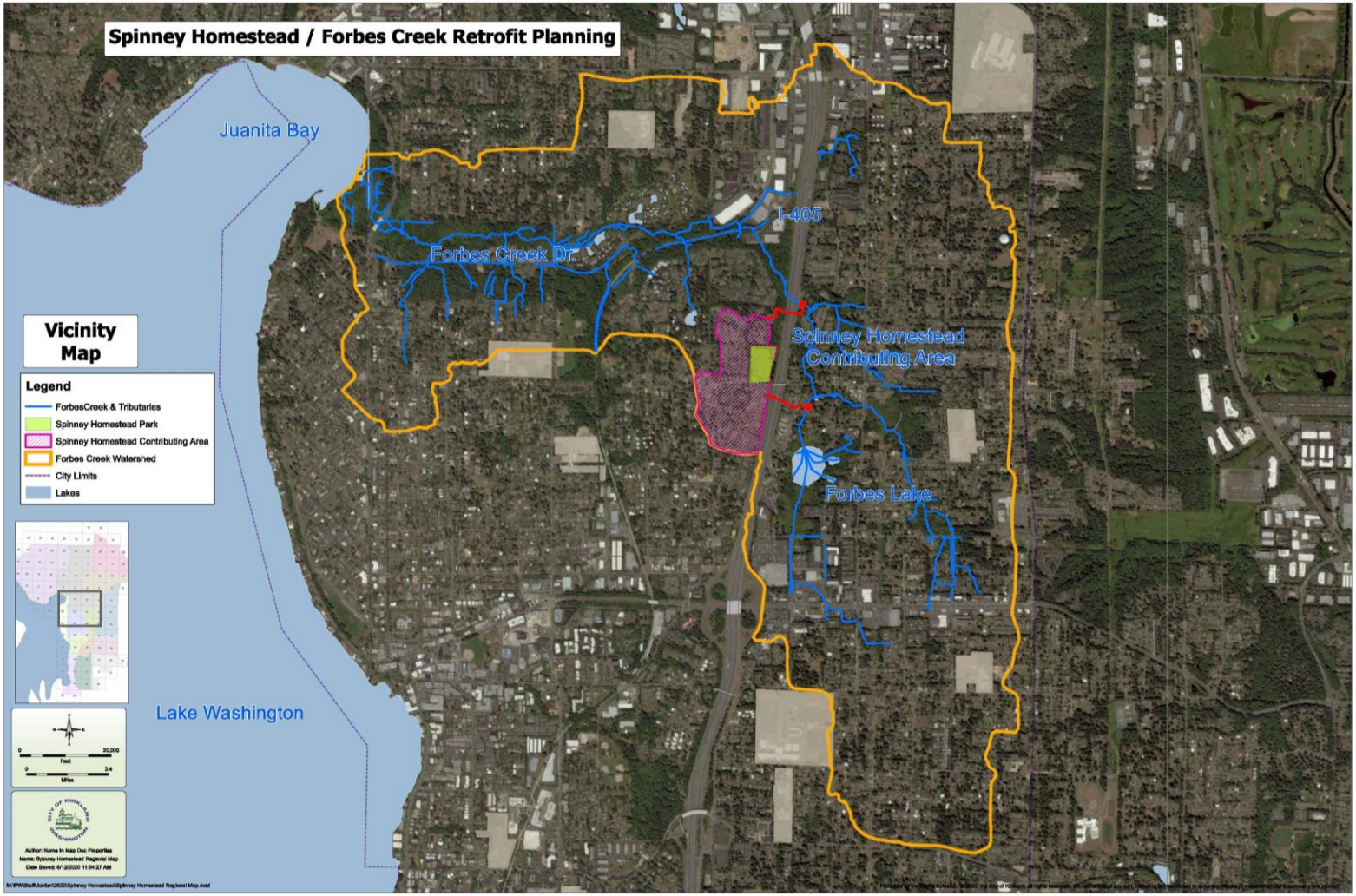


Figure 37: Spinney Homestead Park Stormwater Retrofit Planning and Construction

Cemetery Pond Stormwater Retrofit and Wetland Restoration

Project Name and Number

Cemetery Pond Stormwater Retrofit and Wetland Restoration (8-MC-H28)

WRIA 8 WRE Subbasin

May/Coal

Narrative Description

This project will improve the water quality in May Creek through the retrofit design of an existing stormwater detention pond (DR0509) at SE 128th Street and 165th Avenue SE in an unincorporated area of King County near Renton. The facility will reduce flows to May Creek by providing stormwater detention.

The Washington Department of Ecology identified May Creek as a targeted watershed for stormwater retrofit planning due to its high ecological integrity, indicating that stormwater retrofit actions within the watershed will have a greater probability of contributing to the recovery and stability of a functioning aquatic ecosystem. The Final Adopted May Creek Basin Action Plan recommends enhancement and restoration of the wetland by cleanup of existing trash piles, replanting of native vegetation and restoration of filled wetland areas. This work will serve as a pilot demonstration project to inform future stormwater retrofit projects involving wetlands.

The project is currently in early design stages and is negotiating a grant from Washington Department of Ecology (WQC-2022-KCWLRD-00069) to deliver Acquisitions of project site, 90% Design, & Community outreach. The 90% design package will be completed in 2024.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The project is anticipated to reduce flows to May Creek by providing stormwater detention. Infiltration capacity at the site has not yet been determined. Surface geology at the site consists of wetland and till, so significant infiltration is unlikely.

Conceptual-level map and drawings of the project and location.

See map on last page of project description (Figure 38).

Description of the anticipated spatial distribution of likely benefits.

Primary benefits expected for May Creek Tributary 291A. Benefits may carry down to May Creek.

Performance goals and measures.

Pond water levels, storm flow releases, downstream water quality and B-IBI scores.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

May Creek supports five species of fish: Chinook, Sockeye, Coho and kokanee salmon, and steelhead and Cutthroat Trout (Kerwin, 2001; "Stream List," 2016). From 2000 to 2015, volunteers with the King County Salmon Watcher Program observed salmon in May Creek. Volunteers consistently saw Sockeye Salmon. Less commonly spotted were Chinook Salmon, Coho Salmon, Cutthroat Trout, and kokanee salmon.

Identification of anticipated support and barriers to completion.

King County currently owns the majority of the project site (category 2 wetland) and acquired 5 additional parcels 2019-2021. The project continues to negotiate acquisitions with will sellers to maximize public ownership of this critical area.

Potential budget and O&M costs.

Construction and O&M costs not yet determined.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the stormwater project to maintain benefits over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater infrastructure would be maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that impacts the project offset.
- Land use changes external to the project site would have negligible impact on project function.

- The water source likely would lack the predictability inherent to other types of managed aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water, and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- The project diversion can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the stormwater infiltration site and surrounding area likely would not impact project function and the anticipated benefits.
- Sea level increase would not impact project function.
- Project function could be impacted by a decrease in summer precipitation, drought conditions, an increase in the frequency and/or intensity of storm events, an increase in evaporation, or other climatic factors.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County is conducting project design with grant funding from Washington Department of Ecology.

Documentation of sources.

Kerwin, J., 2001. Salmon and Steelhead Habitat Limiting Factors Report for the Cedar – Sammamish Basin (Water Resource Inventory Area 8). Washington Conservation Commission. Olympia, WA.

King County "Stream List," 2016: https://www.kingcounty.gov/services/environment/animals-and-plants/salmon-and-trout/salmon-watchers/streams.aspx

Project website: https://kingcounty.gov/depts/dnrp/wlr/sections-programs/stormwater-services-section/capital-services-unit/small-stream-basin-retrofit/may-creek-trib-291A-retrofit.aspx

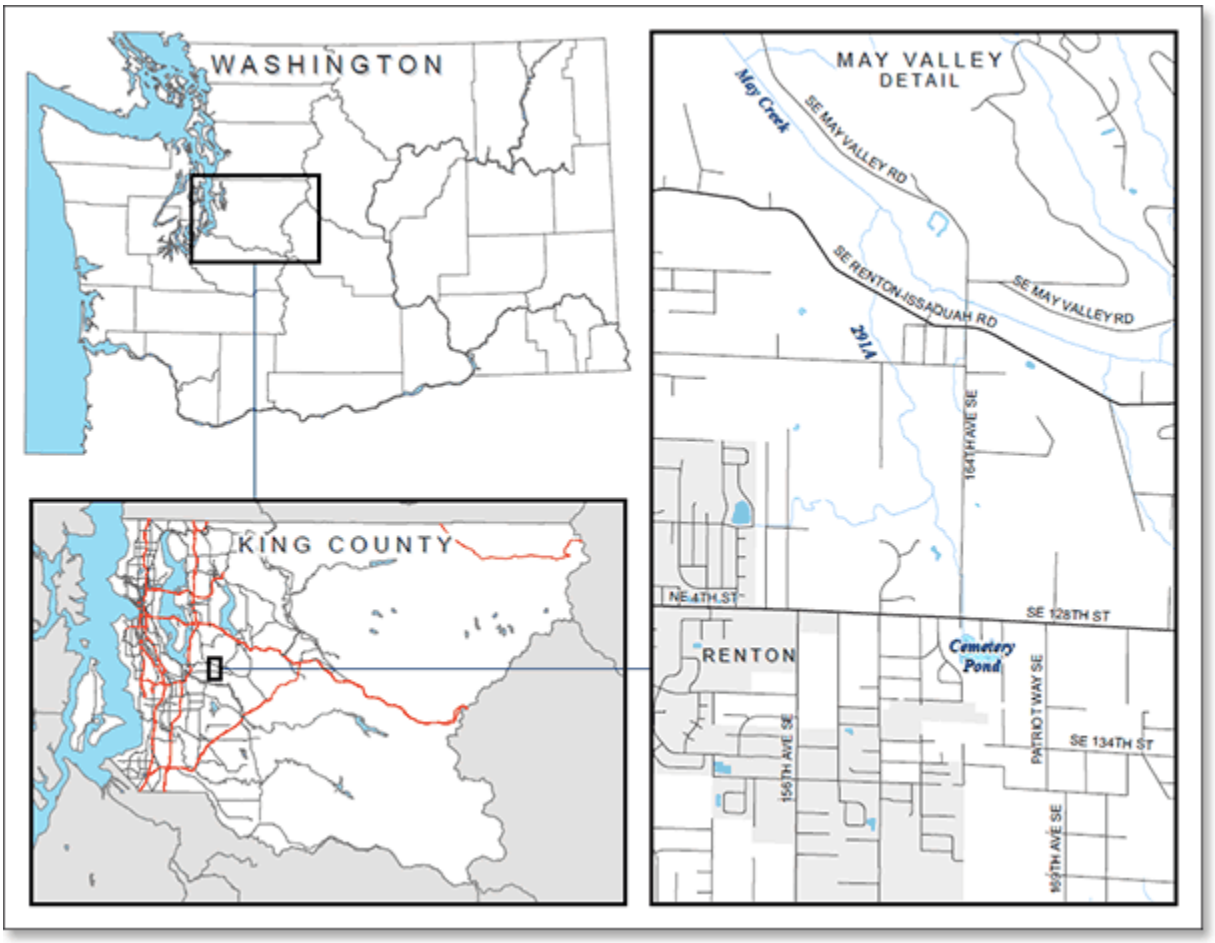


Figure 38: Cemetery Pond Stormwater Retrofit and Wetland Restoration

Map source: https://kingcounty.gov/depts/dnrp/wlr/sections-programs/stormwater-services-section/capital-services-unit/small-stream-basin-retrofit/may-creek-trib-291A-retrofit.aspx

