Appendices

WRIA 15 Kitsap Watershed

The following appendices are linked to this report as an Appendices file at:
https://apps.ecology.wa.gov/publications/SummaryPages/2211017.html

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Appendix A: Committee Roster

WRIA 15 Committee Members – Primary Representatives and Alternates

David Nash[1], Kitsap County

Dave Ward[2], Kitsap County

Kathy Peters, Kitsap County

Commissioner Randy Neatherlin, Mason County

David Windom, Mason County

Dan Cardwell, Pierce County

Austin Jennings, Pierce County

Greg Rabourn, King County

Joe Hovencotter, King County

Eric Ferguson, King County

David Winfrey, Puyallup Tribe

Seth Book, Skokomish Tribe

Dana Sarff, Skokomish Tribe

Jeff Dickison, Squaxin Island Tribe

Paul Pickett, Squaxin Island Tribe

Erica Marbet, Squaxin Island Tribe

Leonard Forsman, Suquamish Tribe

Alison O'Sullivan, Suquamish Tribe

Sam Phillips, Port Gamble S'Klallam Tribe

Paul McCollum, Port Gamble S'Klallam Tribe

Jacki Brown, City of Port Orchard

Thomas Hunter[2], City of Port Orchard

Zach Holt, City of Port Orchard

Trent Ward, City of Gig Harbor

Brienn Ellis, City of Gig Harbor

Michael Michael[2], City of Bainbridge Island

Christian Berg, City of Bainbridge Island

Christy Carr[2], City of Bainbridge Island

Teresa Smith, City of Bremerton

Allison Satter[2], City of Bremerton

Mayor Becky Erikson[3], City of Poulsbo

Joel Purdy, Kitsap Public Utility District

Mark Morgan, Kitsap Public Utility District

Bob Hunter, Kitsap Public Utility District

Brittany Gordon[2], Department of Fish and Wildlife

Nam Siu, Department of Fish and Wildlife

Stacy Vynne McKinstry, Department of Ecology

Russ Shiplet, Kitsap Building Association

Josie Cummings, Building Industry Association of Washington

Joy Garitone, Kitsap Conservation District

Nathan Daniel, Great Peninsula Conservancy

Sandra Staples-Bortner[2], Great Peninsula Conservancy

Larry Boltz, Mason Kitsap Farm Bureau (ex officio)

Shawn O'Dell, Washington Water Service (ex officio)

WRIA 15 Technical Consultant Team

Bob Montgomery, Anchor QEA

Burt Clothier, Pacific Groundwater Group

Chad Wiseman, HDR

HDR, Pacific Groundwater Group and Anchor QEA Support Staff

Lisa Daly Wilson, Daly Environmental

Facilitation Team

Susan Gulick, Sound Resolutions

Angela Pietschmann, Cascadia Consulting

Additional support from Cascadia Consulting Staff and Environmental Science Associates (ESA)

Department of Ecology Staff

Stacy Vynne McKinstry, Chair

John Covert, Lead Technical Support

Paulina Levy, Committee and Plan Development Support

Stephanie Potts, WRIA 15 Alternate Chair

Ria Berns, Regional Section Manager

Bennett Weinstein, Streamflow Section Manager

Mugdha Flores, Streamflow Communications Lead

Streamflow Section Technical Staff

Northwest Region Water Resources Section

Project Workgroup

Joy Garitone and Brian Stahl, Kitsap Conservation District

Jon Turk, Aspect (Consultant to Skokomish Tribe)

Joel Massman, Keta Waters (Consultant to Suquamish Tribe)

Alison O'Sullivan and John O'Leary[2], Suquamish Tribe

Austin Jennings and Dan Cardwell, Pierce County

Brittany Gordon[2] and Nam Siu, Department of Fish and Wildlife

David Nash[1] and Kathy Peters, Kitsap County

David Windom, Mason County

Paul Pickett, Squaxin Island Tribe

Sam Phillips, Port Gamble S'Klallam Tribe

Thomas Hunter[2] and Zach Holt, City of Port Orchard

Brenda Padgham, Bainbridge Island Land Trust

Greg Rabourn, King County

Seth Book and Dana Sarff, Skokomish Tribe

Bob Montgomery, Anchor QEA

Burt Clothier, Pacific Groundwater Group

Stacy Vynne McKinstry, Department of Ecology

Erik Steffens, Great Peninsula Conservancy

Joel Purdy, Kitsap Public Utility District

Technical Workgroup

Eric Ferguson, King County

Jon Turk, Aspect (Consultant to Skokomish Tribe)

Joel Massman, Keta Waters (Consultant to Suquamish Tribe)

Alison O'Sullivan and John O'Leary[2], Suquamish Tribe

Austin Jennings and Dan Cardwell, Pierce County

Brittany Gordon[2] and Nam Siu, Department of Fish and Wildlife

David Nash[1], Kitsap County

David Windom, Mason County

Paul Pickett, Squaxin Island Tribe

Sam Phillips, Port Gamble S'Klallam Tribe

Thomas Hunter[2] and Zach Holt, City of Port Orchard

Joel Purdy and Bob Hunter, Kitsap Public Utility District

Bob Montgomery, Anchor QEA

Burt Clothier, Pacific Groundwater Group

Stacy Vynne McKinstry, Department of Ecology

Thank you to the Committee members that participated in short-term, ad hoc workgroups.

Thank you also to Tribal, city and county staff, Kitsap Public Health District, and USGS for providing resources and presentations throughout this process.

[1]David Nash, formerly with Kitsap County, is now deceased.

[2]No longer at entity.

[3]Withdrew from Committee.

Appendix B: Final Meeting Summary of the WRIA 15 Committee

Final Meeting Summary

WRIA 15 Watershed Restoration and Enhancement

Committee Meeting

April 26, 2021 | 1:00 p.m.- 3:00 p.m. | WRIA 15 Committee Webpage

Location
WebEx

Committee Chair
Stacy Vynne
svyn461@ecy.wa.gov
(425) 649-7114

Handouts
- Agenda
- Final Draft WRIA 15 Plan
- Plan Corrections
- Plan Pathways

Attendance

*Committee Representatives and Alternates **

Dave Ward (Kitsap County)
Kathy Peters (Kitsap County)
Randy Neatherlin (Mason County)
David Windom (Mason County, alternate)
David Winfrey (Puyallup Tribe)
Dan Cardwell (Pierce County)
Austin Jennings (Pierce County, alternate)
Dana Sarff (Skokomish Tribe)
Seth Book (Skokomish Tribe)
Alison O'Sullivan (Suquamish Tribe)
Teresa Smith (City of Bremerton)
Allison Satter (City of Bremerton, alternate)
Sam Phillips (Port Gamble S'Klallam Tribe)
Jacki Brown (City of Port Orchard)
Paul Pickett (Squaxin Island Tribe)
Jeff Dickison (Squaxin Island Tribe)
Scott Stelzner (Squaxin Island Tribe, alternate)
Zach Holt (City of Port Orchard, alternate)
Bri Ellis (City of Gig Harbor)
Christian Berg (City of Bainbridge Island, alternate)
Chris Wierzbicki (City of Bainbridge Island)
Joel Purdy (Kitsap Public Utility District)
Brittany Gordon (WA Dept of Fish & Wildlife)
Nam Siu (WA Dept of Fish & Wildlife, alternate)
Greg Rabourn (King County)
Joe Hovenkotter (King County)
Russ Shiplet (Kitsap Building Association)
Joy Garitone (Kitsap Conservation District)
Nathan Daniel (Great Peninsula Conservancy)
Larry Boltz (Mason-Kitsap Farm Bureau, ex-officio)
Shawn O'Dell (Washington Water Service, ex-officio)
Stacy Vynne McKinstry (WA Dept of Ecology)

Other Attendees

Susan Gulick (Facilitator)
Caroline Burney (Info Manager)
John Covert (Ecology)
Bob Montgomery, Anchor QEA
Angela Johnson (Ecology)
Stephanie Potts (Ecology)

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

Updates and Announcements

- Ecology adopted the remaining plans under section 020 of the streamflow restoration law by the February 1, 2021 legislative deadline:
    - WRIAs 22/23: Chehalis
    - WRIA 49: Okanagan
    - WRIA 55: Little Spokane
- Update on local approval of watershed plans under section 030 of the streamflow restoration law:
    - Approved**:** WRIAs 9, 10, 12
        - Adoption deadline of June 30, 2021.
    - Not approved**:** WRIAs 7, 8, 13, 14
        - WRIAs 7 and 8 are still considering a path towards approval prior to June 30.
- 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.
    - Ecology requested $40 million for the biennium and $40 million was included in the Governor's Capital budget proposal.
- Summary of WRIA 15 Plan Corrections:
    - Updates since March 1 corrected version incorporated feedback from Ecology's technical staff and Committee members.
    - Edits included minor corrections as well as expansion of project descriptions.
    - Distributed a Comment Tracker with meeting materials.
    - Not planning to review revisions in detail since we are not expecting plan approval today.
    - Not planning to speak to the compendium today because that would only be submitted with an approved plan.

Steps to Plan Adoption

Ecology reviewed the pathways for Plan adoption. Plans must be approved by all members of the Committee prior to submission to Ecology review and consideration for adoption.

Materials:

- Steps to Plan Adoption

Discussion:

- If the Plan is approved today:

    - Chair will submit the Plan and any compendium materials to Ecology tonight.
    - Ecology will complete the State Environmental Policy Act (SEPA) review.
        - Environmental checklist and threshold determination for a non-project programmatic plan review.
        - Once Ecology makes a SEPA determination, there is a 25-day public comment period.
    - Ecology's technical staff will determine whether the Plan meets Net Ecological Benefit (NEB).
    - Ecology management reviews the materials to provide a recommendation to the Director.
    - Ecology Director reviews and makes determination on adoption by June 30, 2021.
    - Plan adoption.
    - After plan adoption, the Water Resources Program will review policy, adaptive management, and implementation recommendations across all of the watershed plans to decide how to invest resources.
- If the Plan is not approved and adopted by June 30:
    - Ecology prepares the final draft Plan.
    - Ecology submits the Plan to the Salmon Recovery Funding Board (SRFB) for technical review and recommendations.
    - Ecology considers the recommendations and finalizes the Plan.
    - Ecology adopts the Plan.
    - Director shall initiate rulemaking within six months of plan adoption to incorporate recommendations into rules adopted under chapter 90.94 or under Chapter 90.22 or 90.54 RCW, and shall adopt amended rules within two years of initiation of rule-making.
    - No timeline identified in the legislation for Ecology to finalize the Plan.
    - No role identified for the Committee after June 30, 2021.
- If the plan is not approved today, it does not preclude the Committee from continuing to work on the Plan until June 30.

Public Comment

No comments.

Committee Member Vote and Statements on WRIA 15 WRE Plan

Facilitator reminded the Committee of the Operating Principles regarding voting on the 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."

Materials:

- Final Draft WRIA 15 Plan

- Letters from Committee members and resolutions

Decision:
Committee members' votes are below.

Entity	Committee Member	Vote
Ecology	Stacy Vynne McKinstry	Approve
Port Gamble S'Klallam Tribe	Sam Phillips	Disapprove
Suquamish Tribe	Alison O'Sullivan	Disapprove
Skokomish Tribe	Dana Sarff	Disapprove
Squaxin Island Tribe	Jeff Dickison	Disapprove
Puyallup Tribe	David Winfrey	Abstain
Department of Fish and Wildlife	Brittany Gordon	Disapprove
Kitsap County	David Ward	Approve
Pierce County	Dan Cardwell	Approve
Mason County	Randy Neatherlin	Approve
King County	Greg Rabourn	Approve
City of Bremerton	Teresa Smith	Approve
City of Port Orchard	Jacki Brown	Approve
City of Gig Harbor	Bri Ellis	Disapprove
City of Bainbridge Island	Chris Wierzbicki	Approve
Kitsap Public Utility District	Joel Purdy	Approve
Kitsap Building Association (residential construction interest)	Russ Shiplet	Approve
Great Peninsula Conservancy (environmental interest)	Nathan Daniel	Approve
Kitsap Conservation District (agricultural interest)	Joy Garitone	Approve
TOTALS	**12 approved, 6 disapproved, 1 abstained**	

Statements:

- Dana Sarff shared that the Skokomish Tribe disapproved.
    - The Skokomish Tribe thanks the Ecology team including Stacy, Susan, and the technical team for all the hard work during these challenging times. The Skokomish Tribe will continue to work in partnership with the other Tribes and stakeholders for the restoration of streamflows, salmon, and other species.

- Jeff Dickison shared that the Squaxin Island Tribe disapproved. Squaxin Island Tribe circulated a letter to Ecology outlining their position.
- David Winfrey shared that the Puyallup Tribe did not have time to consider the Plan. The Puyallup Tribe abstained.
    - Brittany Gordon shared that WDFW has a number of concerns including the methodology used to determine consumptive use, uncertainty with regards to habitat benefits to streamflows, and a reliance on habitat projects.
- Brittany thanked Ecology for the collaborative process and expressed appreciation to the Committee for its partnership.
- Greg Rabourn, King County, thanked community members, Ecology, the consultant team, and Kitsap Conservation District for hosting a great meeting.
- Joel Purdy, Kitsap Public Utility District, shared gratitude for Committee members and Ecology for all of the time and effort during difficult circumstances.
- Nathan Daniel, Great Peninsula Conservancy, thanked everyone for the hard work.
- Dave Ward, Kitsap County, thanked Ecology and Committee members for all of the relationships and hard work.
- Shawn O'Dell, Washington Water Service (Ex-Officio) commended everyone for their hard work throughout the process.