WRIA 8 – Project Description
Carey/Holder/Issaquah Confluence Restoration

Project Name and Number

Carey/Holder/Issaquah Confluence Restoration (8-I-H30)

WRIA 8 WRE Subbasin

Issaquah

Narrative Description

This project includes restoration at the confluence of Carey, Holder and Issaquah Creeks located in the Issaquah subbasin in Hobart, Washington. The confluence is on a 120-acre site in King County ownership. This project proposes to restore riparian vegetation, add livestock fencing, and implement other best management practices for livestock. Some fencing has already been built. This project also has the opportunity to install large woody debris to facilitate floodplain interactions and off-channel habitat creation, including wetlands.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize these three creeks as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

This project will restore the confluence of Carey, Holder, and Issaquah Creeks on a site in King County ownership. The proposed restoration actions include adding woody debris to facilitate floodplain interactions and create off-channel habitat, including wetlands. This proposal also includes revegetating riparian areas and installing livestock fencing. These restoration actions will increase the volume and availability of off-channel habitat for juvenile salmonids and increase overall channel complexity and habitat quality.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 39).

Description of the anticipated spatial distribution of likely benefits.

This project includes restoration at the confluence of Carey, Holder and Issaquah Creeks located in the Issaquah subbasin in Hobart, Washington. The confluence is on a 120-acre site is in King

County ownership. Associated wetlands and small streams will also be included in the future project footprint.

Performance goals and measures.

Project is in feasibility phase, performance goals and measures are in development at this time.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize these three creeks as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the ESA. Creation of edge habitat and enhanced riparian buffers through the addition of woody debris and restoration of wetlands will provide hydraulic complexity in addition to benefitting prey availability for fish species, water quality and water quantity. Riparian vegetation will provide shade to help protect water temperatures and detritus, essential for the aquatic food web.

Identification of anticipated support and barriers to completion.

Project is in feasibility phase and anticipated support and barriers to completion are unknown at this time.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost is unknown at this time.

Anticipated durability and resiliency.

Not available at this feasibility stage.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County. Sponsor contact: Judy Blanco, jublanco@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources.

None

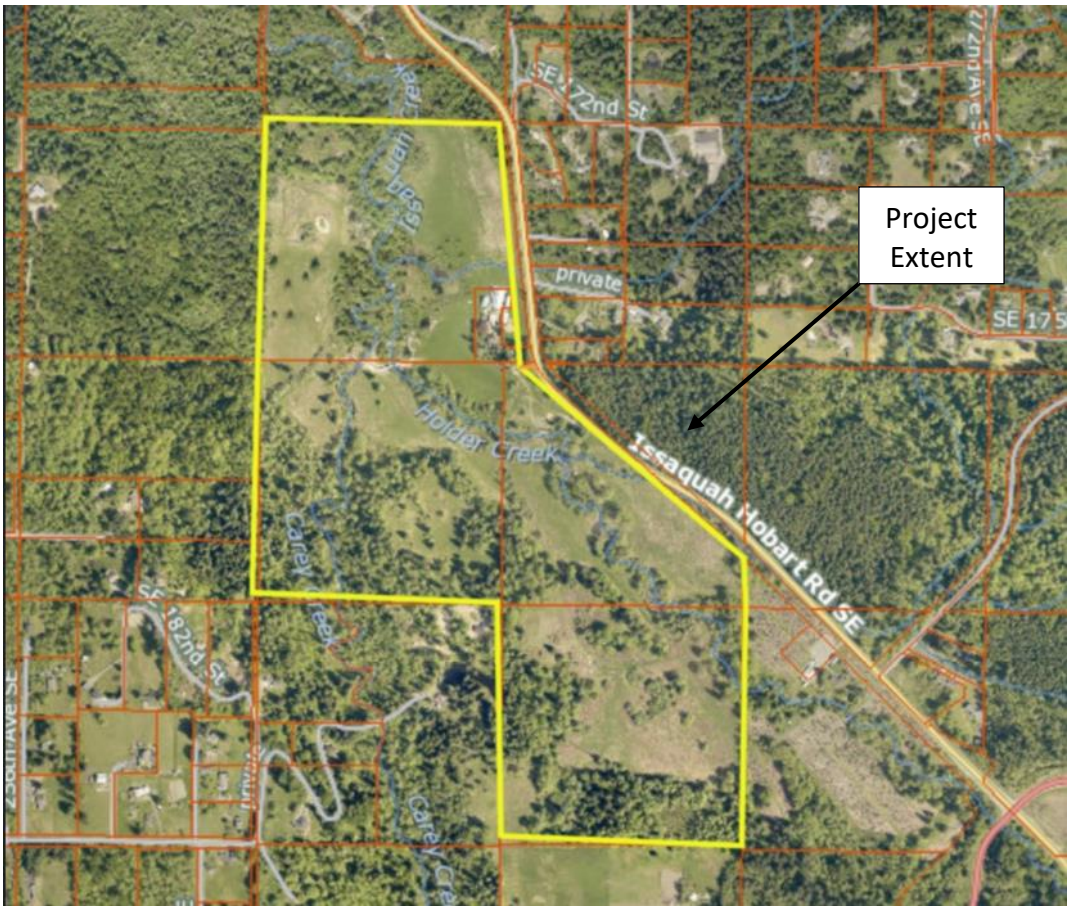


Figure 39: Site Plan for Cary/Holder Issaquah Confluence Restoration Project

WRIA 8 – Project Description
Issaquah Creek In-Stream & Riparian Restoration - Lake Sammamish State Park

Project Name and Number

Issaquah Creek In-Stream & Riparian Restoration - Lake Sammamish State Park (8-I-H31)

WRIA 8 WRE Subbasin

Issaquah

Narrative Description

The Mountains to Sound Greenway Trust will complete in-stream restoration and riparian buffer restoration along 6,000' of Issaquah Creek within Lake Sammamish State Park, a Tier 1 system in the WRIA 8 Salmon Recovery Plan. This project will provide significant habitat benefits for juvenile Chinook and other salmonids including in-creek Large Woody Material (LWM) placement for structural diversity and creation of floodplain and side-channel connectivity, resulting in more functional and complex refuge and foraging habitat.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Issaquah Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the stream and riparian habitats associated with Issaquah Creek within Lake Sammamish State Park in Issaquah, Washington. Creation of floodplain and side-channel connectivity and installation of LWM has several ecological functions including increasing hydraulic diversity, managing flows, creating deeper pools that provide refugia for fish, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Shade from installed riparian vegetation will moderate water temperature, reduce evaporation, create habitat, and provide long-term recruitment of LWM.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 40).

Description of the anticipated spatial distribution of likely benefits.

The project proposes to restore 6,000 feet of Issaquah Creek within the Lake Sammamish State Park, which connects with Lake Sammamish immediately downstream of the proposed project area.

Performance goals and measures.

The primary goal for this project is to enhance the quality and quantity of key, strategically located salmonid habitat, particularly for juvenile Chinook rearing and adult Chinook holding in Issaquah Creek to support WRIA 8 Salmon recovery goals. Adding large wood to the creek will create a suite of low-velocity habitats promoting longer stream residence. The hydrology of the system will engage the floodplain, and the LWM will scour out pools. Increase in refuge areas will result in longer periods of rearing, helping fish achieve greater fitness and condition. Riparian reforestation will provide future LWM recruitment, shade the creek, provide additional nutrients, and other benefits.

This will be completed through the following objectives/measures:

- Improve canopy cover by revegetating 5 acres of riparian habitat with the installation of 4,000 native trees and shrubs to achieve a diverse conifer-based forest to increase shading and food sources for salmonids within 150’ of creek. Installed trees will provide an important source of wood recruitment to the stream over the coming decades.
- Continue active restoration on more than 40 acres of existing riparian buffer enhancement projects. Install at least 5,000 native trees and shrubs to continue establishment of coniferous forest canopy.
- Create a 193’ pilot channel to reconnect the creek to oxbow channel providing an additional 0.3 miles (1.5 acres) of habit for salmonids which will be available immediately and provide opportunity for the creek to migrate more freely within the delineated channel migration zone.
- Scrape 250’ of steep banks to accelerate channel widening and increase sinuosity. Assuming a 10-year flood event, an additional 50’ of bank is expected to naturally erode increasing the width of the lower floodplain bench and adding channel length.
- Construct 3 apex jams and 17 large spur jams to partition stream flow, increase sinuosity, create a velocity shadow downstream to form gravel bars, improve hyporheic flow to reduce stream temps, and create 23 pools for juvenile rearing/adult holding.
- Install 32 logs, 16 log jacks and 1 small spur jam in and along the creek and oxbow channel to immediately improve in-water habitat for salmonids, increase bank roughness to provide refugia for juvenile salmonids during higher flows, and supporting pool and multifractional size sediment bar formation (operating in conjunction with larger structures).

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, kokanee, and resident Cutthroat Trout that utilize Issaquah Creek as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the ESA. LWM and restoration of riparian vegetation will directly benefit prey availability, spawning success as well as survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

The Greenway Trust has completed significant partner and stakeholder engagement in this effort, with efforts including Washington State Parks & Recreation Commission (the landowner and land manager) engaged routinely and regularly in planning and design, seeking input from staff from multiple tribes, ongoing conversations with the City of Issaquah, close coordination with the Lake Washington/Cedar/Sammamish Watershed (WRIA 8) and the WRIA 8 Technical Committee, and discussion with other interested parties (Washington Dept. of Fish and Wildlife, King County kokanee Work Group, nonprofit partners).

Funding for the design phase of the project has been secured via grants from the WRIA 8 / King County Flood Control District (KCFCD) Cooperative Watershed Management (CWM) grant program, the Salmon Recovery Funding Board (through the Washington State Recreation & Conservation Office), and from private contributions from The Boeing Company.

The Greenway Trust is currently seeking funding to complete construction of the project in Phases, with anticipated grants from WRIA 8/KCFCD CWM program, and from the Salmon Recovery Funding Board and Puget Sound Acquisition and Restoration programs. The Greenway Trust is also seeking funding from other public and private sources including the National Fish and Wildlife Foundation.

Possible barriers to completion are limited. An uncommon aspect of this project is the relatively unique opportunity to complete in-stream and riparian habitat restoration on such a large stretch of Creek within an otherwise heavily developing area. Two key project partners (State Parks and the City of Issaquah) have placed only a handful of limitations on the project:

- No additional adverse impact to existing and future State Parks facilities (Sunset Beach bathhouse and pedestrian bridge, small pump station in Reach 4).
- Leave an area for a future mid-Park channel-spanning bridge across the Creek (in Reach 3, where the Creek is deeply incised and unlikely to meander substantially).
- Flood Impacts: Zero rise at the Park-City boundary upstream, and compliance with City and FEMA requirements for projects within a FEMA-regulated floodway.

An additional possible constraint is associated with the overall cost of the project, as funding is being sought to complete the effort in multiple Phases. The Greenway Trust anticipates initiating the project in the 2022-23 construction window using funding secured to date, and will continue to seek funding to complete the project in the coming years.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are estimated at $4,500,000. Approximately $2.5 million has been secured to date. Riparian buffer maintenance is anticipated to cost $25,000 per year; in-stream maintenance costs are not determined at this time. Effectiveness monitoring for the project, which is desired by multiple entities, is anticipated to cost $25-50,000 per year.

Anticipated durability and resiliency.

After the project is completed, there will still be some need for site maintenance in order to achieve functional forested riparian habitat. Throughout the duration of this project, the Greenway Trust will focus on invasive weed control, mulching, monitoring and adaptive site management, and plant replacement with a goal of minimizing the need for long term maintenance. The Greenway Trust will complete a minimum of 5 years of intensive maintenance of the riparian buffer restoration plantings with a focus on native plant survival and invasive weed control. Maintenance intervals will be reduced as viable after 5 years. The Greenway Trust has a 15+ year history of performing similar activities in the Park, supported by local grants, Greenway Trust staff, sponsored AmeriCorps members, volunteers, and other elements. The Greenway Trust has been successful in obtaining stewardship and maintenance funding from other funding sources, including state and local grants and private funding from the Greenway Trust's partnership with Carter Subaru. The Greenway Trust also has a long history of working with volunteers and schools in Lake Sammamish State Park and will continue to lead volunteer stewardship events to remove invasive weeds in the riparian corridor of Issaquah Creek.

In-stream restoration will be monitored, and is not anticipated to be maintained. The in-stream elements of the project are designed and engineered with minimal anchoring to function naturally in a dynamic process-based system. The Greenway Trust is working with State Parks on a conceptual plan for maintenance of the in-stream features to support prevention of damage to the Park's facilities, and this plan will continue to be refined over the coming years. As described elsewhere in this proposal, the in-stream restoration components incorporate many elements that are designed to provide long-term functionality, including spur and apex jams that will help to capture mobile wood throughout the project area. Numerous stakeholders have expressed an interest in long-term effectiveness monitoring for the project, and while funding has not been identified, this aspect will continue to be explored.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Mountains to Sound Greenway Trust. Sponsor contact: Mackenzie Dolstad, mackenzie.dolstad@mtsgreenway.org. The sponsor has submitted for funding and is ready to

proceed with implementation of riparian buffer restoration immediately, as funding from other sources allows for completion of Final Design for in-stream restoration components.

Documentation of sources.

More details on the sources, methods, uncertainties, assumptions, and proposal can be found in the Greenway Trust's Preliminary Design report for the project, prepared by Northwest Hydraulic Consultants and The Watershed Company (2020). Additional project information and a link to the Preliminary Design report is available at: https://mtsgreenway.org/lower-issaquah-creek.

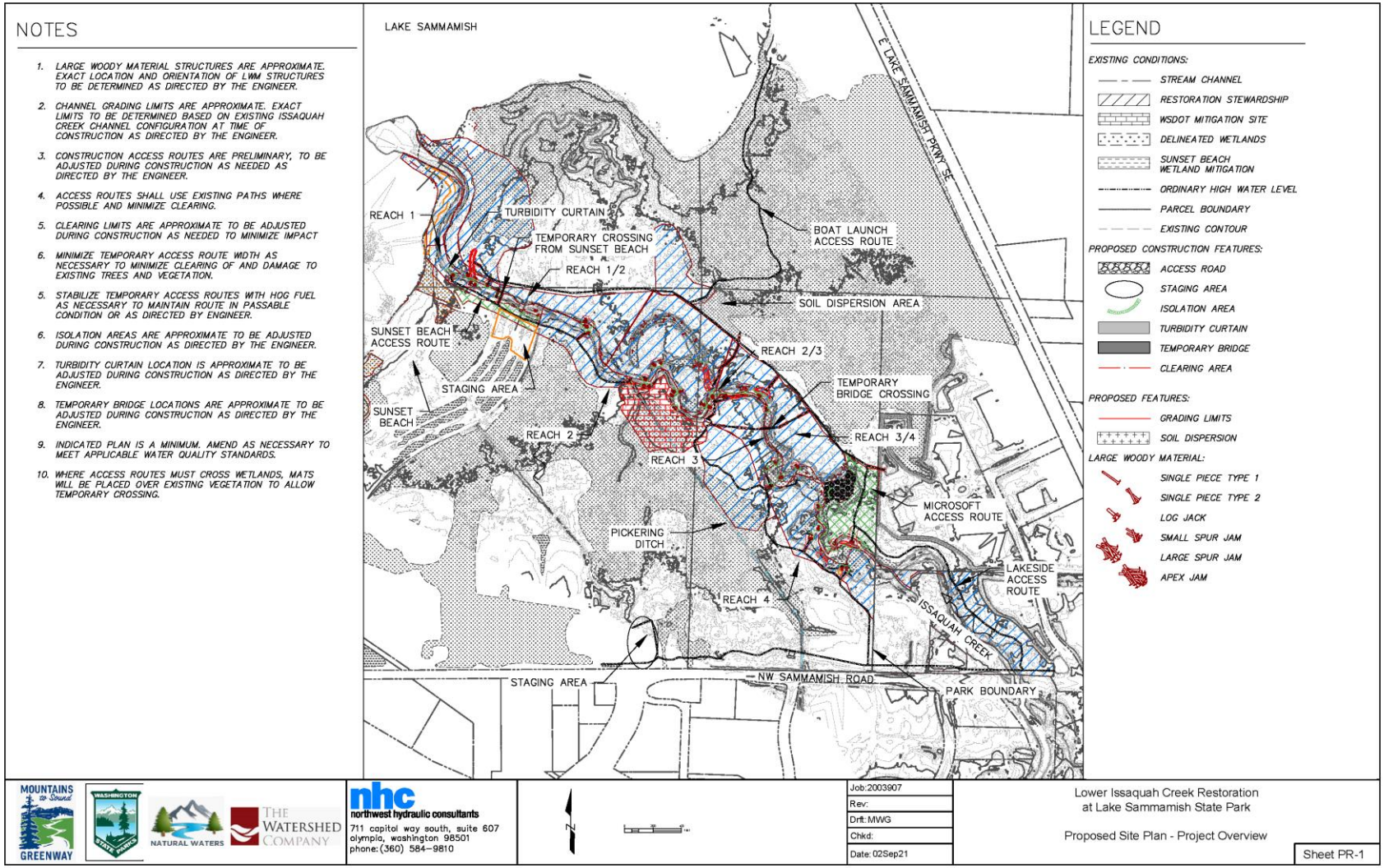


Figure 40: Overview Site Plan for the Issaquah Creek In-Stream & Riparian Restoration Project

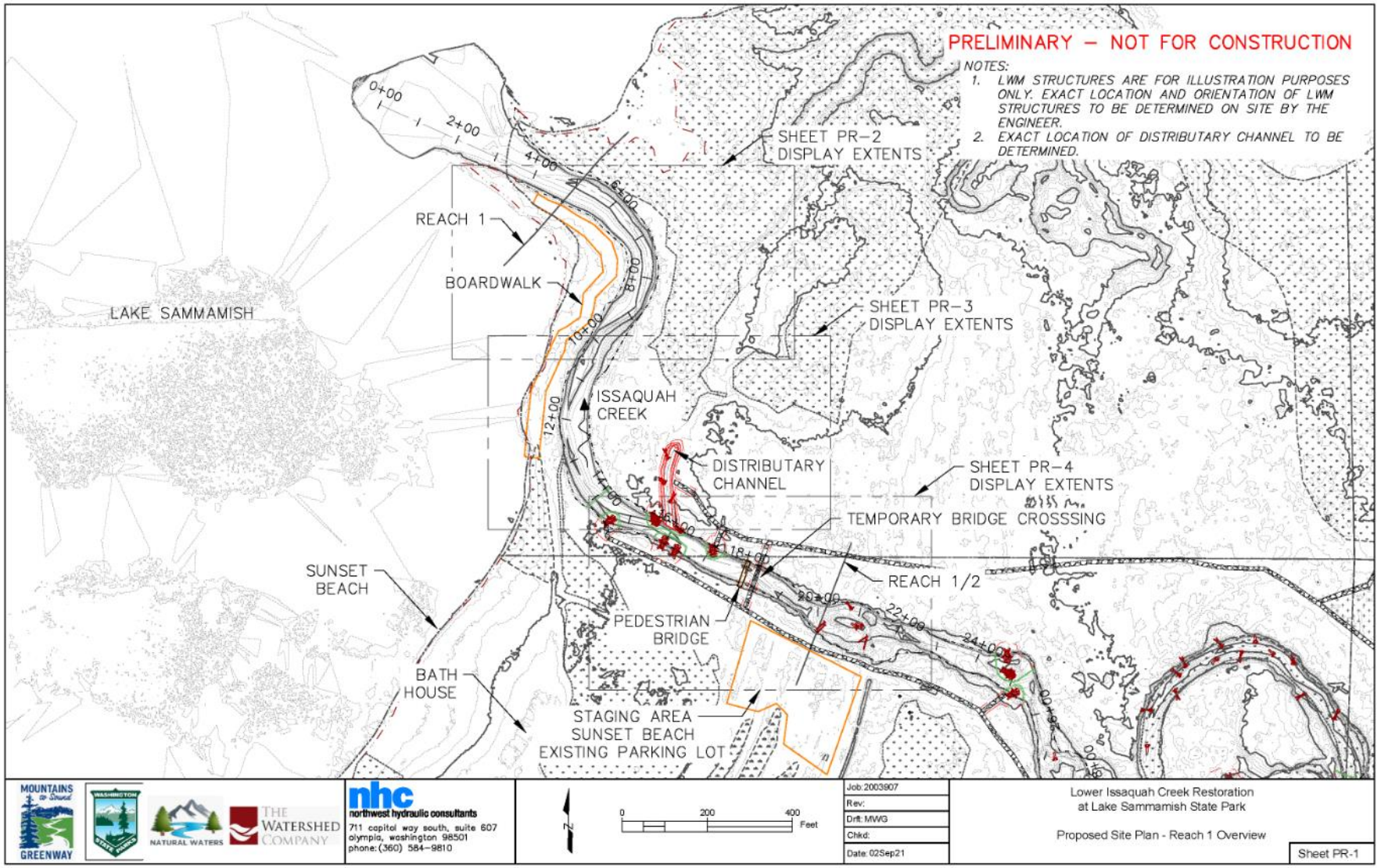


Figure 41: Site Plan Overview for Reach 1 for the Issaquah Creek In-Stream & Riparian Restoration Project