The final vote of 12 in favor, 6 opposed and 1 abstention was announced. Each member was given the opportunity to review the final vote tally to ensure it was accurate.

Next Steps:

- Facilitator thanked the Committee for all of the work, especially during challenging circumstances.
- Ecology does not anticipate reconvening the Committee. However, if a Committee member believes they have found a path to consensus, the Committee can reconvene.
- The facilitator expects that the Final Plan will build on the work of the Committee.
    - Committee members should notify Ecology with any projects or ideas to strengthen or advance the Plan.
- Chair will notify Ecology that the Plan was not approved and submit the Draft Plan and letters.
- Chair will not submit the compendium. If there are additional materials that Committee members would like sent to Ecology, send to Chair tonight.

    - Chair can distribute notifications on updates to the listserv as the Plan is developed if there is interest from the Committee.
- Meeting summary will be distributed and asked for approval via email. Final summary will be posted on Committee website.

Closing: Next Steps and Action Items

- Chair will notify Ecology that the Plan was not approved and submit the Draft Plan and letters.
- Committee members should let the Chair know if they want the Committee listserv maintained for updates on Plan progress.
- Ecology will send April meeting summary for review/approval via email.

Appendix C: Subbasin Delineation Memo

The following technical memo was developed for the WRIA 15 Committee process. Therefore, final conclusions as presented in this plan may not align with the technical memo.

Technical Memorandum
WRE Committees Technical Support

To:	Stacy Vynne McKinstry, Washington State Department of Ecology
From:	Bob Montgomery, Anchor QEA; Chad Wiseman, HDR
Date:	February 12, 2020 (original); May 27, 2020 (revised); June 4, 2020 (review completed by Committee)
Subject:	WRIA 15 Subbasin Delineation (Work Assignment WA-01, Task 2)

1.0 Introduction

HDR is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) committee for Water Resource Inventory Area (WRIA) 15. The Streamflow Restoration law (Revised Code of Washington [RCW] Chapter 90.94) requires that WRE plans include actions to offset new consumptive-use impacts associated with permit-exempt domestic water use. 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." Therefore, delineations must be developed for the subbasins in WRIA 15 that will be used as a spatial framework for growth projections, consumptive-use estimates, and priority offset projects. The Net Ecological Benefit (NEB) evaluation will also be based on this framework. This technical memorandum addresses the basis for subbasin delineation in WRIA 15 (Kitsap).

2.0 Subbasin Delineation

This section explains the initial and final delineations for WRIA 15. The term "subbasin" is used by the WRIA 15 WRE committee for planning purposes only and to meet the requirements of RCW 90.94.030 (3)(b).

2.1 Initial Delineation

The WRIA 15 workgroup (a subcommittee of the WRE committee) was tasked to delineate subbasin boundaries for discussion at WRE committee meetings. An initial discussion was held at the April 4, 2019, workgroup meeting and Pierce County, the Kitsap Public Utility District (PUD), and the Squaxin Tribe subsequently developed maps of proposed subbasin boundaries and provided those to Ecology and the WRE committee.

The initial, general considerations included the following:

- Subbasins should be neither too big nor too small.
- Surface water flows and rain flow patterns should be included.
- Anticipated rural growth and where there is little growth will likely drive projects and impacts.
- Priority areas for salmon recovery should be included.
- Isolated areas like islands without streamflow connectivity to the mainland should be included as their own subbasin (for example, the South Sound Islands are grouped based on relatively low projected growth and proximity to Pierce County mainland).

- There should be recognition that the WRE committee can revise subbasins throughout the process.

The maps were further discussed at the May 2, 2019, WRE committee meeting and the workgroup meeting that immediately followed that meeting.

The result of the discussion on May 2, 2019, was a proposal that divides WRIA 15 into "regions" that are an initial delineation of subbasins that will be revisited as the watershed planning process continues. The key points discussed are as follows:

- Considerations for subbasins include starting large, using a nesting approach, and ensuring that there is justification for offset projects outside of a subbasin.
- The workgroup is committed to finding projects closest to the impact and revisiting subbasin delineations throughout the process.
- The regions map will be used for generating growth projections and consumptive use. The counties shared that they can project growth at any level but recognize that the smaller the subbasins are, the less reliable the data are. It is helpful for the counties to have the proposed size of regions for providing their growth projections.
- Some workgroup members are interested in using smaller assessment areas as well, such as Hydrologic Unit Code 12 (HUC12) boundaries, to look at particular stream impacts.
- Workgroup members also suggesting using Assessment Units[1] (from Ecology's Puget Sound Watershed Characterization Project) as a starting point for mitigation.
- The Squaxin Tribe would like to see a road map of how the subbasin delineations will be revisited throughout the process.

Further discussion of the regions approach occurred in the June 4, 2019, workgroup meeting and the June 6, 2019, WRE committee meeting. Agreement was reached on proceeding with use of the regions with the following caveats:

- The regions approach is a nested approach where regions are essentially a "do not cross" line for finding projects to offset impacts.
- Projects should be closest to the anticipated impact and provide benefit to streams. Using a nested approach, the potential for offsets will be evaluated first at the assessment unit scale, then at the HUC 14 scale, and finally at the subbasin scale. In other words, the committee will look for projects at the finest scale possible first. If the offsets are not

[1] Assessments Units are described in the Puget Sound Watershed Characterization Project (Department of Ecology, 2013). Each WRIA is made up of subwatersheds, called watershed management units, which are further divided into Assessment Units. A variety of watershed assessment results are presented for each assessment unit, including: water flow (for delivery, surface storage, recharge, and discharge processes); water quality processes (for five parameters: sediment, phosphorus, nutrients, pathogens, and metals); and fish and wildlife habitats (for terrestrial, freshwater and marine habitats).

achievable at the small or intermediate unit scale, justification will be provided (for example, there is greater relative benefit in a larger project in a stream of importance).

- The WRE committee will continue to revisit delineation of subbasins once growth projections and projects are developed.

The June proposal included three main regions: South Sound, West Sound, and Hood Canal. The boundary between the West Sound region and the Hood Canal region in the northern Kitsap Peninsula was left flexible with the recognition that projects in one region could benefit streams in the other region. The other regions are Bainbridge Island, Vashon-Maury Island, and the three south Puget Sound islands (McNeil, Anderson, and Ketron).

2.2 Revision to Hood Canal Region

The Skokomish Tribe proposed to revise the region delineation by dividing the Hood Canal region into North Hood Canal and South Hood Canal regions. The reason is differing precipitation amounts, development and status of fish species. The proposal was first presented to the WRIA 15 Committee in October who passed it to the workgroup for discussion. A subset of workgroup members reviewed the proposal and recommended the proposal be accepted. The proposal was further discussed at the November 7, 2019 WRIA 15 Committee meeting. There was agreement amongst all Committee members present to accept the revision to the Hood Canal region.

2.3 Final Delineation

Agreement was reached at the March 5, 2020 WRIA 15 committee meeting to accept the region delineations as the subbasin boundaries. Figure 1 presents the subbasins as agreed to at that meeting.

3.0 Conclusion

The WRIA 15 WRE committee delineation of subbasins will be used as an organizational framework for growth projection and consumptive-use scenarios.

References

Revised Code of Washington (RCW). 2019. Watershed Planning, Chapter 90.82 RCW. Accessed on June 23, 2019, at https://app.leg.wa.gov/rcw/default.aspx?cite=90.82.

RCW. 2019. Streamflow Restoration, Chapter 90.94 RCW. Accessed on June 23, 2019, at https://app.leg.wa.gov/RCW/default.aspx?cite=90.94.

U.S. Geological Survey and U.S. Department of Agriculture, Natural Resources Conservation Service (USGS). 2013. Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD) (4 ed.): Techniques and Methods 11–A3, 63 p., https://pubs.usgs.gov/tm/11/a3/.

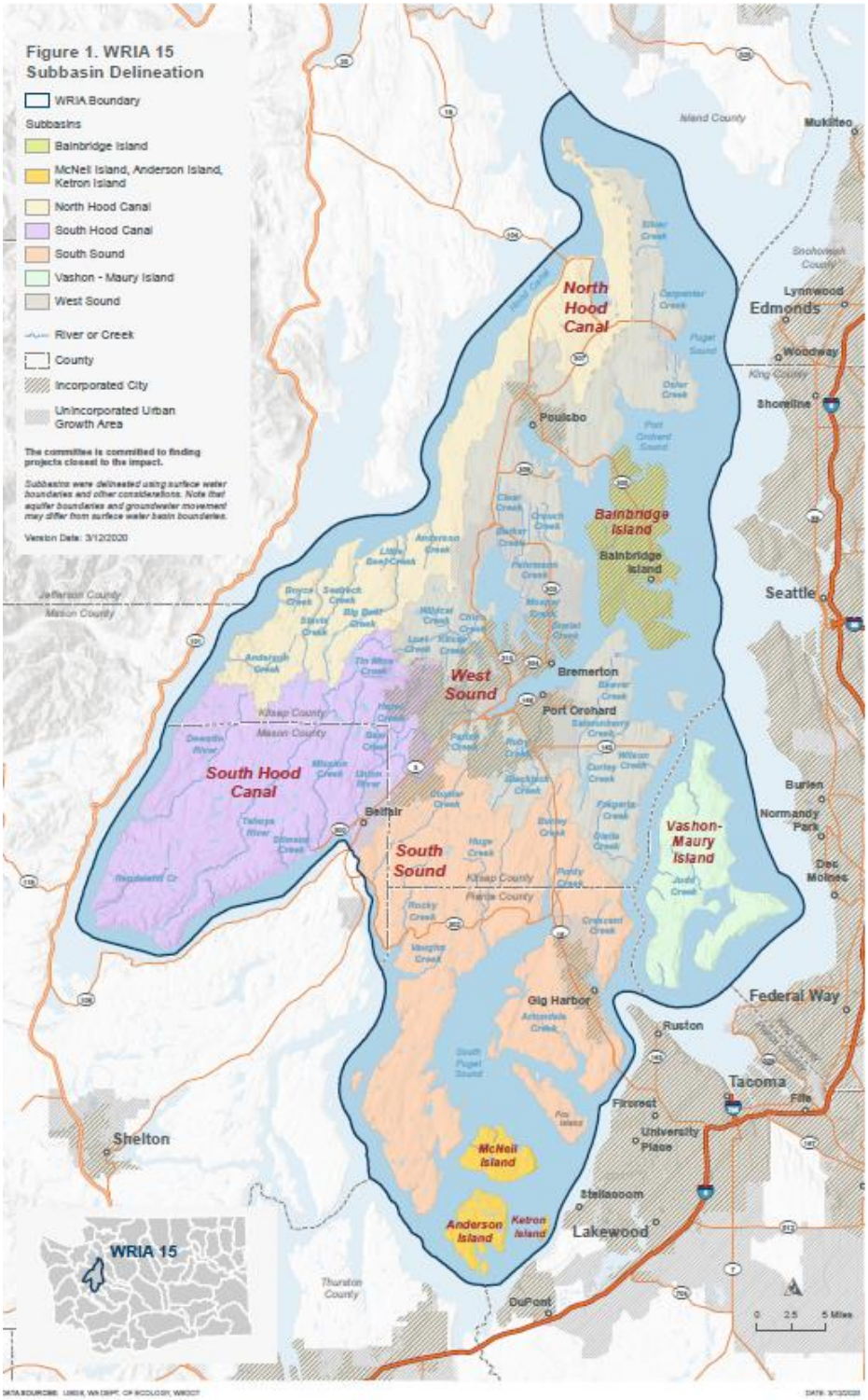

Figure C-1. WRIA 15 subbasin delineation

Appendix D: Growth Projections and Consumptive Use Memo

The following technical memo was developed for the WRIA 15 Committee process. Therefore, final conclusions as presented in this plan may not align with the technical memo.

Technical Memorandum DRAFT

To:	Stacy Vynne McKinstry, Washington State Department of Ecology
From:	Chad Wiseman, HDR and Bob Montgomery, Anchor QEA
Date:	February 13, 2020 (original); May 27, 2020 (revised); June 4, 2020 (review completed by Committee)
Subject:	WRIA 15 PE Growth and Consumptive Use Summary (Work Assignment 2, Tasks 2 and 3)

Introduction

HDR 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) 10, 12, 13, 14, and 15.

Under RCW 90.94, consumptive water use by permit-exempt domestic wells and connections (PE wells) occurring over the 20 year period of 2018-2038 (planning horizon) must be estimated to establish the water use that watershed restoration plans and plan updates are required to address and offset. This memorandum summarizes PE wells and related consumptive use of groundwater that is projected to impact WRIA 15 over the planning horizon.

This memorandum includes:

- A summary of WRIA 15 baseline, low, and high PE growth scenarios.
- A summary of WRIA 15 baseline, low, and high scenario consumptive use using three different methods.

WRIA 15 PE Growth Projection Methods

Portions of Mason, Pierce, and King counties and all of Kitsap County are located within WRIA 15. The WRIA 15 WRE committee agreed to develop high and low growth projection scenarios based on varying the Kitsap and Pierce County projections. At this time, Mason County and King County growth projections remained the same for the baseline high and low scenario projections; however the Squaxin Island Tribe has expressed interest in possibly seeing a higher growth scenario or safety factor for Mason County. Mason County wants to ensure that the adaptive management component of the plan considers the results of the census for changes in population growth (available in 2022).