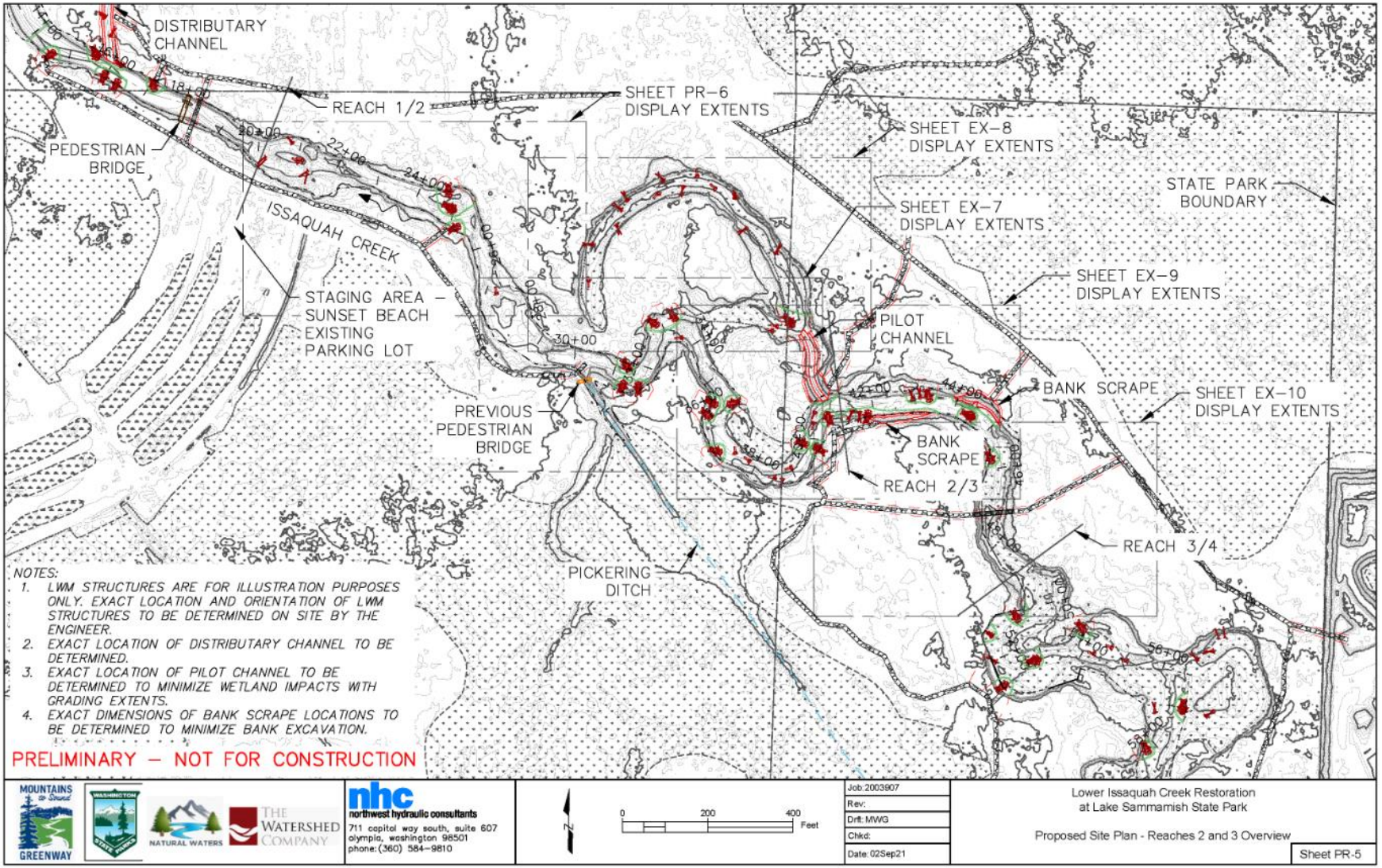


Figure 42: Site Plan Overview for Reaches 2 and 3 for the Issaquah Creek In-Stream & Riparian Restoration Project

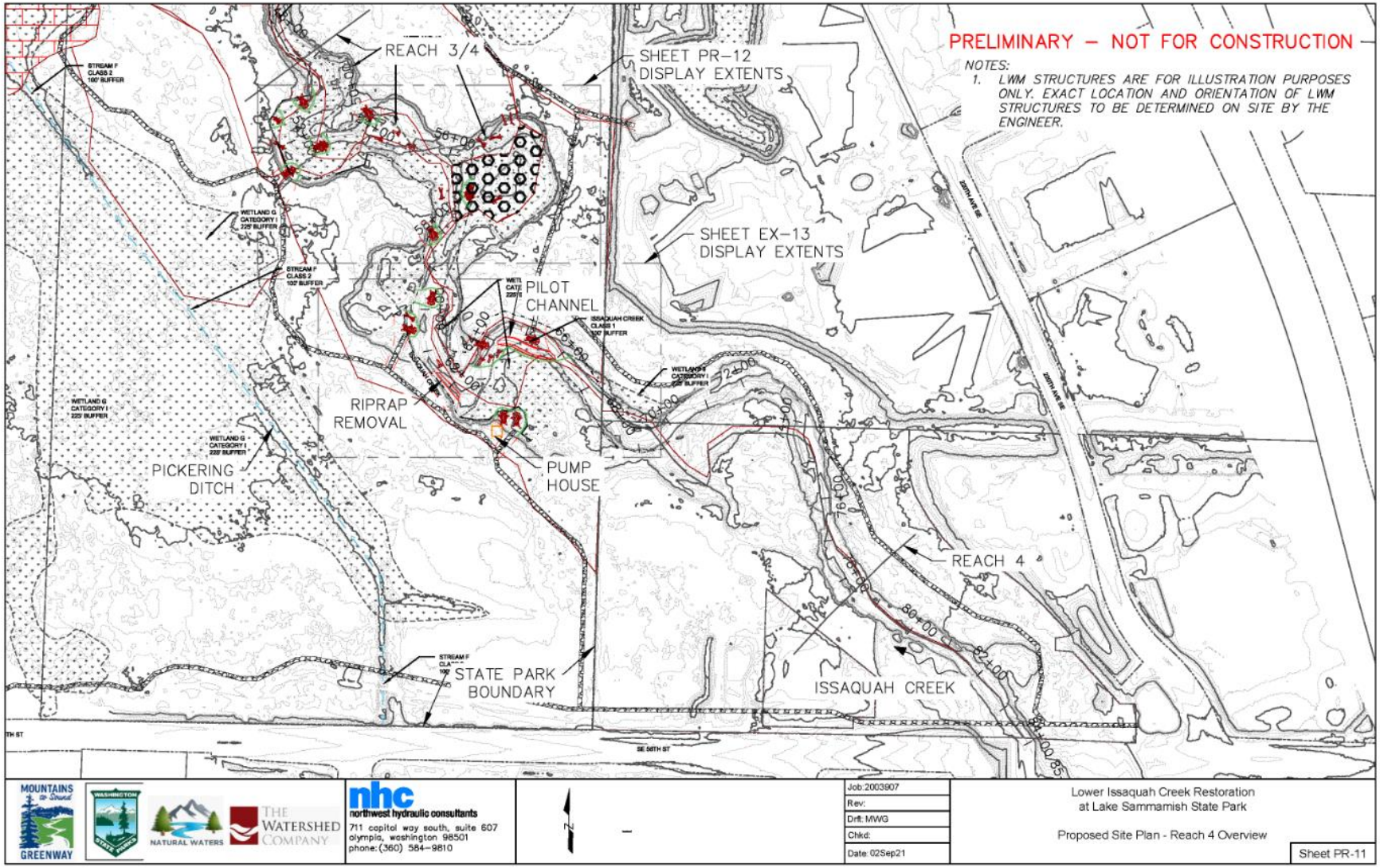


Figure 43: Site Plan Overview for Reaches 2 and 3 for the Issaquah Creek In-Stream & Riparian Restoration Project

WRIA 8 – Project Description
Royal Arch Reach Acquisitions and Floodplain Connection

Project Name and Number

Royal Arch Reach Acquisitions and Floodplain Connection (8-LC-H32)

WRIA 8 WRE Subbasin

Lower Cedar

Narrative Description

This project includes floodplain reconnection and restoration along the Cedar River within the Royal Arch Reach located in the Lower Cedar subbasin just north of Maple Valley, Washington.

Specifically, this project proposes to acquire floodplain properties from State Route (SR) 169 to Highway(HWY) 18 for future floodplain reconnection and restoration. Some floodplain properties are already in public ownership as a result of an effort being led by Seattle Public Utilities. These efforts align with the Cedar Corridor Plan Habitat Opportunity Area #20 and 21. In 2021 a project is in design to remove bank armoring and reconnect and restore approximately 8 acres of the floodplain in the upper reach. These efforts align with Cedar Corridor Plan Habitat Opportunity Area #20 and Project 21.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye and resident Cutthroat Trout that utilize the Cedar River as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the floodplain connectivity improving the aquatic habitats associated with the Cedar River within the floodplain from SR 169 to HWY 18.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 44).

Description of the anticipated spatial distribution of likely benefits.

The project proposes to restore floodplain connectivity along the Cedar River from SR 169 to HWY 18 just north Maple Valley, Washington, in what is known as the Royal Arch Reach.

Performance goals and measures.

Acquire property and remove hardened banks, historic fills, and structures to restore connectivity of the natural floodplain of the Cedar River in the reach, with the primary goal of increasing off-channel rearing and refuge habitat for juvenile salmonids.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize the Cedar River as spawning and especially rearing habitat. Chinook and steelhead are priority species, protected under the ESA. Floodplain restoration will directly benefit fish by restoring riparian vegetation communities, food web complexity and expanding available habitats for flood refuge, foraging, and spawning.

Identification of anticipated support and barriers to completion.

Consistent and repeated funding support has come from WA State Salmon Recover Funding Board (SRFB), including the current sub-project now in design. The biggest barrier to full-reach-scale acquisition and restoration is unwilling sellers of large parcels of land, especially the Royal Arch Mason Park.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are estimated at $4-7 million.

Anticipated durability and resiliency.

Acquisition of land in-fee, followed by process-based reconnection of natural floodplain is anticipated to be naturally resilient and perpetually durable.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Seattle Public Utilities. Sponsor contact: Brent Lackey, Brent.Lackey@seattle.gov. The sponsor is actively seeking additional property acquisitions (15 parcels/30 acres have been acquired as 2020) in the 70-acre reach. Currently in design of first large floodplain reconnection sub-project.

Documentation of sources, methods, uncertainties, and assumptions.

Historic floodplain maps and detailed flow and inundation modeling and studies (SPU 2014-2020); Feasibility and options analyses, and multiple grant application proposals (SPU 2007-2020). Assumes river hydrology is largely static over the course of at least this century. Assumes ongoing occupation of Cedar River by target salmonid species.

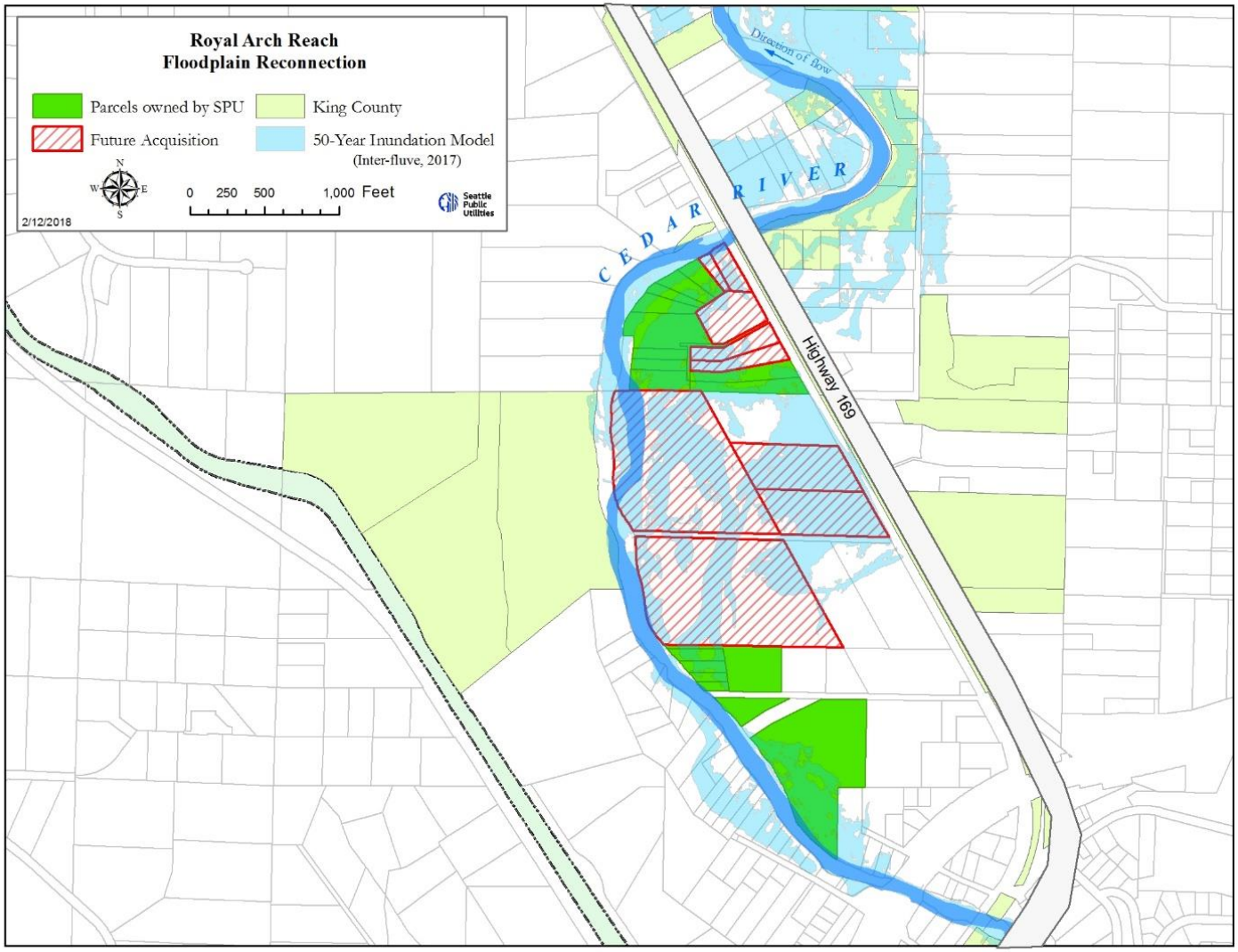


Figure 44: Site Plan for Royal Arch Reach Project

Elliot Bridge Reach Floodplain Restoration

Project Name and Number

Elliot Bridge Floodplain Restoration (8-LC-H33)

WRIA 8 WRE Subbasin

Lower Cedar

Narrative Description

This project includes acquisition of parcels near the former Elliot Bridge site to enable floodplain reconnection and restoration along the Cedar River located in the Lower Cedar subbasin in Renton, Washington.

Once property is acquired, the project proposes to restore the floodplain, including setting back or removing the Elliot Bridge levee, removing the old Elliot Bridge abutments and portions of 149th Ave., and potentially removing the toe rock from the Orting Hill revetment (left in place following a mitigation project). As part of this restoration, this project will also evaluate relocation of lower Madsen Creek to enhance habitat conditions in the creek.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, resident Cutthroat Trout, kokanee and Bull Trout that utilize the Cedar River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the floodplain connectivity improving the aquatic habitats associated with the Cedar River through acquisition of properties within the floodplain.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 45).

Description of the anticipated spatial distribution of likely benefits.

The project proposes to restore floodplain connectivity along the Cedar River through acquisition of two parcels on the right bank just upstream of the Punnett Briggs revetment and up to four parcels on the left bank along the river and 149th Ave SE. This project proposes to remove the Elliot Bridge levee and abutments and potentially the toe rock from the Orting Hill

revetment. The project will also evaluate the relocation of lower Madsen Creek to improve habitat conditions with its connection point with the Cedar River.

Performance goals and measures.

To be determined.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

Chinook, Coho, steelhead, Sockeye, resident Cutthroat Trout, kokanee and Bull Trout that utilize the Cedar River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the ESA. Floodplain restoration will directly benefit fish by restoring riparian vegetation communities, food web complexity and expanding available habitats for foraging and spawning.

Identification of anticipated support and barriers to completion.

Project has been identified by King County and WRIA 8 Salmon Recovery Council as important habitat recovery planning area.

Estimate of capital costs and reoccurring O&M costs.

The total project costs are currently unknown.

Anticipated durability and resiliency.

Project will encourage the establishment of natural riverine processes.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Sponsor contact: Judy Blanco, jublanco@kingcounty.gov. The project sponsor will proceed with scoping and reconnaissance once additional property is conserved.

Documentation of sources.

None

Figure 45: Site Plan for Elliott Bridge Reach Floodplain Restoration

WRIA 8 – Project Description

WPA Levee Removal

Project Name and Number

WPA Levee Removal (8-LC-H34)

WRIA 8 WRE Subbasin

Lower Cedar

Narrative Description

This project proposes to acquire the remaining parcel not on public ownership and setback or remove the WPA levee. This would allow for floodplain restoration along the Cedar River in the Lower Cedar subbasin in the East Renton Highlands, Washington. This project would also include revegetation of the floodplain with riparian plantings.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, resident Cutthroat Trout, kokanee and Bull Trout that utilize the Cedar River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the floodplain connectivity improving the aquatic habitats associated with the WPA levee on the Cedar River through acquisition of the remaining parcel not in public ownership.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 46).

Description of the anticipated spatial distribution of likely benefits.

The spatial distribution of the proposed WPA levee setback or WPA levee removal would have direct benefits within the footprint of the project but also provide benefit to downstream habitats through water quality, water quantity and nutrient availability.

Performance goals and measures.

Project goals and measures have not been drafted yet.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

The species that will benefit are Chinook, Coho, steelhead, Sockeye, resident Cutthroat Trout, kokanee and Bull Trout that utilize the Cedar River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the ESA. Floodplain restoration will directly benefit fish by restoring riparian vegetation communities, food web complexity and expanding available habitats for foraging and spawning.

Identification of anticipated support and barriers to completion.

Future project area has one inholding that will require acquisition to move forward.

Estimate of capital costs and reoccurring O&M costs.

The total cost of the proposed project is unknown.

Anticipated durability and resiliency.

Floodplain connectivity will restore natural riverine processes to the site.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County. Sponsor contact: Judy Blanco, Jublanco@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance once inholding parcel is secured.

Documentation of sources.

None.

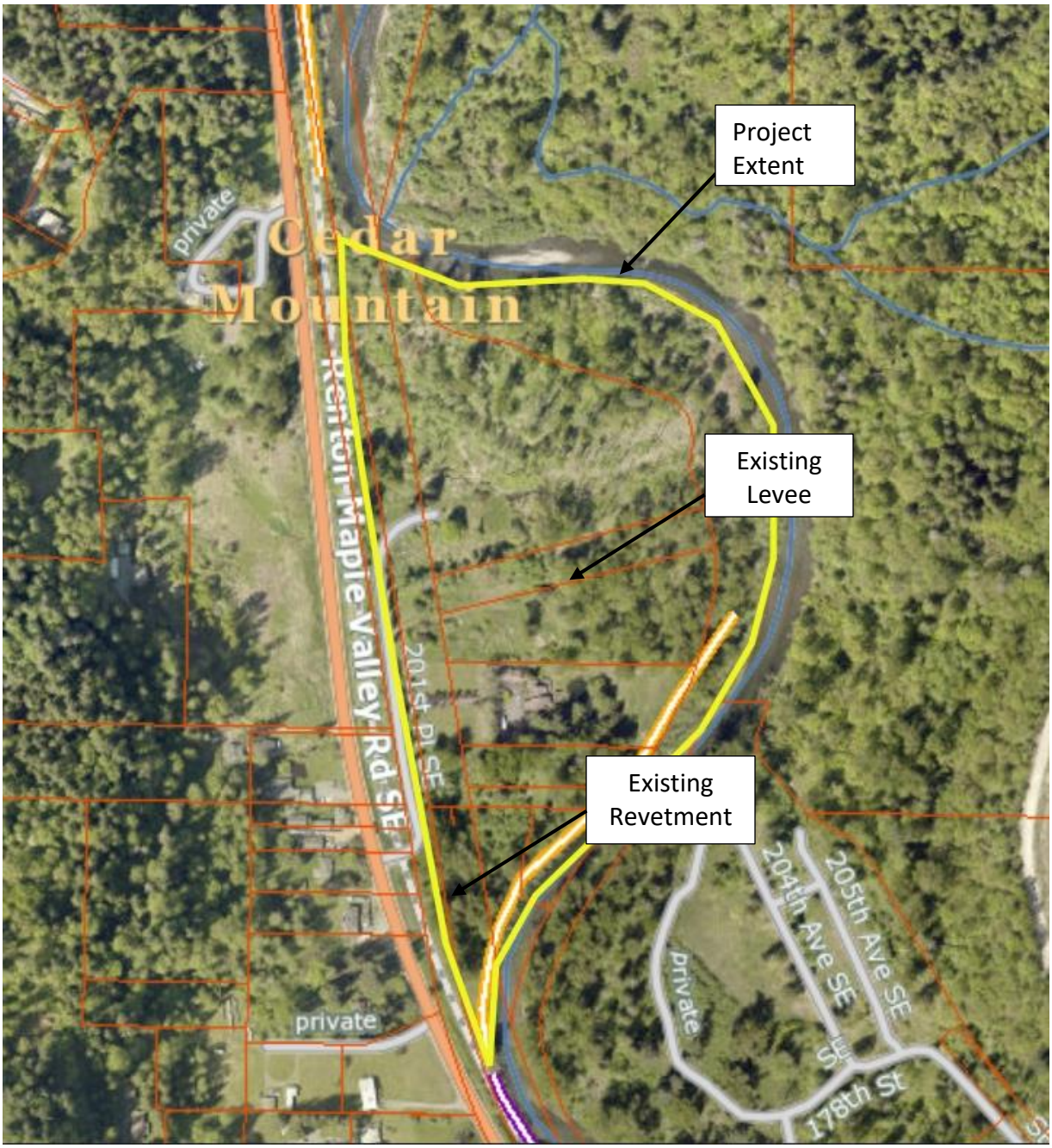


Figure 46: Site Plan for WPA Levee Removal Project

WRIA 8 – Project Description
Rutledge-Johnson Lower and Rhode Levee Setback/Removal