1.1 Kitsap County

Two methods were used to project growth over the planning horizon for Kitsap County. Both the Kitsap County Land Capacity Analysis, completed by County staff, and the Historical Wells Method, completed by Kitsap Public Utility District (Kitsap PUD), result in similar numbers:

Kitsap County Land Capacity Analysis

1) Identify 20-year growth projections from the Kitsap Regional Coordinating Council growth projections (conversion to single-family residences based on assumed people per household and rural growth target).

2) Allocate growth by subbasin based on proportion of historical building permits by subbasin from 2002 to 2019.

3) Conduct a land capacity analysis. Determine vacant parcels within each subbasin that is within and outside of the waterline or sewerline 200-foot buffer. Assume that all parcels greater than 0.15 acre are buildable if they are within the 200-foot buffer. Buildout capacity for parcels greater than 0.75 acre outside of a 200-foot waterline buffer is assumed to be served by PE wells. Assume that that growth occurs along the waterline areas first, and that the forecasted number of PE wells is less than the forecasted number of single family residences as some wells may have multiple connections.

4) Multiply the growth for each subbasin (step 2) by the proportion of growth expected to be served by PE wells (step 3).

5) The application of this method to City of Bainbridge Island results in no new PE wells. An alternative method for City of Bainbridge Island was performed which assumes one PE well connection per parcel, regardless of parcel size. It was also assumed that growth occurs along the waterline areas first with the remaining growth occurring on parcels needing PE wells.

Kitsap County developed three iterations of growth projections in rural areas based on varying the minimum parcel size to be suitable for a PE well in the land capacity analysis (Step 3). The versions included 0.25 acre, 0.75 acre, and 1.0 acre. The final version recommended by the county assumed a minimum acreage for PE wells of 0.15 acre in their land capacity analysis and also used additional data on water lines and sewer lines (as a proxy for water lines). This version was provided to HDR on November 22, 2019. Kitsap County provided a flow chart of the land capacity analysis and heat map (HDR 2019a).

Historical Wells Method (Kitsap PUD):

1) Calculate historical growth rates of PE wells using County records of wells drilled (2003-2018). Note this is all wells drilled, not just PE wells.

2) Forecast growth of future PE well connections for the 20-year planning horizon, based on the historical growth rate.

3) Allocate growth of PE wells within each subbasin spatially, based upon land capacity analysis (i.e., parcel must be outside of UGA, not in a water and wastewater system boundary, not already built upon, or must have zoning category that allows for domestic use).

1.2 King County

The following methods were used to project growth over the planning horizon:

1) Use historical building permit data (2000–2017) to project future growth.

2) Define if each historical building permit used for growth projections is public or private (aka PE well) water service.

3) Multiply the annual (projected) number of building permits per year by the percentage of permits using private water to determine a projected number of PE well connections per year to yield the annual rate of PE well connections.

4) Multiply the rate of annual PE well connections by 20 for the estimated total of PE well connections over a 20-year period.

5) Overlay subbasins to determine number of new PE well connections in each subbasin.

6) Remove the portion of the wells that are projected to be inside of the water district service boundaries.

The King County method is described in more detail in a technical memo provided by the county dated December 16, 2019 (HDR 2019a). King County growth projections did not change from the initial projections on July 31, 2019.

1.3 Mason County

The following methods were used to project growth during the planning horizon:

1) Develop 20-year growth projections based on the Mason County Comprehensive Plan (the Comprehensive Plan is based on Office of Financial Management medium population growth estimates, and conversion to dwelling units based on assumed people per dwelling unit).

2) Determine available land for single-family domestic units and determine proportion of buildout capacity by county urban growth areas (UGAs) and rural lands.

3) Apply growth projections to buildable lands.

4) Remove projected development unlikely to connect to a PE well (i.e., parcel is located within a water system service area; parcel is smaller than 1 acre).

5) Overlay subbasins to determine new PE connections in each subbasin.

Initial growth projections for Mason County were updated because of 1) updates to county parcel attributes and 2) a request from the WRIA 14 and WRIA 15 WRE committees to account for PE wells within water system service areas. Parcel data were updated to correct for circumstances where the zoning and land use attributes identified a parcel as buildable but were also associated with a feature that was incompatible with building (e.g., on top of a waterbody). The initial methods assumed zero PE well growth within water system service areas in both the urban growth areas (UGAs) and rural areas. HDR developed a method that allocates PE well growth in rural water systems proportional to the number of parcels in each water system not currently served by the water system.

The method is comprised of the following steps:

1) Assume future growth is proportional to buildable parcels with available water system hookup and parcels that would require a PE well or connection for development.

2) Define total buildable parcels per county buildable lands analysis that are contained within each respective water system service area. The water system service areas are defined by the Washington State Department of Health (DOH) as polygons in the Geographic Information Service (GIS) platform.

3) Define active and total approved (active + available) water system connections from the DOH Sentry database.

4) Calculate buildable parcels with an available water system hookup (total approved minus active water system connections)

5) Calculate buildable parcels that would require a PE well or connection for development (total buildable parcels minus total approved connections).

6) Calculate ratio of buildable parcels that would require a PE well or connection (step 5) to the parcels with an available water system hookup (step 4) and multiply by the number of dwellings predicted to occur in that water system service area.

1.4 Pierce County

The following methods were used to project growth over the planning horizon:

1) Calculate historical growth rates of PE wells for each subbasin using the Tacoma-Pierce County Health District (TPCHD) well database (1999–2018).

2) Forecast growth of future PE well connections for the planning horizon, based on the subbasin-specific historical growth rate.

3) Allocate growth of PE wells within each subbasin spatially, based upon a parcel assessment for PE well potential (i.e., parcel must be outside of UGA, not in a water and wastewater system boundary, not already built upon, or must have zoning category that allows for domestic use).

No changes were made to the growth projection methods or results occurred since the initial growth projection on July 31, 2019.

High and Low Growth Scenarios

Because of the uncertainty in the projections, the WRIA 15 Committee evaluated additional permit-exempt well scenarios using different periods in the historical TPCHD well database. The high growth scenario uses the 1999–2008 data, which was a time of relatively healthy economic growth resulting in more rapid rural development. The low growth scenario uses the 2009–2018 data, which was a time of a relatively slower rate of rural development and corresponds with the recession and housing downturn. For Kitsap County, a plus or minus five percent was used to calculate the high and low growth scenario. The five percent is based on the margin of error in the County's land capacity analysis. High and low growth scenarios were not calculated for Mason or King counties at the counties' request.

WRIA 15 Consumptive Use Methods

Consumptive use of water from projected PE well growth was estimated using three different methods; 1) the Irrigated Area Method; 2) the Water System Data Method and; 3) the USGS Groundwater Model Method

Irrigated Area Method

Consumptive use was calculated using Ecology's recommended assumptions for indoor and outdoor consumptive use (Ecology 2018; 2019).

Indoor Consumptive Use – Irrigated Area Method

Ecology (2018; 2019) recommends the following assumptions for estimating indoor consumptive water use:

- 60 gpd per person within a household
- 2.5 persons per household (or as otherwise defined by the counties)
- 10 percent of indoor use is consumptively used

  Most homes served by a PE well use septic systems for wastewater. This method assumes 10 percent of water entering the septic system will evaporate out of the septic drain field and the rest will be returned to the groundwater system.

The above assumptions were used to estimate indoor consumptive water use by occupants of a single dwelling unit. Assuming that there is one PE well connection per dwelling unit, a "per PE well connection" consumptive use factor was applied to the growth projections forecast in each subbasin to determine total indoor consumptive use per subbasin. This method is summarized by the following equation:

$$HCIWU\ (gpd) = 60\frac{gal}{day * person} *\ 2.5\frac{people}{household} * CUF$$

Where:

HCIWU = Household Consumptive Indoor Water Use (gpd)

CUF= Consumptive use factor; assumed to be 10% (factor expressed as 0.10)

This estimate of indoor per household per day can be annualized and converted to acre-feet per year or CFS.

Outdoor Consumptive Use – Irrigated Area Method

Ecology (2018; 2019) recommends estimating future outdoor water use based on an estimate of the average outdoor irrigated area for existing homes served by PE wells. To calculate the consumptive portion of total outdoor water required per parcel/connection over a single growing season, Ecology recommends:

- Estimating the average irrigated lawn area (pasture/turf grass) per parcel in each WRIA,
- Applying crop irrigation requirements,
- Correcting for application efficiency (75 percent efficiency recommended by Ecology guidance) to determine the total outdoor water required over a single growing season, and
- Applying a percentage of outdoor water that is assumed to be consumptive (80 percent outdoor consumptive use recommended).

WRE Committees were given the opportunity to adjust variables used in the analysis when applicable to the specific WRIA. WRIA 15 opted not to adjust variables.

The average irrigated area in WRIA 15 was estimated by measuring areas of visible irrigation (i.e. green lawns relative the surrounding, gardens, managed landscaping) in using aerial imagery in 80 random parcels with existing dwellings that have a PE well or connection (Figure 1). The average

irrigated area was 0.08 acres (Table D-1). Most parcels evaluated did not have visible signs of irrigation in the aerial imagery (Figure 2). Detailed methods and results are defined in the consumptive use methods technical memorandum and report (HDR 2019b).

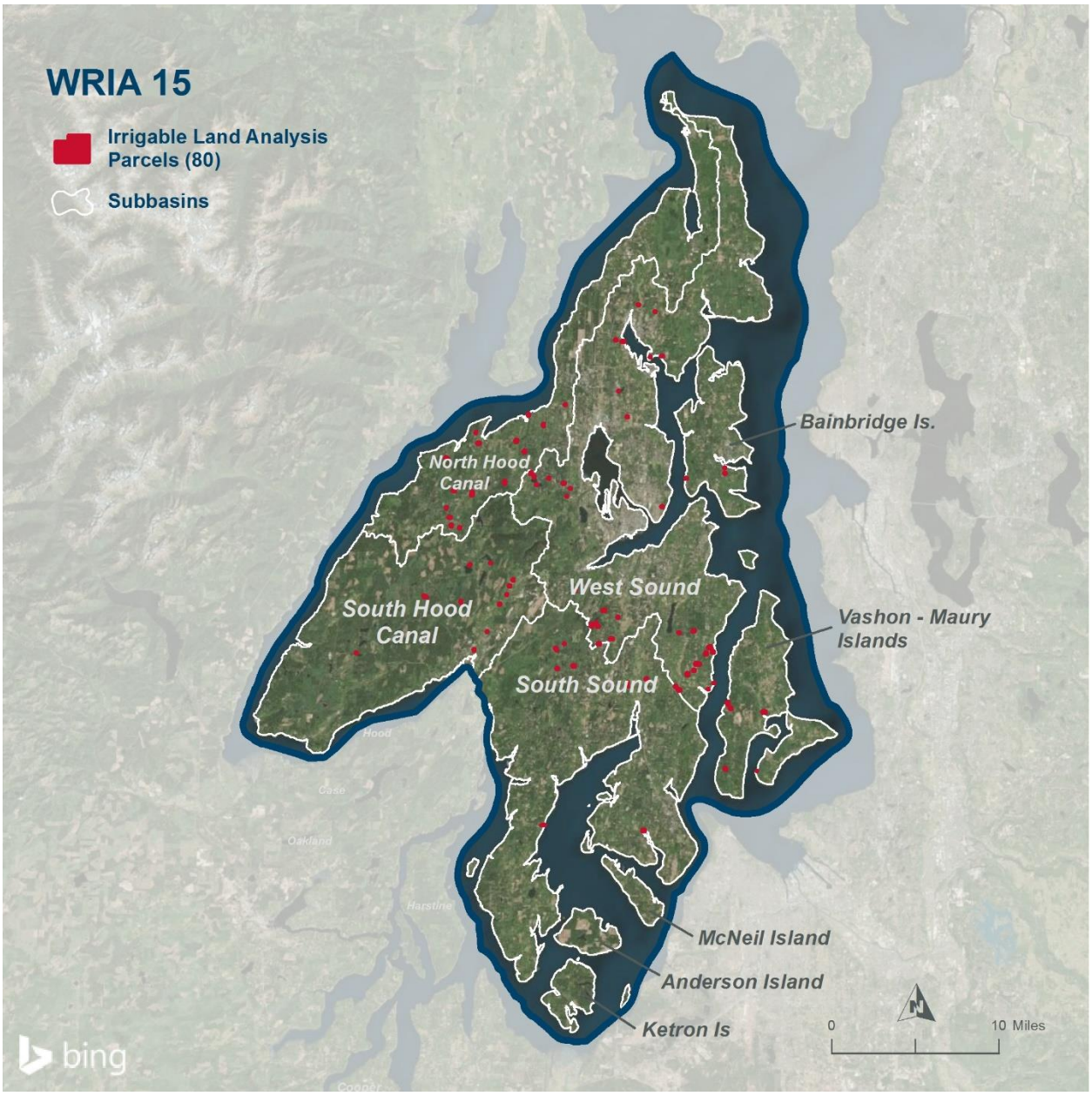

Figure 8. Parcels selected in WRIA 15 with existing PE well that were delineated for apparent irrigated areas.

Table D-1. Irrigated acreage delineation results.