Project Name and Number

Rutledge-Johnson Lower and Rhode Levee Setback/Removal (8-LC-H35)

WRIA 8 WRE Subbasin

Lower Cedar

Narrative Description

This project includes two proposals along the Cedar River in the Lower Cedar subbasin in Maple Valley, Washington. These proposals are the Rutledge-Johnson Lower and Rutledge-Johnson/Rhode projects. The Rutledge-Johnson Lower project proposes removal or setback of the downstream 600 feet of the Rutledge-Johnson levee to allow for floodplain connection with an existing King County owned parcel. This would restore 16 acres of reconnected floodplain habitat. The second proposal under this project is the Rutledge Johnson/Rhode project which proposes to acquire remaining parcels along the left bank behind the Rhode and Rutledge-Johnson levee and remove or setback the levees and restore the floodplain.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize the Cedar River as spawning and rearing habitat. Chinook and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will restore the floodplain connectivity improving the aquatic habitats associated with the Cedar River through levee removal or setback. The Rutledge-Johnson levee removal or setback is estimated to restore 16 acres of reconnected floodplain habitat.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 47).

Description of the anticipated spatial distribution of likely benefits.

The project proposes to restore floodplain connectivity along the Cedar River in the area around the Rutledge-Johnson and the Rhode levees, just south of Cedar Grove in Maple Valley, Washington. Floodplain restoration will directly benefit the habitat within the project footprint

and there are downstream benefits with respect to water quality, water quantity and nutrient availability.

Performance goals and measures.

This is not applicable at this early design phase of the project.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

Chinook, Coho, steelhead, Sockeye, resident Cutthroat Trout, kokanee and Bull Trout that utilize the Cedar River as spawning and rearing habitat will benefit from these proposed actions. Chinook, steelhead, and Bull Trout are priority species, protected under the ESA. Floodplain restoration will directly benefit fish by restoring riparian vegetation communities, food web complexity and expanding available habitats for foraging and spawning.

Identification of anticipated support and barriers to completion.

Project is supported by the WRIA 8 Salmon Recovery Council and has received design funding from state and local sources. Project is in early design phase and anticipated support and barriers to completion are currently under review.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are currently unknown.

Anticipated durability and resiliency.

Project will allow natural riverine processes to return to the site.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County. Sponsor contact: Judy Blanco, jublanco@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources.

None

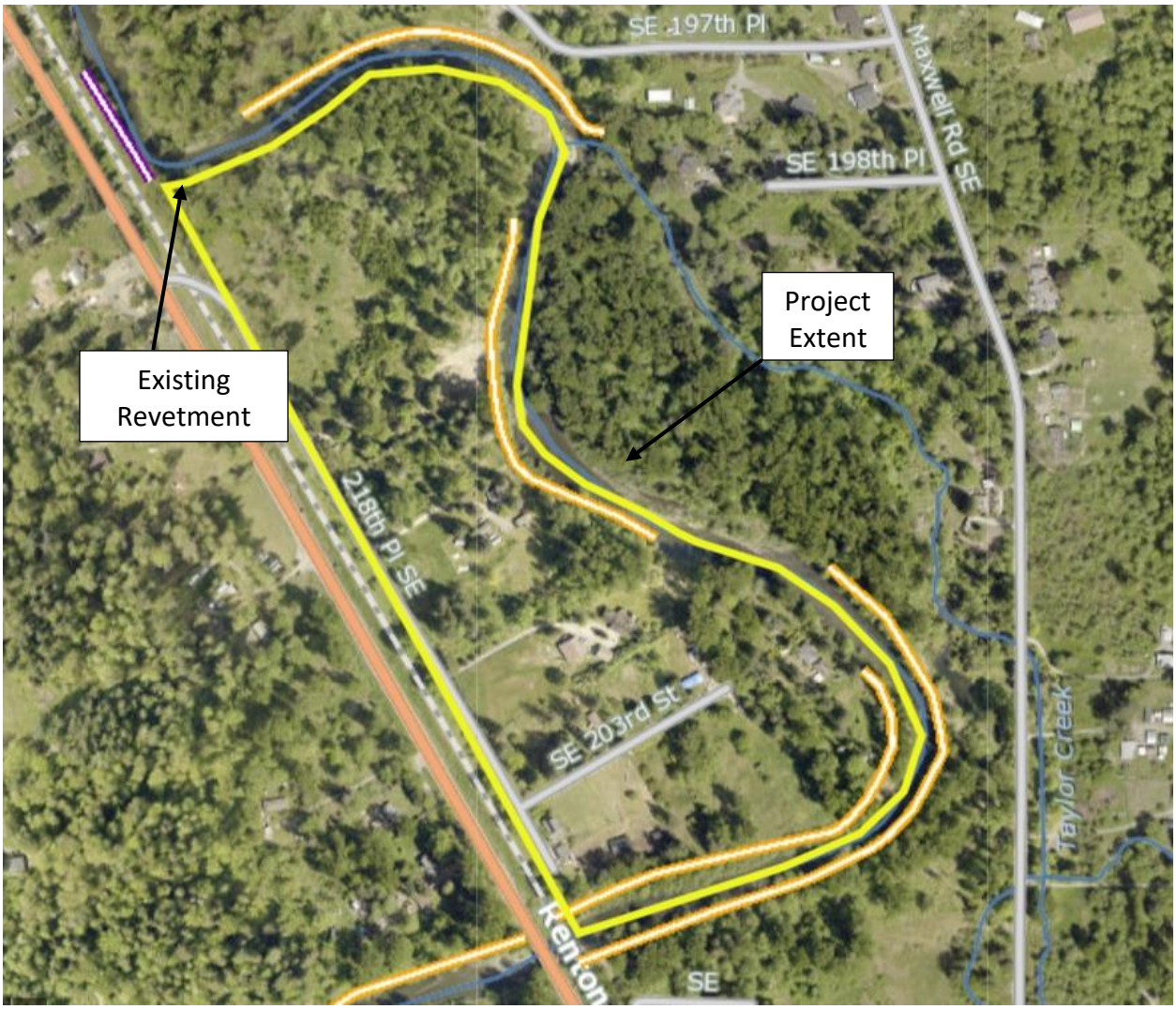


Figure 47: Site Plan for Rutledge-Johnson Lower (a) and Rutledge Johnson/Rhode (b) Project

WRIA 8 – Project Description

Reconnection of Wetland 69

Project Name and Number

Reconnection of Wetland 69 (8-LC-H36)

WRIA 8 WRE Subbasin

Lower Cedar

Narrative Description

This project proposes to reconnect Wetland 69, an oxbow, with the Cedar River. This project is located within the Lower Cedar subbasin in Hobart, Washington. This project also proposes removing all, or portions of, the CRT 9 Revetment. To accomplish these project tasks, additional land acquisition is necessary as well as relocating a trail behind the wetland.

These proposed restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout that utilize Cedar River as spawning and rearing habitat. Chinook, and steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The proposed project will reconnect a wetland feature, known as Wetland 69, with the Cedar River which will provide refugia for fish and vegetation and nutrients for insects and invertebrates which are a prey source for fish.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features on the attached Site Plan (Figure 48).

Description of the anticipated spatial distribution of likely benefits.

The project proposes to connect Wetland 69 with the Cedar River, which will benefit the fish species that spawn and rear within this section. Connecting the Cedar River with Wetland 69 will also have downstream water quality and water quantity benefits.

Performance goals and measures.

Unknown at this project stage.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

These restoration actions will benefit documented Chinook, Coho, steelhead, Sockeye, and resident Cutthroat Trout, and Bull Trout that utilize Cedar River as spawning and rearing habitat. Chinook, steelhead, and Bull Trout are priority species, protected under the ESA. Connecting Wetland 69 with the Cedar River has significant benefits to juvenile salmonids by directly benefit prey availability, spawning success as well as survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

Unknown at this project stage. Project is outlined in King County basin planning documents and is included in the WRIA 8 Salmon Recovery project list.

Estimate of capital costs and reoccurring O&M costs.

Total project costs are currently unknown.

Anticipated durability and resiliency.

Unknown at this project stage.

Project sponsor(s) (if identified) and readiness to proceed/implement.

King County. Sponsor contact: Judy Blanco, jublanco@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance if project area is secured through land acquisition.

Documentation of sources.