Statistic	WRIA 15
PE Parcel Sample Pool	8,987
Sample Size	80
Mean (acres)	0.08
Standard Deviation (acres)	0.13
95% UCL (acres)	0.14

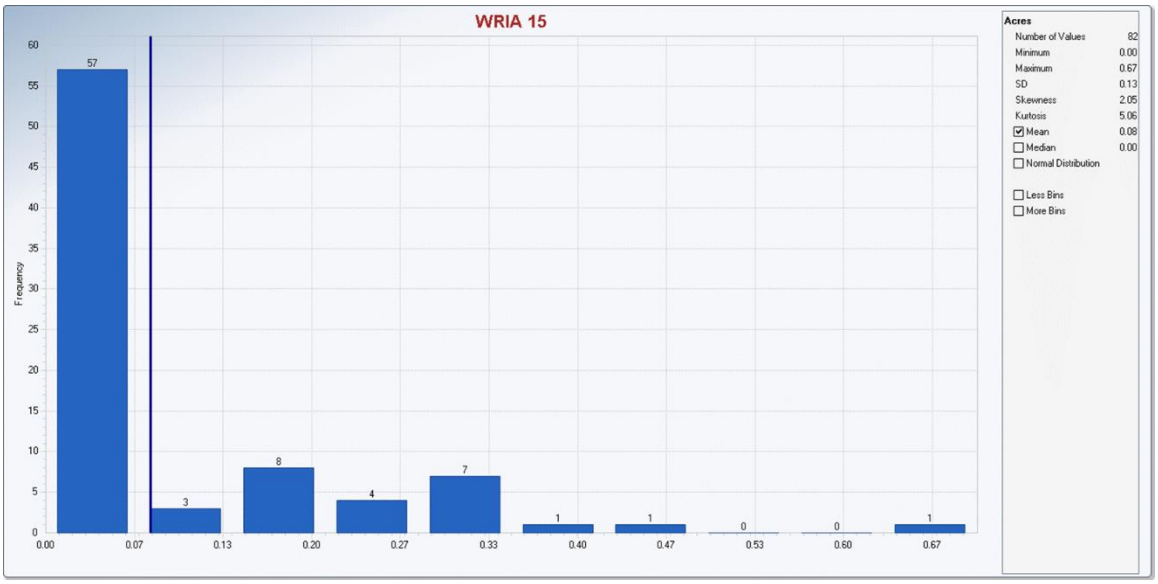

Figure D-1. Histogram of WRIA 15 irrigated acreage delineation results.

Once average irrigable acreage per connection was determined for a WRIA, water use was calculated based on irrigation requirements and application efficiency. Crop irrigation requirements were estimated for pasture/turf grass from nearby stations as provided in the Washington Irrigation Guide (NRCS-USDA, 1997). An irrigation application efficiency was applied to account for water that does not reach the turf. Ecology (2018; 2019) recommends using a 75 percent application efficiency factor. The consumptive portion of total amount of water used for outdoor use was assumed to be 80 percent of the total. This method is summarized in the following equation:

$$HCOWU\ (gpd) = A\ (acres) * IR(feet) * AE * CUF * CF$$

Where:

HCOWU = Household Consumptive Outdoor Water Use (gpd)

A = Irrigated Area (acres)

IR = Irrigation Requirement over one irrigation season (feet)

AE = Application efficiency; assumed to be 75% (factor expressed as 1/0.75)

CUF= Consumptive use factor; assumed to be 80% (factor expressed as 0.80)

CF = Conversion Factor to convert AFY to gpd; 1 AFY = 892.742 gpd

Uncertainty in Irrigated Area Calculations

The irrigated area measurements were performed using a set of 80 parcels distributed throughout WRIA 15. The number of parcels selected was based on the budget for this task as agreed to by HDR and Ecology. Concern was expressed by some members of the Committee that a repeatable, spatially distributed, and statistically valid subset of parcels was not used. While this concern was recognized and acknowledged, ultimately the Committee determined that the results were representative of the WRIA.

The parcels analyzed were selected using the following procedure:

- Define the available pool of parcels with existing PE wells using Tacoma-Pierce County Health Department data for Pierce County and in Mason, Kitsap and King counties using assessor's data and water system boundary data to locate existing residences not served by water systems
- Classify parcels by value (less than $350,000, $350-600,000, greater than $600,000)
- From the available pool of parcels, randomly select a subset of parcels throughout WRIA 15, while ensuring the distribution of parcel values is like that of the entire WRIA 15

The parcel selection procedure provided a spatially distributed and representative sample of parcels with PE wells.

After measuring irrigated area for the subset of 80 parcels, the results were presented to a WRIA 15 workgroup. Kitsap PUD and the Suquamish Tribe performed analyses to independently verify the results. The two independent analyses confirmed the findings of the irrigated area analysis. This indicates the procedure was repeatable. The Committee, with their knowledge of the WRIA, stated that the results were in line with water use in the WRIA. In addition, the technique used to delineate irrigated area was subject to a quality assurance check by another consultant, GeoEngineers, at the request of Ecology (GeoEngineers and HDR, 2020).

The average irrigated area measured for the 80 parcels is 0.08 acres. The area is low due to a high number of non-irrigated parcels. HDR performed statistical analyses of the irrigated acreage to estimate the upper confidence limits and to determine the sample size of parcels required to estimate a mean value of irrigated acreage for error margins ranging from 0.01 acre to 0.06 acre. It was found the set of 80 parcels allows the mean to be calculated within a 0.03-acre error margin.

The Committee reviewed the irrigated area calculations and chose not to adjust the calculations by assuming a base amount of irrigation instead of zero for non-irrigated parcels. The Committee believes that 0.08 acres is representative of the irrigated areas for PE wells in WRIA 15 and adopted that value for consumptive use calculations. Factors in that decision are the conservative nature of the consumptive use calculation when applied to the irrigated area and the independent analyses performed to confirm the measurements of irrigated acreage.

At the request of Committee members, the consultant team considered other approaches to measuring and calculating average irrigated area. Measurement techniques using remote sensing data were considered but it was determined that it would be more costly and time-consuming than the method employed by HDR. Additional parcels for analysis were delineated and provided to Committee members for additional analysis for further verification of average irrigated area. No additional analysis was received from Committee members.

Water System Data Method

Consumptive use by PE wells and connections may also be estimated using metered connections from water systems. HDR requested data from WRE Committee members for water systems that use (or have used) a flat rate billing structure and were similar in character to the rural environments in which households may connect to PE wells. In WRIA 15, Kitsap PUD provided consumption data for all Kitsap PUD water systems for years 2017 and 2018.

Indoor Use

Average daily use in December, January, and February is representative of year-round daily indoor use. Average daily system-wide use is divided by the number of connections (assuming all connections are residential), to determine average daily indoor use per connection. A 10 percent consumptive use factor was applied to the average daily use in the winter months to determine the consumptive portion of indoor water use per connection.

Outdoor Water Use

Average daily indoor use was multiplied by the number of days in a year to estimate total annual indoor use. Total annual indoor use was subtracted from total annual use by a water system to estimate total annual outdoor use. An 80 percent consumptive factor was applied to determine the consumptive portion of outdoor use.

Seasonal Outdoor Water Use

Outdoor consumptive use was also estimated on a seasonal basis. The Washington Irrigation Guide reports irrigation requirements between the months of April and September for representative weather stations in WRIA 15. Therefore, seasonal outdoor water use was assumed to occur over a period of six months. Average daily indoor use was multiplied by the number of days in the irrigation season to calculate total indoor use for the irrigation season. Total irrigation season indoor use was then subtracted from total season use to determine total outdoor use for the irrigation season. The value was proportionally allocated to each month in the irrigation season using the requirements from the Washington Irrigation Guide. An 80 percent consumptive factor was applied to determine the consumptive portion of outdoor use.

1.5 USGS Groundwater Model Method

A groundwater-flow model was developed by the USGS to improve understanding of water resources on the Kitsap Peninsula. The study area did not include WRIA 15 areas of Key Peninsula, and Vashon, Fox, Anderson, McNeil and Ketron Islands. The first step in the modeling process was to characterize the groundwater-flow system on the Kitsap Peninsula and to prepare a water budget for the study area, which are contained in the report titled *Hydrogeologic Framework, Groundwater Movement and Water Budget of the Kitsap Peninsula, West-Central Washington* (Welch, Frans, and Olsen, 2014). The report provides a survey of consumption from select water utilities serving more than 221,700 people with more than 88,500 residential connections on the Kitsap Peninsula.

The USGS study differentiated between the indoor and outdoor portions of use. Estimated indoor use (based on November–April pumping values) was 66 gallons per person per day. Outdoor use was estimated for the outdoor growing season and varied by month from 4 gallons per person per day in May to 97 gallons per person per day in September; a value of 26 gallons per person per day was used in the calculation. For the purposes of groundwater modeling USGS set the consumptive use rate for indoor domestic use at 10 percent in nonsewered areas, and the consumptive use rate

for outdoor use at 90 percent. The water use values and consumptive use rates for the USGS study area are used in this report to develop an additional estimate of consumptive use per permit-exempt connection for the entire WRIA 15. To differentiate this method from the water system data method that uses Kitsap PUD managed water system data, it is termed the USGS groundwater model method.

Results

PE Connection Growth

Baseline PE connection growth is projected to be 5,568 connections (Table D-2). The high PE growth scenario is projected to have 584 additional connections, for a total of 6,152 PE connections. The low PE growth scenario is projected to have 707 fewer connections than the baseline scenario, for a total of 4,861 PE connections. PE connection growth is expected to be greatest in the “South Sound” subbasin.

Consumptive Use

The irrigated area method yielded a total consumptive use per PE connection of 122.9 gpd.

The water system data method yielded a total consumptive use per PE connection of 64.3 gpd. The USGS model method yielded a total consumptive use per PE connection of 75 gpd.
The estimates of consumptive use in WRIA 15 over the 20-year planning horizon using the irrigation area method was 1.06 (baseline), 0.93 (low growth), and 1.17 cfs (high growth).

The estimates of consumptive use in WRIA 15 over the planning horizon using the water system data method were 0.55 cfs (baseline), 0.48 cfs (low growth), and 0.61 cfs (high growth).

The estimates of consumptive use in WRIA 15 over the planning horizon using the USGS model method were 0.65 cfs (baseline), 0.57 (low growth), and 0.72 (high growth).
For WRIA 15 scenarios, the estimates of consumptive use using the irrigation area method estimates are approximately 1.9 times higher than the water system data method. Consumptive use is 1.1 times higher in the high growth scenario than the baseline scenario, and approximately 1.7 times higher than the USGS model method. Consumptive use is approximately 1.14 times higher in the baseline scenario than the low growth scenario.

Table D-2. Annualized Average Consumptive Use Estimates for WRIA 15 – Baseline Growth

Annualized Consumptive Use Estimates for WRIA 15 (2020–2040) – Baseline Growth Projection; 0.75 acre minimum threshold										
Subbasin	Projected PE Well Connections	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: USGS Estimates			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
West Sound	1,336	96.2	59.6	0.1331	112.2	69.6	0.1553	183.9	114.0	0.2545
Hood Canal	656	47.2	29.3	0.0653	55.1	34.2	0.0763	90.3	56.0	0.1249
South Hood Canal	1,126	81.0	50.2	0.1121	94.6	58.6	0.1309	155.0	96.1	0.2145
Bainbridge Island	491	35.3	21.9	0.0489	41.3	25.6	0.0571	67.6	41.9	0.0935
South Sound	1,553	111.8	69.3	0.1547	130.5	80.9	0.1805	213.8	132.5	0.2958
Vashon – Maury Island	368	26.5	16.4	0.0367	30.9	19.2	0.0428	50.7	31.4	0.0701
McNeil Island, Anderson Island, Ketron Island	38	2.7	1.7	0.0038	3.2	2.0	0.0044	5.2	3.2	0.0072
Totals	**5,568**	**400.8**	**248.4**	**0.5545**	**467.8**	**290.0**	**0.6473**	**766.4**	**475.1**	**1.0605**

Table D-3. Annualized Average Consumptive Use Estimates for WRIA 15 – Low Growth

Annualized Consumptive Use Estimates for WRIA 15 (2020–2040) - Low Growth Projection; 0.75 acre minimum threshold										
Subbasin	Projected PE Well Connections	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: USGS Estimates			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
West Sound	1,142	82.2	51.0	0.1137	95.9	59.5	0.1328	157.2	97.4	0.2175
Hood Canal	561	40.4	25.0	0.0559	47.1	29.2	0.0652	77.2	47.9	0.1068
South Hood Canal	1,119	80.5	49.9	0.1114	94.0	58.3	0.1301	154.0	95.5	0.2131
Bainbridge Island	491	35.3	21.9	0.0489	41.3	25.6	0.0571	67.6	41.9	0.0935
South Sound	1,158	83.3	51.7	0.1153	97.3	60.3	0.1346	159.4	98.8	0.2206
Vashon – Maury Island	368	26.5	16.4	0.0367	30.9	19.2	0.0428	50.7	31.4	0.0701
McNeil Island, Anderson Island, Ketron Island	22	1.6	1.0	0.0022	1.8	1.1	0.0026	3.0	1.9	0.0042
Totals	**4,861**	**349.9**	**216.9**	**0.4841**	**408.4**	**253.2**	**0.5651**	**669.1**	**414.8**	**0.9258**

Table D-4. Annualized Average Consumptive Use Estimates for WRIA 15 – High Growth

Annualized Consumptive Use Estimates for WRIA 15 (2020–2040) - High Growth Projection; 0.75 acre minimum threshold										
Subbasin	Projected PE Well Connections	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: USGS Estimates			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
West Sound	1,403	101.0	62.6	0.1397	117.9	73.1	0.1631	193.1	119.7	0.2672
Hood Canal	689	49.6	30.7	0.0686	57.9	35.9	0.0801	94.8	58.8	0.1312
South Hood Canal	1,128	81.2	50.3	0.1123	94.8	58.8	0.1311	155.3	96.2	0.2148
Bainbridge Island	516	37.1	23.0	0.0514	43.4	26.9	0.0600	71.0	44.0	0.0983
South Sound	1,992	143.4	88.9	0.1984	167.4	103.8	0.2316	274.2	170.0	0.3794
Vashon – Maury Island	368	26.5	16.4	0.0367	30.9	19.2	0.0428	50.7	31.4	0.0701
McNeil Island, Anderson Island, Ketron Island	56	4.0	2.5	0.0056	4.7	2.9	0.0065	7.7	4.8	0.0107
Totals	**6,152**	**442.8**	**274.5**	**0.6127**	**516.9**	**320.4**	**0.7152**	**846.8**	**524.9**	**1.1717**

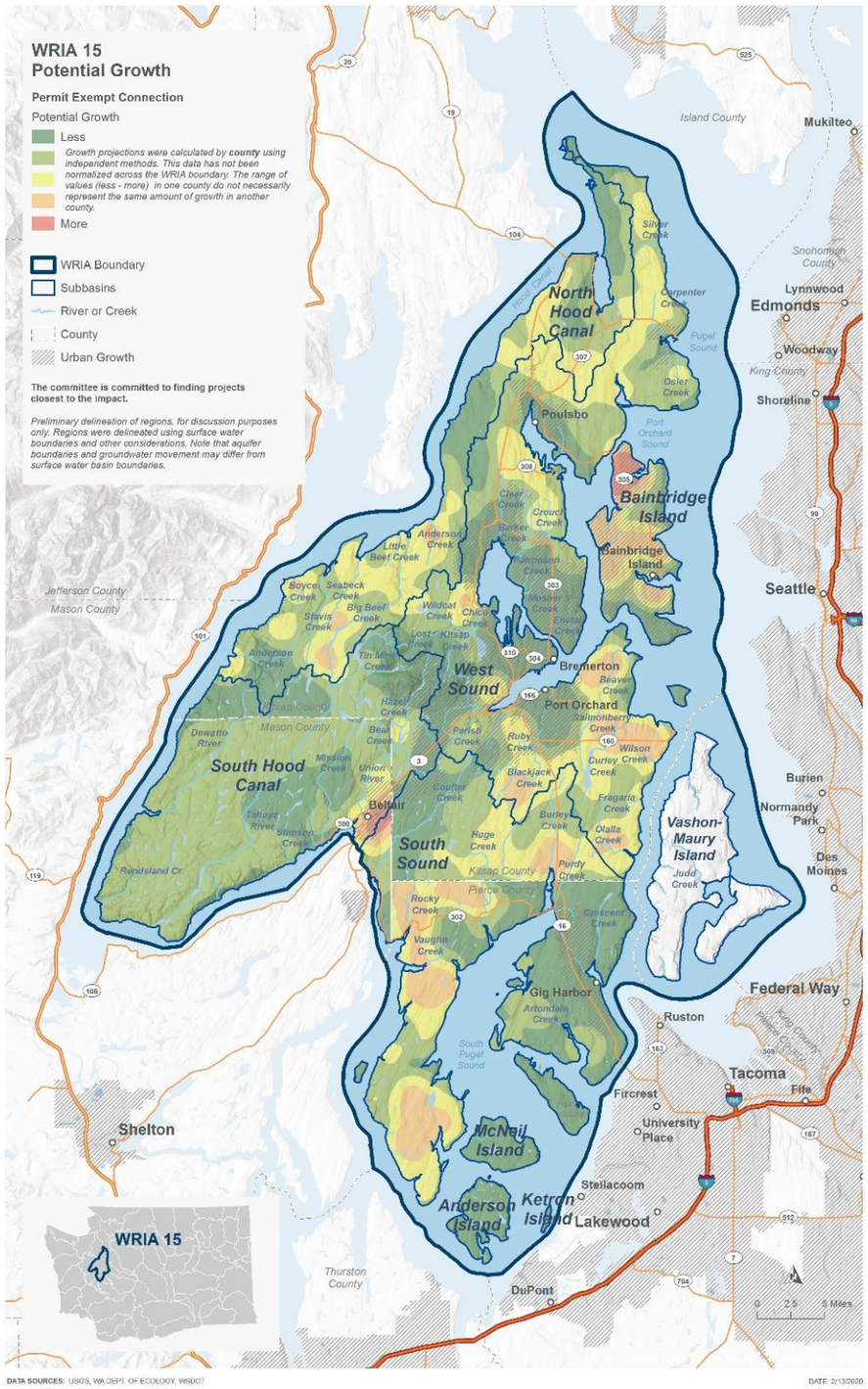

Figure D-2. WRIA 15 projected PE connection growth.

Seasonal Use

Monthly outdoor water use was calculated as part of the consumptive use analysis for the Irrigated Area method. Seasonal water use by month is reported by subbasin and scenario (Table D-4a-c). The month of July has the highest irrigation requirement, resulting in the highest monthly consumptive use impact. This information may be used when evaluating projects designed to offset subbasin- and season-specific impacts.

Tables D-4a-c: WRIA 15 Monthly Consumptive Water Use (cfs)

Subbasin	Projected No. PE Wells (Baseline)	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
West Sound	1,336	0.0311	0.0311	0.0311	0.0311	0.3316	0.7239	0.9879	0.7585	0.3726	0.0311	0.0311	0.0311
Hood Canal	656	0.0153	0.0153	0.0153	0.0153	0.1628	0.3555	0.4851	0.3724	0.1829	0.0153	0.0153	0.0153
South Hood Canal	1,126	0.0262	0.0262	0.0262	0.0262	0.2795	0.6101	0.8327	0.6393	0.3140	0.0262	0.0262	0.0262
Bainbridge Island	491	0.0114	0.0114	0.0114	0.0114	0.1219	0.2661	0.3631	0.2788	0.1369	0.0114	0.0114	0.0114
South Sound	1,553	0.0361	0.0361	0.0361	0.0361	0.3855	0.8415	1.1484	0.8817	0.4331	0.0361	0.0361	0.0361
Vashon – Maury Island	368	0.0086	0.0086	0.0086	0.0086	0.0914	0.1994	0.2721	0.2089	0.1026	0.0086	0.0086	0.0086
McNeil Anderson, Ketron	38	0.0009	0.0009	0.0009	0.0009	0.0094	0.0206	0.0281	0.0216	0.0106	0.0009	0.0009	0.0009
Totals	**5,568**	**0.1295**	**0.1295**	**0.1295**	**0.1295**	**1.3822**	**3.0171**	**4.1174**	**3.1612**	**1.5527**	**0.1295**	**0.1295**	**0.1295**

Subbasin	Projected No. PE Wells (Low Growth)	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
West Sound	1,142	0.0266	0.0266	0.0266	0.0266	0.2835	0.6188	0.8445	0.6484	0.3185	0.0266	0.0266	0.0266
Hood Canal	561	0.0130	0.0130	0.0130	0.0130	0.1393	0.3040	0.4148	0.3185	0.1564	0.0130	0.0130	0.0130
South Hood Canal	1,119	0.0260	0.0260	0.0260	0.0260	0.2778	0.6064	0.8275	0.6353	0.3120	0.0260	0.0260	0.0260
Bainbridge Island	491	0.0114	0.0114	0.0114	0.0114	0.1219	0.2661	0.3631	0.2788	0.1369	0.0114	0.0114	0.0114
South Sound	1,158	0.0269	0.0269	0.0269	0.0269	0.2875	0.6275	0.8563	0.6574	0.3229	0.0269	0.0269	0.0269
Vashon – Maury Island	368	0.0086	0.0086	0.0086	0.0086	0.0914	0.1994	0.2721	0.2089	0.1026	0.0086	0.0086	0.0086
McNeil Anderson, Ketron	22	0.0005	0.0005	0.0005	0.0005	0.0055	0.0119	0.0163	0.0125	0.0061	0.0005	0.0005	0.0005
Totals	**4,861**	**0.1130**	**0.1130**	**0.1130**	**0.1130**	**1.2067**	**2.6340**	**3.5946**	**2.7598**	**1.3555**	**0.1130**	**0.1130**	**0.1130**

Subbasin	Projected No. PE Wells (High Growth)	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
West Sound	1,403	0.0326	0.0326	0.0326	0.0326	0.3483	0.7602	1.0375	0.7965	0.3912	0.0326	0.0326	0.0326
Hood Canal	689	0.0160	0.0160	0.0160	0.0160	0.1710	0.3733	0.5095	0.3912	0.1921	0.0160	0.0160	0.0160
South Hood Canal	1,128	0.0262	0.0262	0.0262	0.0262	0.2800	0.6112	0.8341	0.6404	0.3145	0.0262	0.0262	0.0262
Bainbridge Island	516	0.0120	0.0120	0.0120	0.0120	0.1281	0.2796	0.3816	0.2930	0.1439	0.0120	0.0120	0.0120
South Sound	1,992	0.0463	0.0463	0.0463	0.0463	0.4945	1.0794	1.4730	1.1309	0.5555	0.0463	0.0463	0.0463
Vashon – Maury Island	368	0.0086	0.0086	0.0086	0.0086	0.0914	0.1994	0.2721	0.2089	0.1026	0.0086	0.0086	0.0086
McNeil Anderson, Ketron	56	0.0013	0.0013	0.0013	0.0013	0.0139	0.0303	0.0414	0.0318	0.0156	0.0013	0.0013	0.0013
Totals	**6,152**	**0.1430**	**0.1430**	**0.1430**	**0.1430**	**1.5272**	**3.3336**	**4.5493**	**3.4928**	**1.7155**	**0.1430**	**0.1430**	**0.1430**

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Appendix E: Detailed Descriptions for Water Offset Projects

Kingston Treatment Plant and Recycled Water (15-WS-OP1)

WRIA 15 WRE Subbasin
West Sound Subbasin

Water Offset
328 acre-feet (AF) per year

Project Status
Kitsap County Public Works Department contracted the preparation of a Kingston Recycled Water Facility Plan (Brown and Caldwell, 2020), dated March 12, 2020, and herein designated the Facility Plan. Among other components, the Facility Plan contains an alternatives analysis, a description of project benefits, recommended recycled water facilities, a financial analysis, an environmental analysis, and a permitting discussion. The Facility Plan recommended a preferred project alternative (which forms the basis for the project described herein) and indicates that the next steps toward project implementation are the development of a user agreement with the Suquamish Tribe and pursuit of project funding sources.

Narrative Description
Kitsap County is proposing to produce Class A recycled water at the existing Kingston Wastewater Treatment Plan (WWTP), which would be used for summer irrigation at the White Horse Golf Course (WHGC) and winter indirect groundwater recharge to the area north of the WHGC. The stated objective of the County for the project is to "treat water as a resource rather than a waste stream" to address water quality and quantity concerns specific to Kingston, and other related water resource issues throughout the county.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.
Currently, irrigation water for WHGC is purchased from the Kitsap Public Utility District (KPUD) and is sourced from groundwater wells that pump from a freshwater aquifer in presumed hydraulic continuity with Puget Sound. Recharge to the source aquifer generally is limited to infiltration of precipitation within upgradient portions of Kitsap Peninsula. As such, the volume of groundwater that can sustainably be extracted from the source aquifer is limited. As the local demand for groundwater supplies increases, groundwater level declines (groundwater mining) and saltwater intrusion (and associated impacts to groundwater quality) are possible.

The proposed project would infiltrate about 107 million gallons per year (328 AF) of highly treated recycled water into the target aquifer, which provides baseflow to Grovers Creek and its tributaries (Brown and Caldwell, 2020). This volume of recycled water should be available each year for aquifer recharge, in addition to any recycled water used for golf course irrigation

Assuming an average infiltration volume of 0.3 million gallons per day, the Project could increase baseflow in Grovers Creek and/or its tributaries by roughly 0.5 cfs (Brown and Caldwell, 2020).

Based on these estimates, the projected water offset quantity for the WRIA 15 Watershed Plan is 328 AF per year.

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

Figure E-1 summarizes the conceptual design of the project. Additional maps and drawings can be accessed in the Kingston Recycled Water Facility Plan (Brown and Caldwell, 2020).