None

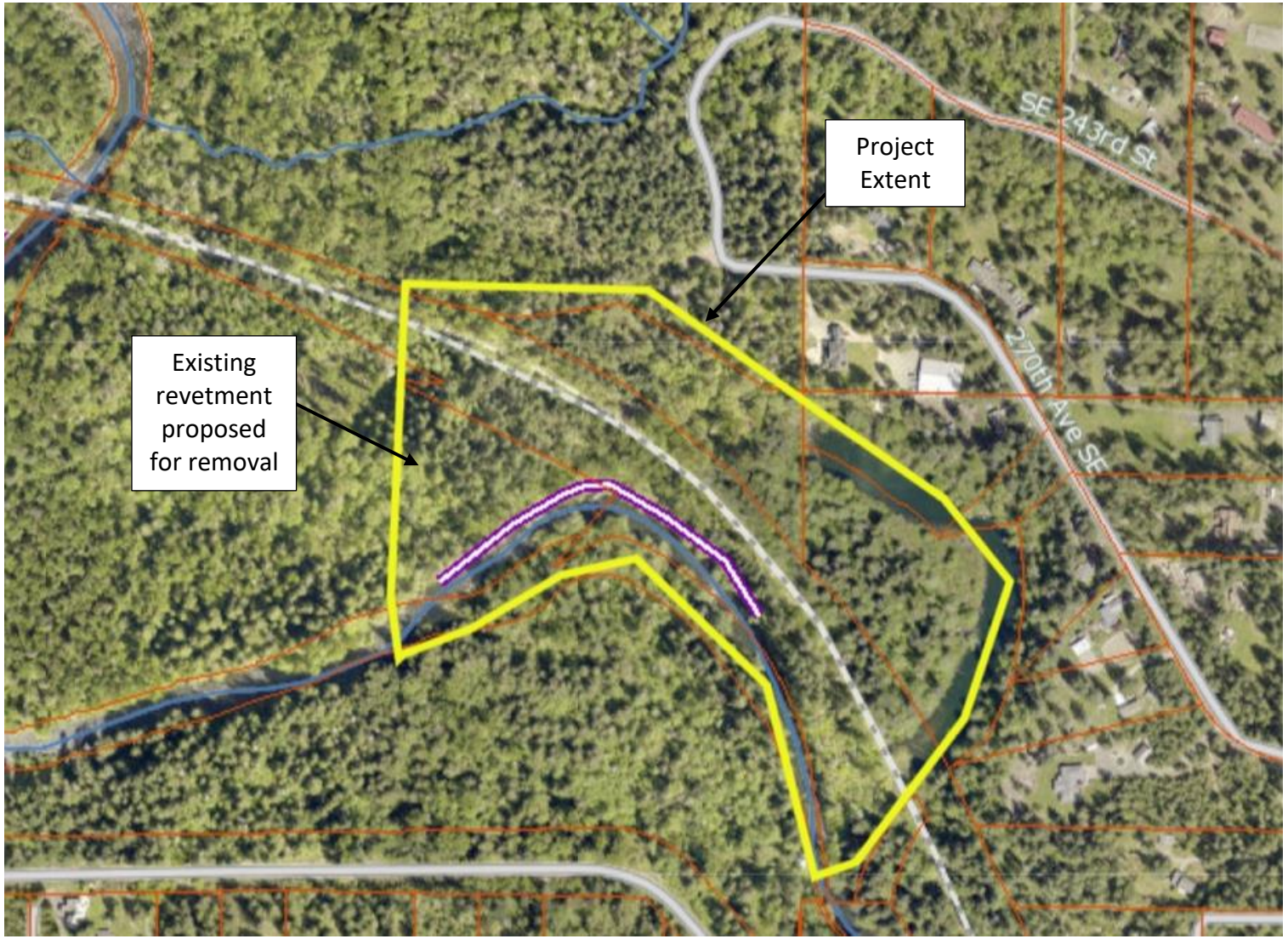


Figure 48: Site Plan for Reconnection of Wetland 69 Project

Appendix F – WRIA 8 Committee's Adaptive Management, Implementation, and Policy Recommendations

The WRIA 8 Committee spent several months preparing recommendations for policy and regulatory change, as well as plan implementation tracking and adaptive management. While Ecology is not putting forward these recommendations as part of our plan, we want to preserve the work of the committee and present the recommendations for WRIA 8 partners that may choose to move these recommendations forward. This language is taken directly from the WRIA 8 draft plan (version November 2020) with only minor revisions for formatting.

1. Plan Implementation and Adaptive Management Recommendations

The WRIA 8 Committee recommends an adaptive management process for implementation of the WRIA 8 watershed plan. Adaptive management is defined in the Final NEB Guidance as "an iterative and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions."

Adaptive management is intended to help address uncertainty, provide more reasonable assurance for plan implementation, and to ensure that 1) water use from new permit-exempt (PE) wells is adequately offset, as required by RCW 90.94.030, and 2) implementation of the watershed plan produces a net ecological benefit to the watershed, as required by RCW 90.94.030. The periodic review in this adaptive management process will provide a verifiable process for plan monitoring and ensure transparency in plan implementation.

Existing Challenges

The WRIA 8 Committee identified the following challenges in the planning process and seeks to address these challenges through monitoring and adaptive management:

- The watershed plan includes projected, not actual, PE well water use by subbasin. Many factors could influence the consumptive water use from new PE wells in the future, including water system infrastructure expansion, policies or programs to require or incentivize homes to connect to public water systems, and programs that provide education and incentives for homeowners to conserve water. Monitoring the number of new PE wells, actual PE well water use, and associated consumptive water use would provide data for comparison and adjustments, as needed, in planning for ongoing offsets to ensure the mandates of RCW 90.94 are being met.
- The watershed plan includes water offset and habitat projects, and estimated benefits associated with each, by subbasin. The WRIA 8 Committee used a tiering process to identify projects with greater implementation certainty, however that will likely change over time. Measuring and tracking project implementation and actual water offsets and

habitat benefits by subbasin, to the extent possible, can be used to verify intended streamflow benefits.

- Our global climate is changing. While the effects of climate change over the 20-year life of this plan cannot be precisely known, shifts in climatic conditions will influence the hydrologic regime in the watershed and will impact instream flows. Rainfall, snowmelt, and evapotranspiration have been and will continue to be identified as the primary mechanisms driving changes in groundwater storage. These mechanisms will be affected by a changing climate. Air and water temperatures will increase and summer streamflows will be reduced. Under these conditions, groundwater pumping and indirect effects of irrigation and land use changes, like increases in impervious surface and reduced recharge, will have an increasing impact to groundwater resources and the availability for future water supply and instream flows. The Committee recognizes that a successful plan must acknowledge that climate is changing and include a mechanism to ensure that the statutory requirements to offset water withdrawals by new PE wells and provide a net ecological benefit will be met under future climatic conditions. Monitoring actual water use and the amount of offset water actually generated will inform this determination.
- Projects identified in the plan are expected to provide water offset through methods including increasing groundwater storage and augmenting streamflows. Water offset projects should be monitored in order to ensure that they continue to function as designed, and generate instream water to offset new PE wells under a changing climate. The WRIA 8 Committee chose to apply an overall margin of safety to help address these concerns. However, this margin of safety may not address the possibility that a water offset project might fail to meaningfully function under changed conditions.
- The adaptive management recommendations in this plan will help to monitor and assess the validity of the projections identified, to determine whether projects are functioning as designed even under climate change conditions, and to allow for course corrections where needed. Water offset projects should be analyzed to determine how much offset water they are actually producing. Habitat projects should also be analyzed for their resilience to changing conditions.

To address the above challenges, the WRIA 8 Committee added a margin of safety to the consumptive use estimate and recommends the following adaptive management strategies.

1.1. Tracking and Monitoring

The WRIA 8 Committee recommends that the Washington Department of Ecology (Ecology) monitor watershed plan implementation, in consultation with the Washington Department of Fish and Wildlife (WDFW), and King and Snohomish Counties. Specifically, the Committee recommends that Ecology, in consultation with WDFW and King and Snohomish Counties, review actions resulting from watershed plans to ensure the mandates of RCW 90.94 are being met, including:

- Track annual new permit-exempt wells by subbasin;

- Track project implementation and the actual amount of offset water generated, or reasonably certain to be generated, by subbasin; and
- Develop a process to adaptively manage implementation if net ecological benefit is not being met as envisioned by the watershed plan.

Track PE Wells and Project Implementation

The WRIA 8 Committee recommends WDFW, in collaboration with Ecology and the Recreation and Conservation Office (RCO), pilot the Salmon Recovery Portal (https://srp.rco.wa.gov/about), managed by RCO, for tracking streamflow restoration projects and new domestic permit-exempt wells.[1] To improve harmonization of streamflow restoration with ongoing salmon recovery efforts, local salmon recovery Lead Entity Coordinators shall be consulted prior to initial data uploads. While input and oversight is welcomed, no commitment of additional work is required from Lead Entity Coordinators. University of Washington data stewards will be employed to conduct data entry, quality assurance, and quality control.

Tracking streamflow restoration projects and new domestic permit-exempt wells will:

- Improve the capacity to conduct implementation and effectiveness monitoring of streamflow restoration projects and actions,
- Build grant funding opportunities and track streamflow restoration associated costs, and
- Provide a template for adaptively managing emergent restoration needs.

Continue monitoring of streamflow and groundwater levels

This Watershed Restoration and Enhancement Plan is one of many water resource management efforts underway in WRIA 8. Understanding the status and trends of streamflow in the basin will assist with adaptively managing this plan. The WRIA 8 Committee understands that neither the impact of individual projects nor new permit exempt wells would be tracked through monitoring streamflow or groundwater levels, but the Committee believes that monitoring assists with an overall understanding of the hydrology in the basin.

The WRIA 8 Committee recommends that agencies with current or planned gauging stations and groundwater monitoring programs continue funding and/or seek supplemental funding sources to ensure that monitoring continues and the data is publicly available. This includes counties, Ecology, USGS, and other relevant entities. The Committee would support the development of a clearinghouse so that external reports, data and links to hydrological and hydrogeological data is easier to find and use. The development of widespread groundwater elevation tracking across the WRIA would help monitor trends.

Continue studies that improve understanding of WRIA 8 hydrology

[1] See Supplemental Document: Project Tracking for WRE Plans for further details on project tracking procedures using the Salmon Recovery Portal.

The Committee supports the continuation or initiation of research, models, and additional datasets that provide regional, basin-wide and site-specific information to better understand the hydrology of WRIA 8 and inform the adaptive management of the plan (examples may include subbasin level studies such as the Bear Creek Watershed Management Study, UW Climate Impacts Group Research, VELMA, DHSVM or other process-based modeling, hydrology-fish life cycle modeling, King County water quality monitoring, and others).

Table 1 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table F.1: Implementation of Tracking and Monitoring Recommendation

Action	**Entity or Entities Responsible**	**Funding Considerations**
Track building permits issued with permit-exempt wells.	Ecology (via reporting from counties and cities)	The number of building permits and associated fees are transmitted to Ecology annually. No additional funding is needed.
Maintain an ongoing list and map of new PE wells within each subbasin.	Ecology	Update the existing Ecology well report tracking database. No additional funding is needed.
Maintain a summary of the status of implementation for each project.	WDFW using the Salmon Recovery Portal	WDFW may need additional funding to support maintaining the Salmon Recovery Portal.
Monitor streamflow and groundwater levels.	Various (USGS, Ecology, Counties, etc.)	External entities fund and implement these programs. Committee support may be helpful in communicating the importance and ensuring continuation of these efforts.
Continue studies that improve understanding of WRIA 8 hydrology.	Various (University of Washington, Counties, Tribes, NGOs, etc.)	These studies will require additional and new funding outside the Streamflow Grant process. Committee support may be helpful in securing outside funds.

1.2. Oversight and Adaptation

The WRIA 8 Committee recommends Ecology issue four watershed plan implementation reports, one each in 2027, 2032, 2037, and 2042 detailing the successes, challenges, and gaps related to implementation of the watershed plan. Each report should cover the five-year period occurring immediately prior to the year of issuance, except the first reporting period, which

should start when the plan is adopted by Ecology. The report should include information on whether the watershed plan is on track to achieve the expected net ecological benefit and water offsets as well as streamflow conditions, including identifying subbasins with known impacts that have not yet implemented water offset or habitat projects. In addition, the report should include information on any discretionary programs that were implemented, including for example, water conservation education and outreach, incentives for public water service connections, and voluntary PE well metering. The report should be sent to all members of the WRIA 8 Committee, King and Snohomish County Councils, all local jurisdictions within the watershed, and any additional stakeholders identified at the time of reporting.

Ecology's report should include recommendations to adjust the projects and actions if the adopted goals of the watershed plans are not on track to being met in the plan's 20-year timeframe. If Ecology or any other Committee member determines that the watershed plan is not on track to achieve NEB and water offsets, a notice of action to adjust the plan should be sent to Ecology and all members of the WRIA 8 Committee with 60 days to comment.

At that time, any member of the WRIA 8 Committee may request that Ecology reach out to members of WRIA 8 Committee to reconvene. However, members of the WRIA 8 Committee are not obligated to reconvene after approving the plan.

The WRIA 8 Committee as a whole will reconvene if at least one entity representing each of the following groups agrees to participate. A subgroup of Committee members may convene, but representation from all of the following groups is needed to represent the entire Committee.

- A federally recognized tribal government with reservation land or usual and accustomed harvest area within the WRIA.
- A county government within the WRIA.
- A city government within the WRIA.
- Washington State Department of Fish and Wildlife.
- A water purveyor.
- An organization representing agricultural interests.
- An organization representing environmental interests.
- An organization representing the residential construction industry.

If no representative is available from the same government or organization that participated in the WRIA 8 Committee at the time of plan approval, the Committee member may propose an alternate entity that can represent the same interest on the Committee.

Ecology should review, publish, and attempt to address comments received from the WRIA 8 Committee before amending the plan. Following a 45-day initial public comment period, Ecology should issue its responses and findings to the public. Following the issuance of Ecology's responses to comments, the public should have an additional 14-days to offer additional comments to Ecology. At the end of the full 60-day public comment period, any final adjustments and amendments to the plan shall be at the sole discretion of Ecology. Ecology

should issue its final findings within 30-days from the close of the full 60-day public comment period.

Preference for funding of new projects should be given to projects in subbasins that have not offset permit-exempt water use.

Table 2 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table F.2: Implementation of Oversight and Adaptation Recommendation

Action	Entity or Entities Responsible	Funding Considerations
Develop and distribute Watershed plan implementation report, including any recommended adjustments to projects and actions.	Ecology	Ecology may need additional funding to support development of the report.
Support reconvening of the WRIA 8 Committee, if needed.	Ecology	Ecology may need additional funding to support reconvening.
Revise Streamflow Restoration Grant Guidance to prioritize projects in subbasins that have not offset permit-exempt water use.	Ecology	No additional funding is needed.

1.3. Funding

The WRIA 8 Committee recommends funding plan implementation and adaptive management from a variety of sources, including the Washington State Legislature, cities, counties, and various grant programs administered by state and federal agencies. Funding and staffing at local, county and state levels is likely to see continued shortfalls due to COVID-19 related impacts over the next several years. The Committee urges a collaborative approach to fund Ecology, RCO, and WDFW to ensure plan implementation and monitoring, streamflow health, water offsets, net ecological benefit, and full compliance with the mandates found in RCW 90.94.

2. Policy and Regulatory Recommendations

The Streamflow Restoration law lists optional elements committees may consider including in the plan to manage water resources for the WRIA or a portion of the WRIA (RCW 90.94.030(3)(f)). The WRIA 8 Committee included what they have termed “policy and regulatory recommendations” in the plan to show support for programs, policies, and regulatory actions that would contribute to the goal of streamflow restoration. When similar

concepts arose from other Watershed Restoration and Enhancement Committees, the WRIA 8 Committee coordinated with those other Committees to put forward common language for inclusion in the watershed plans, when appropriate. Coordination also occurred for jurisdictions that cross multiple watersheds. All projects and actions the WRIA 8 Committee intended to count toward the required consumptive use offset or Net Ecological Benefit are included in Chapter 5: Projects and Actions.[2]

As required by the NEB Guidance, the WRIA 8 Committee prepared the plan with implementation in mind. However, as articulated in the Streamflow Restoration Policy and Interpretive Statement (POL-2094), "RCW 90.94.020 and 90.94.030 do not create an obligation on any party to ensure that plans, or projects and actions in those plans or associated with rulemaking, are implemented."

The WRIA 8 Committee initially identified a list of potential policy and regulatory recommendations. After iterative rounds of discussion, the Committee narrowed the recommendations in this section to those that both supported the goal of streamflow restoration and had the support of the full Committee. Committee members identified as the implementing entity for each recommendation are committed to investigating the feasibility of the recommendation. The identification and listing of these policy and regulatory recommendations is directly from the WRIA 8 Committee members and is not endorsed or opposed by Ecology.

The WRIA 8 Committee supports the following recommendations:

2.1. Well reporting upgrades

Proposed implementing entity:

Ecology

Recommendation:

Change the Ecology well tracking system in the following ways, in order to efficiently and transparently track the number and location of permit-exempt wells in use:

- Implement a web-based well report form that mimics the current well report forms, and that uploads directly to Ecology's database with Ecology verification;
- Require coordinates (latitude and longitude) of wells on well report forms, and implement an intuitive web tool for well drillers which automatically provides the Public Lands Survey (PLS) location and coordinates for a new well;
- Identify permit-exempt wells on well report forms; and
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

Purpose:

[2] "New regulations or amendments to existing regulations adopted after January 19, 2018, enacted to contribute to the restoration or enhancement of streamflows may count towards the required consumptive use offset and/or providing NEB." Streamflow Restoration Policy and Interpretive Statement, POL-2094.

Directly and efficiently address identified shortcomings in Ecology's existing well tracking database and reporting protocols. Accurate tracking of the locations and features of permit-exempt wells will support the WRIA 8 Committee's desire to engage in monitoring and adaptive management after adoption of the watershed plan.

Funding sources:

Leverage existing resources and efforts currently underway through the Ecology Well Construction Technical Advisory Group (TAG) and other departmental means. Additional funding from the Washington State Legislature or local permitting fees to increase capacity for Ecology to verify well reports may aid in implementing this recommendation in a timely manner.

Additional information or resources:

Ecology's Well Report Location Accuracy Study

Ecology's Mason County Well Location Accuracy Study

2.2. Encourage conservation and reduce impacts on tributaries and subbasins through connections to public water

Proposed implementing entities:

County and city planning departments; public utilities and other water purveyors; Ecology; Department of Health.

Recommendation:

- Adopt and implement consistent and coordinated policies that reduce dependence on water use from PE wells and promote connections to municipal and regional water supplies.
- Water purveyors and county/city land use planners explore opportunities to extend water distribution systems further into their individual service areas, particularly where rapid rural growth is anticipated.
- Develop cost-benefit analysis and fiscal implications to (1) fund programs to support connections to public water systems and (2) gain political support.

Purpose:

Reduce uncertainty about future streamflow and aquifer impacts from PE wells. Encourage state/local policies and funding to support streamflow objectives within the watershed plan. Demonstrate the WRIA 8 Committee's endorsement of encouraging conservation through promoting connections to public water systems, provided that all provisions of the Growth Management Act continue to be followed, and that rural growth is not accelerated through the extension of water lines into rural areas, thereby unintentionally counteracting potential benefits of conversation with impacts from increased rural development.

Funding sources:

Fees collected through local permitting processes; pass-through fees associated with well maintenance services collected by service providers; state or local rate increases or taxes.

2.3. Development and use of reclaimed water

Proposed implementing entities:

Washington State Legislature; Ecology; Washington State Department of Health

Recommendation:

- Enact and promulgate state laws, rules, and regulations that enable the development and use of reclaimed water, for the purpose of:
- Offsetting the impact of or providing an alternative source to permit exempt wells or other water rights using reclaimed water.
- Facilitating enhanced reclaimed water treatment to enable its use for streamflow restoration projects, other than direct augmentation.
- Encouraging developers to integrate rainwater and/or reclaimed water into their projects for the purpose of avoiding or limiting use of a permit-exempt well.
- Encouraging partnership with the local water purveyors, where appropriate.

Purpose:

Offset water that would otherwise be diverted from the supply in rivers and streams due to permit exempt wells. Reduce the amount of treated wastewater discharged into receiving water bodies. Create water supply options as an alternative or to offset permit exempt wells while enhancing resiliency against drought and climate change.

Funding sources:

If Ecology does not have capacity to support the work to integrate this proposal into the RCW and WAC with existing staffing and resources, the WRIA 8 Committee recommends the Washington State Legislature provide funding for this purpose.

2.4. Voluntary permit exempt well metering program

Proposed implementing entity:

Ecology; King and/or Snohomish Counties; King and/or Snohomish Conservation Districts.

Recommendation:

Pilot a voluntary five-year program in one or more WRIA 8 subbasins to meter permit-exempt wells (indoor and outdoor residential use). Supplement the voluntary metering program with a robust education and community engagement program about water consumption and conservation.

Purpose:

Increase confidence in assumptions made regarding the average water use of individual PE well users to inform the adaptive management process and future water management and planning efforts. Data could inform (1) growth policies and patterns, (2) where to target incentives and education/outreach programs, and (3) where to place resources across subbasins to help improve streamflow, water levels, and temperature.

Funding sources:
Individual landowners are not expected to pay for costs associated with participation in the program. General operation or appropriated funds from (1) the state, (2) counties, and/or (3) conservation districts related to water, habitat restoration (salmon recovery), or housing. Environmental grants.

2.5. Water conservation education & incentives program

Proposed implementing entity:
Ecology; King and Snohomish Counties; water purveyors; with support from conservation districts and non-governmental organizations.

Recommendation:
Ecology partners with counties and conservation districts to develop and implement outreach and incentives programs that encourage rural landowners with PE wells to (1) reduce their indoor and outdoor water use through water conservation best practices; and (2) comply with drought and other water use restrictions.

Education and incentives could include:

- Educate current homeowners and offer rebates to install water-saving fixtures and appliances, as well as more efficient plumbing techniques.
- Invite new and current residents to participate in the well-metering pilot program.
- Educate new and existing homeowners about the overall positive impacts water conservation has on the environment and climate.

Empower homeowners to be good stewards of rural lands. Programs could also include education and outreach to homebuilders to adopt Built Green or other green building incentives, and adopt water saving design and landscaping strategies like green roofs, rain barrels, buried retention tanks, bio retention, drip irrigation systems, and drought tolerant plantings.

Purpose:
Raise awareness of the impacts PE well water usage has on (1) groundwater levels and (2) the connection to streams and rivers. Supplement water offset and restoration projects, especially in subbasins critical for fish and where water offset projects were difficult to find.

Funding sources:
Potential funding sources could include: new funding from Washington State Legislature; grants (e.g., Ecology's Streamflow Restoration Grant Program); allocation of Ecology resources; fees associated with new PE wells; contributions from local governments and tribes; part of county or conservation district ongoing education, outreach and incentive program.

2.6. Statewide mandatory water conservation measures in unincorporated areas of the state during drought

Proposed implementing entity:

Washington State Legislature; Ecology.

Recommendation:

- Implement mandatory water conservation measures for PE well users during drought events. Measures would focus on limiting outdoor water use, with exemptions for growing food. Washington State Legislature could require Ecology to implement water conservation policies.
- Ecology could write a rule to require water conservation measures.

Purpose:

Reduce water usage from PE well users during drought. Reduce impacts on streamflows from PE well users and support net ecological benefit goals. Increase climate change resilience.

Funding sources:

Potential funding sources could include: new funding from Washington State Legislature; allocation of existing Ecology resources; fees associated with new PE wells.