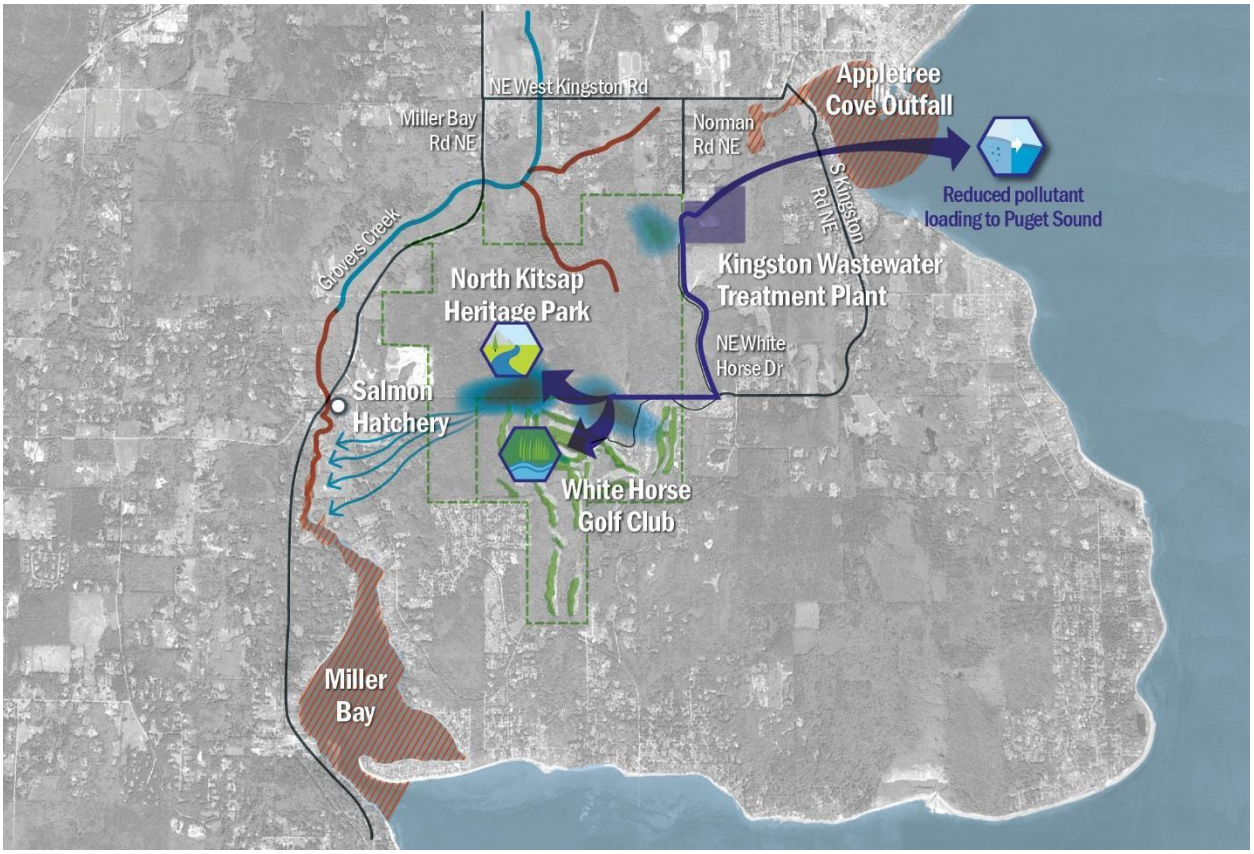

Figure E-1. Conceptual-level map of the baseline project option described by Brown and Caldwell (2020) (Figure 1-1 of Brown & Caldwell, 2020)

Description of the anticipated spatial distribution of likely benefits.

Infiltration-based groundwater recharge at the WHGC could increase groundwater levels within the shallow aquifer downgradient of the infiltration basin, which provides baseflow to area streams. Project implementation will provide increased baseflow to nearly three miles of perennial streams (Grovers Creek and South Fork Grovers Creek) and up to 1.5 miles of intermittent streams (tributaries to Grovers Creek and South Fork Grovers Creek). Groundwater recharge could also enhance or restore wetlands associated with the creeks or headwater areas.

Performance goals and measures.

The project's performance goal is to increase recycled water infiltration by 328 AF per year to improve baseflow in downgradient streams. Specific measures will be an increase in baseflow in Grovers Creek and South Fork Grovers Creek by about 0.5 cfs during seasonal periods of increased groundwater discharge. The increased baseflow also should reduce summer and early fall water temperatures in benefitted streams.

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

The Washington Department of Fish and Wildlife (WDFW, 2020) identified that Coho Salmon are present in both Grovers Creek and South Fork Grovers Creek. The Endangered Species Act (ESA) indicated that Puget Sound winter steelhead are present in Grovers Creek (although Grovers Creek is not listed as critical habitat). Chum Salmon are present at the mouth of Grovers Creek below the fish hatchery weir/dam operated by the Suquamish Tribe near Miller Bay Road (barrier ID: 930696).

The Washington Stream Catalog (WDF, 1975) indicates that both Coho Salmon and Chum Salmon were historically present in Grovers Creek. These North Kitsap streams were noted in the Stream Catalog (WDF, 1975) as having good steady base flows at the time (likely supported by glacial outwash soils and infiltration of precipitation).

Increased baseflow and reduced surface water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA, 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. MAR and source exchanges are identified project types that could address the new consumptive water use and achievement of net ecological benefit (NEB).

A stakeholder coordination and public involvement program was completed for the project and is described in the Facility Plan. Support was expressed for the selected project alternative, which consists of wastewater recycling, WHGC irrigation supply, and aquifer recharge during winter months. The project is also believed to be in alignment with the broader goals of the Washington State Department of Ecology, Governor Jay Inslee's Shellfish Initiative, West Central Local Integrating Organization, and the Puget Sound Partnership's Strategic Initiatives to prevent pollution, protect and restore habitat, and recover shellfish beds.

Barriers to completion include evaluation of MAR feasibility, procurement of permits (recycled water, wastewater discharge, and others), and procurement of funding for project construction and O&M costs.

Potential budget and O&M costs.

The project cost for the preferred alternative is approximately $13,700,000 (Brown and Caldwell, 2020). The annual O&M cost for the preferred alternative is estimated to be $151,000 (Brown and Caldwell, 2020).

Anticipated durability and resiliency.

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

- The water source will be controlled by Kitsap County and should be reliable, even during low water years. The water source might increase with the forecasted increase in associated population.
- Recycled water delivery to the WHGC and infiltration basin would be precisely maintained through engineering controls and conveyed with minimal loss to the use/recharge location.
- Groundwater recharge rate presumably would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- Land use changes external to the project site likely would have negligible impact on project function.
- O&M presumably would be funded through ratepayers.

However, the short- and long-term feasibility of MAR has not been evaluated.

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:

- The water source is not limited by seasonal or longer-term low streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.

- Sea level increase, on the order of several feet or less, likely would not impact project function.

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

The project sponsors are Kitsap County Public Works Department and the Suquamish Tribe. Readiness to proceed at this time is dependent upon development of a user agreement between the two entities and procurement of funding.

Documentation of sources, methods, and assumptions.

Brown and Caldwell. 2020. Final Kingston Recycled Water Facility Plan. Prepared for Kitsap County Public Works, Sewer Utility Division, Port Orchard Washington. March 12.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDF (Washington Department of Fisheries). 1975. A Catalog of Washington Streams and Salmon Utilization, WRIA 15. Accessed at: https://www.streamnetlibrary.org/?page_id=95.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Central Kitsap Treatment Plant Recycled Water (15-WS-OP2)

WRIA 15 WRE Subbasin
West Sound and North Hood Canal Subbasins

Water Offset
560 acre-feet (AF) per year

Project Status
Silverdale Water District No. 16 (SWD) is building infrastructure to move recycled water throughout most of their service area. The source of the recycled water is wastewater that originates from surrounding communities of Poulsbo, Bangor, Silverdale, and Central Kitsap, and flows to the Central Kitsap Wastewater Treatment Plant (CKWWTP).

Narrative Description
Currently, treated effluent from the CKWWTP discharges into Puget Sound approximately 3,200 feet offshore within Port Orchard Bay. The average daily rate of discharge is about 3.4 million gallons per day (MGD). SWD's overall goal for their recycled water program is for zero discharge into Puget Sound. To achieve this goal, the CKWWTP will produce recycled water ("Class A" reclaimed water) using a sand filtration system with a capacity of 4 MGD. SWD will distribute the recycled water for various uses, including irrigation, dual-plumbing (flushing toilets), construction, streamflow augmentation and aquifer recharge. SWD has installed 7.4 miles of the planned 13.7 miles of purple pipe, the universal color for recycled water pipes. When completed, SWD will have the ability to move 3.5 MGD of recycled water through the system.

As it relates to the WRIA 15 Watershed Restoration and Enhancement Plan, the stated objective of this project is to provide "water-for-water" offset for future permit-exempt (PE) wells. This can be accomplished by infiltrating recycled water and indirectly augmenting streamflow or by direct augmentation to a surface water body such as a stream or wetland.

The key element of SWD's recycled water infrastructure pertinent to an offset for PE wells is the pipeline that runs along Newberry Hill Road. By extending this portion of pipeline and connecting it to the recycled water source, the recycled water would reach three potential infiltration sites that could indirectly augment streams. These are the sand and gravel facilities at Dickey Road, the Asbury Soils site, and a stormwater retention pond along Newberry Hill Road at the end of the planned pipeline. The benefitting streams are within the West Sound and North Hood Canal subbasins of WRIA 15. They potentially include Little Anderson Creek, Anderson Creek, Big Beef Creek, Strawberry Creek, Wildcat Creek, and Chico Creek.

This project uses recycled water for MAR recharge. However, direct streamflow augmentation could also occur along the pipeline route. Strawberry Creek is along the path of a recycled water pipeline and is a candidate for direct augmentation. In other parts of SWD's service area with recycled water pipelines, Clear and Barker creeks are candidates for direct augmentation.

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

SWD estimates the total amount available for streamflow augmentation through MAR-based infiltration at the Newberry Hill Road sites is approximately 0.5 MGD, equivalent to 0.77 cubic feet per second (CFS), 560 AF per year, and 347 gallons per minute (GPM). The reclaimed water system will be equipped with a Supervisory Control and Data Acquisition (SCADA) system that includes weather monitoring and forecasting. The SCADA systems will allow SWD to regulate flow at all points of discharge/augmentation.

Based on this estimate, the projected water offset quantity for the WRIA 15 Watershed Plan is 560 AF per year.

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

Conceptual level design for the project is summarized in the attached Figure D-4 from SWD's 2021-2022 Capital Improvement Plan. The attached figure presents the location of existing and proposed recycled water system pipe within the SWD service area, the three potential infiltration sites along the proposed Newberry Hill Road pipeline, and cost estimates for future elements of the planned recycled water system.

Description of the anticipated spatial distribution of likely benefits.

Infiltration-based MAR at the WHGC could increase groundwater levels within the shallow aquifer system downgradient of the planned infiltration basins, which provides baseflow to area streams. The potential infiltration site at the Dickey gravel pit would likely benefit Strawberry Creek in the West Sound subbasin. The Asbury infiltration site would likely benefit Johnson, Wildcat and Chico Creek in the West Sound subbasin. The stormwater retention pond along Newberry Road would likely benefit Little Anderson Creek in the North Hood Canal subbasin and could enhance the nearby wetland at the headwaters of Anderson Creek and a tributary to Big Beef Creek.

Performance goals and measures.

The performance goals for this project are focused on the augmentation of streamflow in streams located adjacent to the planned infiltration sites. The volume of recycled water used for streamflow augmentation will be measured and recorded using totalizing flow meters.

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

The Washington Department of Fish and Wildlife (WDFW, 2020) has identified the presence of the following salmonid species within benefitting streams:

- Coho Salmon and Chum Salmon and the Endangered Species Act (ESA) listed Puget Sound winter steelhead are present in both Anderson Creek and Strawberry Creek.
- Big Beef Creek and Wildcat Creek contain the species listed in the first bullet as well as the ESA-listed Puget Sound Chinook Salmon.

- Chum Salmon are present at the mouth of Koch Creek below Highway 3.

The Washington Stream Catalog (WDF, 1975) indicates that both Coho Salmon and Chum Salmon were historically present in each of the above-listed streams, although due to their size, only Big Beef Creek produced large numbers of salmon. These streams (except Big Beef Creek) were noted in the Stream Catalog (WDF, 1975) as having substantial low flow problems including intermittent flows.

Big Beef Creek is listed for high water temperatures on Ecology's 303(d) list of impaired waterbodies and Strawberry Creek is listed for dissolved oxygen and bacteria (Ecology, 2020).

Increased baseflow and reduced water temperatures would benefit both adult migrant spawning grounds and juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve survival of adults and both the productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA, 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. The headwaters of Big Beef Creek and Anderson Creek include wetland areas that could also benefit from increased groundwater levels.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. Infiltration of recycled water for downgradient augmentation of streamflow is a form of MAR, an identified project types that could address the new consumptive water use and achievement of net ecological benefit (NEB).

SWD is the stakeholder who will coordinate the operations and maintenance of the infiltration and/or augmentation sites. SWD will collect, compile, share, and report the metering data.

The primary barrier to project implementation is the availability of funding for the construction and operations and maintenance (O&M) costs. Other barriers include potential water quality issues, permitting, and the feasibility of infiltration at the planned infiltration sites. These and potentially other considerations would need to be evaluated during a feasibility study.

Potential budget and O&M costs.

As of today, the construction costs for necessary infrastructure to convey recycled water to the end of the Newberry Hill section is $12.8 million. These costs include $5.1 million for the conveyance and metering along Newberry Hill Road. The annual O&M cost for the reclaimed water system is estimated to be $100,000. Additional costs for feasibility studies, design, permitting and construction management would be incurred, typically 15-20% of the construction cost, or $1.92 -$2.56 million. The total implementation costs would be approximately $14.7 million to $15.4 million.

Anticipated durability and resiliency.

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

- The water source will be controlled by SWD and should be reliable, even during low water years. The SCADA system will allow for adaptive management of the augmentation rate.
- Recycled water delivery to planned infiltration basins would be precisely maintained through engineering controls and conveyed with minimal loss to the use/recharge location.
- Groundwater recharge rate presumably would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- Land use changes external to the project site likely would have negligible impact on project function.
- O&M presumably would be funded through ratepayers.

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:

- The water source is not limited by seasonal or longer-term low streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase, on the order of several feet or less, likely would not impact project function.

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

SWD would sponsor the project. The project is in agreement with SWD's plans for their recycled water program and is predicated on the extension of an existing pipeline.

Next project steps could include an evaluation of MAR feasibility and identification/procurement of easements and/or property acquisitions required for conveyance and/or infiltration. Funding for the project will need to be secured prior to implementation. Because the project will reduce or remove a wastewater outfall into Puget Sound, SWD intends to pursue grant funding through the Washington State Departments of Ecology and/or Health. Once funding is secured, it is estimated that feasibility evaluation, planning, permitting, and design could require on the order of 2 years.

Documentation of sources, methods, and assumptions.

Ecology (Washington Department of Ecology). 2020. 303(d) Listed Waterbodies. Available at: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDF (Washington Department of Fisheries). 1975. "A Catalog of Washington Streams and Salmon Utilization, WRIA 15." Accessed at: https://www.streamnetlibrary.org/?page_id=95.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Tahuya River Managed Aquifer Recharge Project (15-SHC-OP1)

WRIA 15 WRE Subbasin

South Hood Canal Subbasin

Water Offset

200 acre-feet (AF) per year

Project Status

The Tahuya River Managed Aquifer Recharge (MAR) Project is currently at the conceptual level and additional technical studies will be needed to determine its feasibility and design. A potential MAR infiltration facility has been identified on property owned by the Washington State Department of Natural Resources. This location is approximately shown in Figure D-5. However, the precise location of project facilities will be determined during future feasibility evaluation.

Narrative Description

The Tahuya River MAR Project is based on the siting and construction of a MAR facility adjacent to the Tahuya River in Mason County, Washington. It is anticipated that the MAR facility will be constructed as a buried infiltration gallery, but design details will be further developed during future feasibility planning.

The Tahuya River MAR project will augment stream flows by increasing shallow aquifer discharge (baseflow) to the Tahuya River, which flows into Hood Canal at the community of Tahuya, Washington. The Tahuya River has instream flow conditions and is closed to additional consumptive appropriations between June 15 and October 15 by WAC 173-515-030. The project concept is predicated on diverting water from the Tahuya River when streamflow conditions allow; for the purposes of this project description an assumed 100-day diversion period between the months of November and March is assumed. Diverted water will be conveyed from a constructed Tahuya River diversion to a constructed MAR facility located at sufficient distance from the Tahuya River to create favorable return flow timing. The diverted water will infiltrate into the shallow aquifer underlying the MAR facility, be transported down-gradient, and ultimately discharge to the Tahuya River as re-timed baseflow. A preliminary MAR facility location is shown herein, however, the actual MAR facility will be sited, and infiltration timed, so that the Tahuya River will receive additional baseflow during seasonal low flow periods.

Geologic mapping from DNR (2021) indicate that deposits of relatively coarse-grained glacial outwash outcrop in a number of locations surrounding the Tahuya River and in proximity to the preliminary MAR facility location. Glacial outwash presumably is interbedded with glacial till and alluvium throughout the area. If unsaturated glacial outwash is present in sufficient thickness underlying a proposed MAR facility, infiltration rates potentially could support MAR.

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 MAR facility will result in a streamflow benefit to the Tahuya River by diverting and temporarily storing excess water within the shallow alluvial aquifer system in hydraulic connection with the creek. Assumptions made in estimating the potential water offset to the Tahuya River included the following:

- The MAR facility will operate for a period of 100 days in the winter and early spring (November to March).
- The infiltration rate through the MAR facility will be 1 cubic foot per second (cfs), or approximately 60 AF per month. The above infiltration rate is based upon a soil infiltration rate of 1 inch per hour and an infiltration basin size of one acre.
- All water infiltrated at the MAR facility will emerge in the Tahuya River.

Given these assumptions, the anticipated offset volume for this project is 200 AF per year, estimated using Equation 1:

Annual Volume = Infiltration Rate x Duration of Diversion Equation 1

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). The magnitude and temporal distribution of the retimed streamflow benefit will be precisely estimated during the feasibility study. As such, the diversion rate and offset benefit presented in this project description are for planning purposes and may be modified during feasibility evaluation.

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

The approximate location of the potential Tahuya River MAR site is shown in Figures E-2 and E-3.

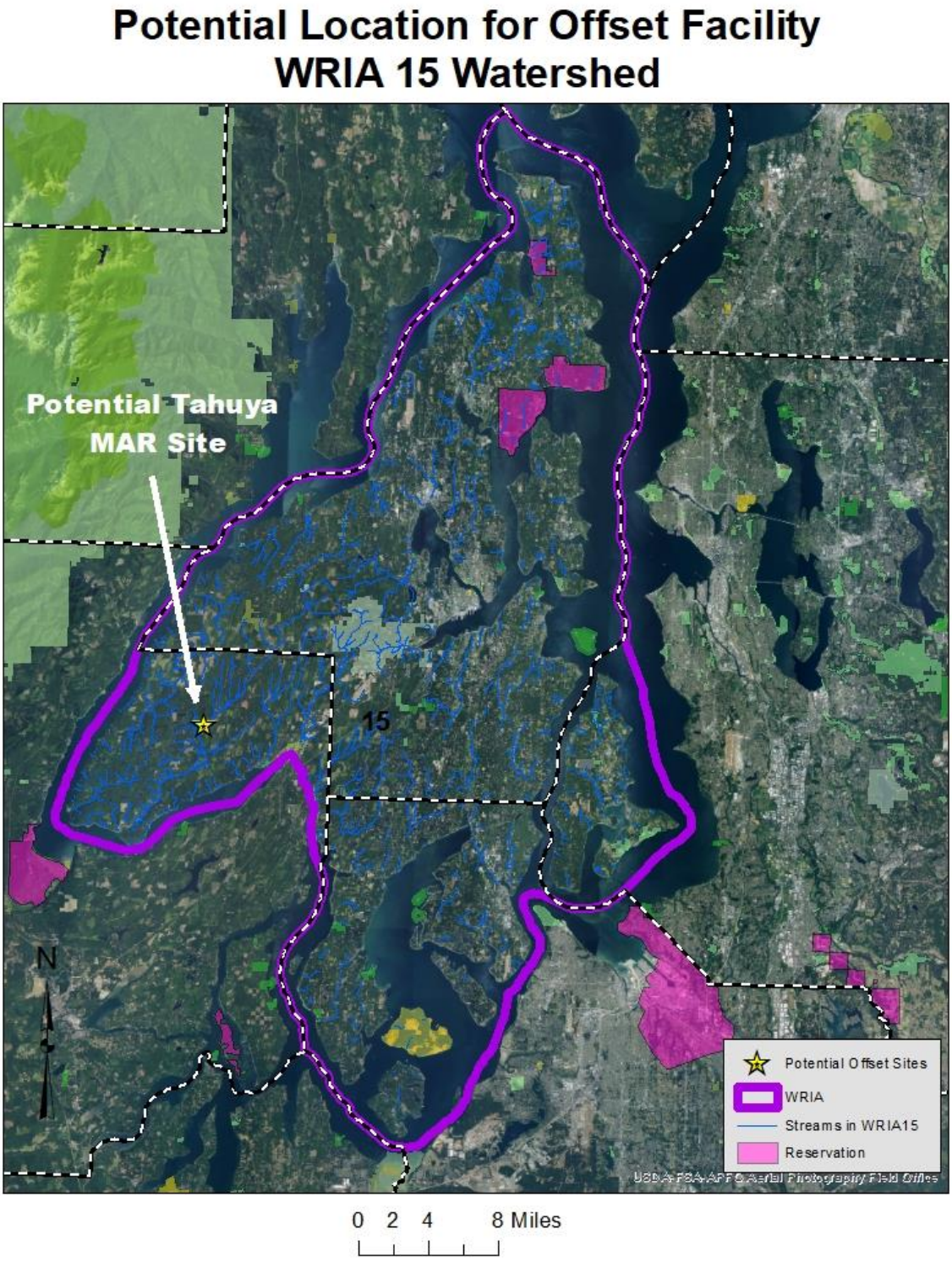

Figure E-2. Tahuya River vicinity map

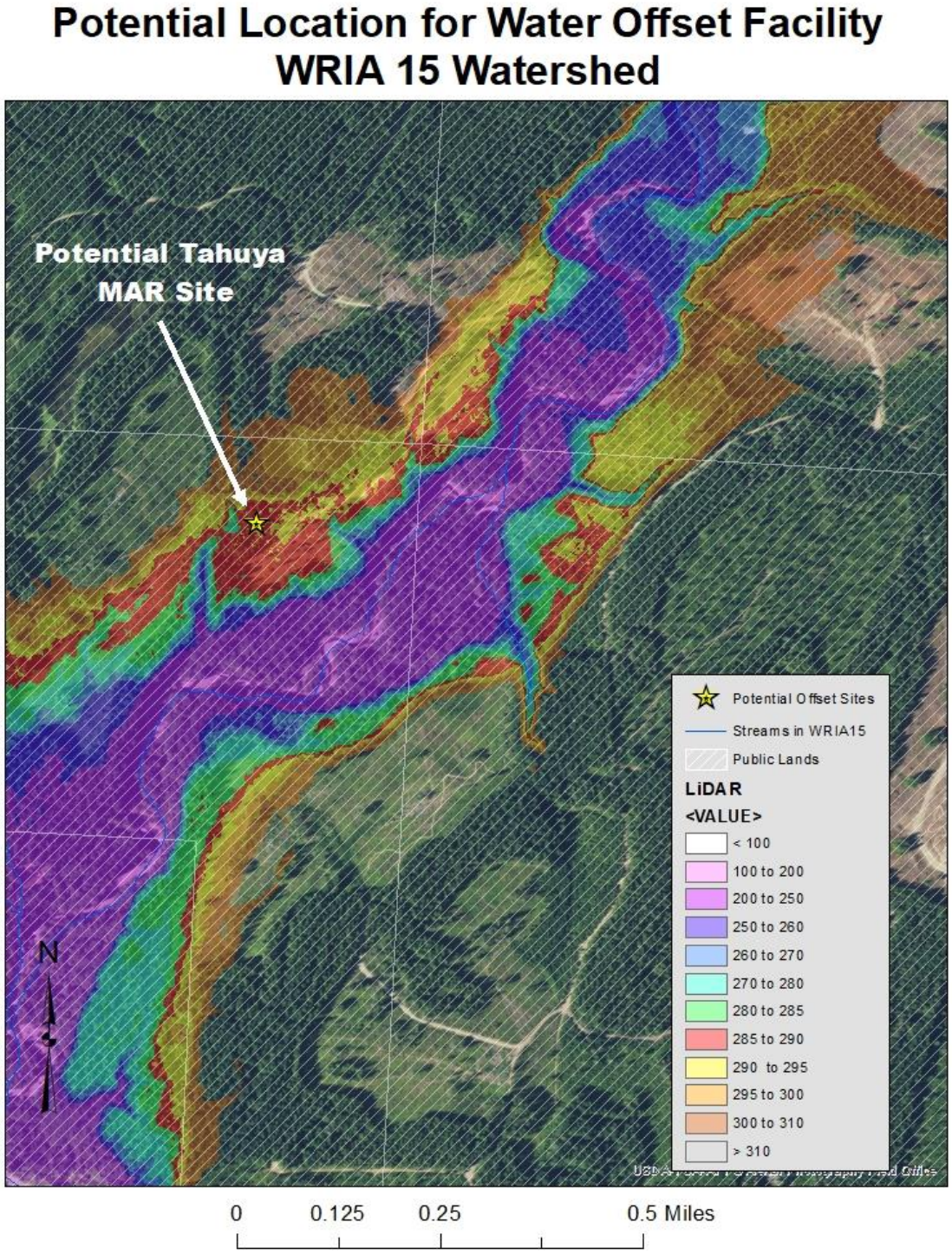

Figure E-3. Potential Tahuya River MAR facility location.

Description of the anticipated spatial distribution of likely benefits.

Infiltration of diverted water at one or more MAR facilities will increase: (1) groundwater storage in the shallow aquifer system; and (2) associated groundwater discharge to hydraulically connected streams such as the Tahuya River.

Performance goals and measures.

The project's performance goal is to increase baseflow to the Tahuya River through infiltration at one or more MAR facilities. The performance measure will be an increase in streamflow in the Tahuya River. Specific quantities and timing for surface water diversion, as well as refined estimates for baseflow augmentation, will be determined during a feasibility study.

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

The Tahuya River is subject to a minimum instream flow requirement per WAC 173-515-030 and is closed to further consumptive use from June 15 through October 15. The Tahuya River is inhabited by winter steelhead, Coho Salmon, Fall Chinook Salmon, Fall Chum Salmon, Summer Chum Salmon and resident coastal cutthroat (WDFW, 2021).

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased baseflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. MAR is identified as a project type that potentially could address new consumptive water use and achievement of NEB.

Barriers to implementation could include feasibility of MAR-based infiltration, procurement of suitable parcels for MAR facility construction, the availability of funding for project construction costs as well as operations and maintenance (O&M) costs, project permitting, and the feasibility of constructing conveyance infrastructure from a diversion location to one or more MAR facilities. Feasibility considerations would need to be studied and addressed during one or more technical investigations.

Potential budget and O&M costs.

Potential budget and O&M costs have not been evaluated at this time.

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 hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- The reliability of the water sources, for example during low water years, has not been evaluated.
- The feasibility of MAR has not been evaluated.
- 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).
- Land use changes external to the project sites likely 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:

- Diversion typically would occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase, on the order of several feet or less, likely would not impact project function.

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

The project is currently at the conceptual level and additional technical studies will be needed to determine its feasibility and design. No sponsor has been identified.

Documentation of sources, methods, and assumptions.

DNR (Washington State Department of Natural Resources). 2021. Washington State Google Earth geology overlays. Accessed on October 15, 2021. Accessed at: https://www.dnr.wa.gov/programs-and-services/geology/publications-and-data/publications-and-maps#geologic-maps.3

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

Ecology (Washington State Department of Ecology). 2019b. Streamflow Restoration Policy & Interpretative Statement, POL-2094, Water Resources Program Policy & Interpretative Statement. Washington State, Department of Ecology. https://appswr.ecology.wa.gov/docs/WaterRights/wrwebpdf/pol-2094.pdf.

KPUD (Kitsap Public Utility District), 2021, KPUD Daily Discharge Data. Accessed on October 15. 2021. Accessed at: http://kpudhydrodata.kpud.org/APSFED_DISCHARGE.aspx

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Accessed at: http://apps.wdfw.wa.gov/salmonscape/

South Hood Canal Lake Storage and Managed Aquifer Recharge (15-SHC-OP2)

WRIA 15 WRE Subbasin
South Hood Canal Subbasin

Water Offset
Minimum of 62 acre-feet (AF) per year (assuming one project implemented)

Project Status
The South Hood Canal Lake Storage and MAR project was identified by the Skokomish Indian Tribe and initially consisted of two components: the Shoe Lake Storage and Potential MAR project and the Oak Lake Storage and Potential MAR project. Because of the symmetry in their design and function, these components have been combined to form the South Hood Canal Lake Storage and MAR project described herein.

Narrative Description
The South Hood Canal Lake Storage and MAR project is centered around surface water storage and potential aquifer recharge within two small lakes, Shoe Lake and Oak Lake. These lakes outflow to tributaries to the Dewatto River in the South Hood Canal subbasin, approximately as shown in the Conceptual Level Map.

While surface water storage is an integral component of the project in both lakes, MAR also is a preferred project component. The feasibility of MAR at these locations would depend, in part, on the permeability of glacial deposits underlying the lakes and in the interpreted downgradient groundwater flow direction. Geologic mapping compiled by the Washington State Department of Natural Resources suggests that shallow soil in the vicinity of both lakes primarily consists of Pleistocene-age glacial till, which generally is characterized by low permeability. However, Pleistocene-age glacial outwash deposits, which consists of relatively high permeability sand, are surficially exposed near both lakes, and potentially could support an MAR project component. Additional hydrogeology investigation would be required to evaluate the feasibility of MAR at these locations.

Shoe Lake is owned by two entities – the approximate south half is owned by DNR and the approximate north half by a private group. The area surrounding Shoe Lake is forested, with logged areas located a short distance south and southeast of the lake. There is only one building structure near Shoe Lake, situated on the north side, and it appears to be approximately 10 feet higher in elevation than the lake.

Oak Lake has only one owner - Manke Timber Company. The area surrounding Oak Lake is forested, with logged areas located a short distance northeast, east, and south of the lake. No permanent buildings appear to exist at the lake margins.

The project would increase storage in winter and release it throughout summer at a controlled rate that is higher than natural streamflow, especially in summer. If a suitable MAR site is

nearby, the releases could be timed to maximize streamflow benefit by using the time lag from infiltration to benefit streamflow. It would also reduce the potential for water quality impacts from surface water releases in summer, which would likely be warm.

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

The following estimate of offset benefits is provided for the two project components: Shoe Lake and Oak Lake. Both project components store and/or infiltrate water sourced from the Dewatto River. The Dewatto River has minimum flows defined by Chapter 173-515 of the Washington Administrative Code (WAC) and is closed to further consumptive use from June 15 through October 31. Although the Dewatto River stream gage records are not recent (period of record 1947 to 1974) flows in the November to March time period appear to exceed the minimum flows greater than 50% of the time, indicating additional flow could be stored in the lake.

Shoe Lake

At Shoe Lake, the project would function by placing a control structure at the lake outlet which would either maintain lake levels at a higher elevation later in the year or raise the level of the lake to store more water. The stored water would be released to Shoe Lake's Dewatto River tributary during the design low flow period.

The tributary area to the lake is estimated to be 224 acres and the lake surface area is 21 acres. Maintaining lake levels 2 feet higher or raising the lake by 2 feet would provide 42 AF of streamflow benefit in summer. Maintaining or raising by 3 feet would provide 62 AF. Typically, lakes in this type of hydrologic and land use setting can be raised or maintained a few feet higher than pre-development conditions without prohibitive costs.

No streamflow or lake stage data are available for Shoe Lake. An estimate of runoff was prepared using stream gage records from the Dewatto River (USGS 12068500 Dewatto River Near Dewatto, WA) and adjusting the basin yield by area. The tributary area to the lake has considerably more runoff than the potential storage increase of 42 to 62 AF.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 62 AF per year. Hydrologic and geologic studies are required to prepare a better estimate of the potential offset.

Oak Lake

At Oak Lake, the project also would function by placing a control structure at the lake outlet which would either maintain lake levels at a higher elevation later in the year or raise the level of the lake to store more water. The stored water would be released to Oak Lake's Dewatto River tributary during the design low flow period.

The tributary area to Oak Lake is estimated to be 230 acres. Oak Lake varies in surface area as a function of seasonal and potentially longer-term trends. An aerial photo from July 2018 showed three visible ponds with a combined surface area of 4.2 acres. An aerial photo from February 2015 showed a single lake with a surface area of about 25 acres. Assuming the Oak Lake project component would achieve one fill/release cycle per year, maintaining lake levels 2 feet higher or raising the lake by 2 feet could

provide 50 AF of annual streamflow benefit. Maintaining or raising by 3 feet would provide 75 AF of annual streamflow benefit.

No streamflow or lake stage data are available for Oak Lake. As for Shoe Lake, an estimate of runoff was prepared using stream gage records from the Dewatto River (USGS 12068500 Dewatto River Near Dewatto, WA) and adjusting the basin yield by area. The tributary area to the lake has considerably more runoff than the potential storage increase of 50 to 75 AF.

Cumulative Offset Benefits

The cumulative offset benefit for the South Hood Canal Lake MAR project ranges from 92 AF per year to 137 AF per year, depending on the height of lake water level rise. This estimate does not include any offset achieved by MAR, which would be additive and requires additional hydrogeologic investigation to evaluate MAR feasibility and rate/volume.

It is assumed that an MAR 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.

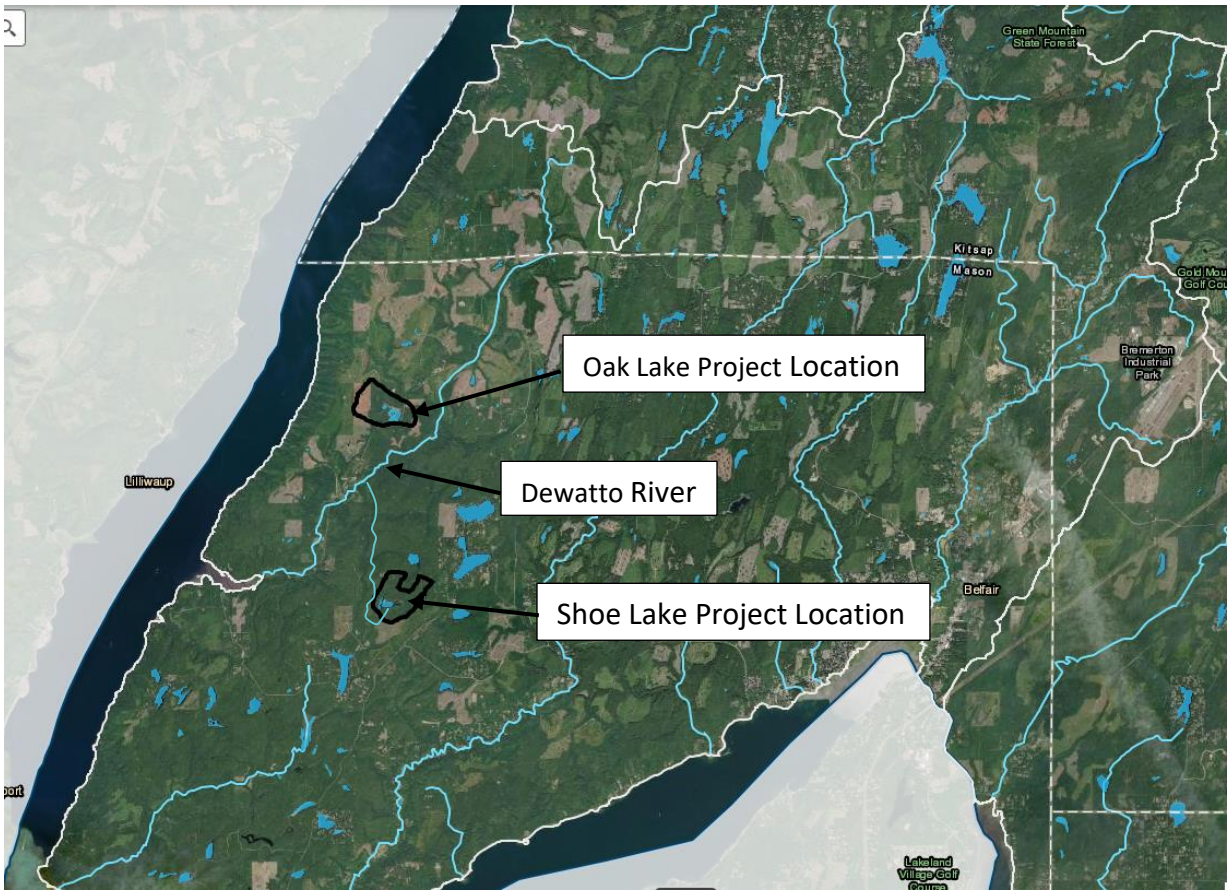

Figure E-4. Project location

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the Dewatto River, which discharges to Hood Canal at Dewatto Bay.

Performance goals and measures.

The performance goals are to increase water storage adjacent to the Dewatto River by storing 92 to 137 AF per year through lake height modification in Shoe Lake and Oak Lake. Performance goals also could include an increase in baseflow to the Dewatto River and/or its tributary, depending on results of MAR feasibility study.

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

The Dewatto River is inhabited by resident coastal cutthroat, winter steelhead, Chum Salmon, Fall Chinook Salmon, Coho Salmon, and Pink Salmon (WDFW 2020a and 2020b).

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. Off-channel storage and MAR are identified project types that could address the new consumptive water use and achievement of NEB.

The barriers to completion include evaluation of MAR feasibility, obtaining funding for construction and O&M costs, and obtaining necessary permitting from the Washington State Department of Ecology, which could include reservoir permitting, water right permitting, and /or dam safety permitting. Streamflow mitigation could be required, consistent with the Foster Decision, if the project causes transient impairment of minimum instream flows.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the water storage and potential 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 and surface water elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- The reliability of the water source, for example during low water years, has not been evaluated.
- The feasibility of MAR has not been evaluated.
- When water is available, lake stage would be precisely maintained through engineering controls and conveyed with minimal loss to the discharge/recharge location.
- Land use changes external to the project site, provided that they are above the high-water elevation, 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:

- Diversion would occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase, on the order of several feet or less, would not impact project function.

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

To be determined.

Documentation of sources, methods, and assumptions.

HDR, Inc. 2020. Technical Memorandum Draft, WRIA 15 PE Growth and Consumptive Use Summary (Work Assignment 2, Tasks 2 and 3. Technical memorandum prepared for Washington State Department of Ecology. Revised edition prepared May 27.

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

Washington State 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

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

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Bainbridge Island Managed Aquifer Recharge and Stormwater Infiltration Opportunities (15-BI-OP1, 15-BI-OP2)

WRIA 15 WRE Subbasin

Bainbridge Island Subbasin

Water Offset

72.2 acre-feet (AF) per year

Project Status

The City of Bainbridge Island (City) has identified two potential MAR projects and one potential stormwater infiltration project within their municipal boundaries. The three potential projects are described herein and include the following: the Manzanita Creek Miller Road Parcel Infiltration Project; the Johnson Farm Springbrook Creek MAR Project; and the M&E Farm Manzanita Creek Stormwater Infiltration Project. The City is exploring project feasibility for the Manzanita Creek Miller Road and the M&E Farm projects through a National Estuary Program (NEP) grant. Approximate project locations are shown in the Conceptual Level Map.

Narrative Description

The Bainbridge Island Opportunities project consists of the Manzanita Creek Miller Road Parcel Infiltration Project, the Johnson Farm Springbrook Creek MAR Project, and the M&E Farm Manzanita Creek Stormwater Infiltration Project. These projects are centered around diversion of flow from area creeks or from stormwater for infiltration at a constructed infiltration facility, as described below.

Manzanita Creek Miller Road Parcel Infiltration Project

The Manzanita Creek Miller Road Parcel Infiltration project is located on a City of Bainbridge Island-owned parcel on Miller Road (parcel #092502-4-002-2006). The project would divert flow from a tributary to Manzanita Creek that currently flows under an existing compost facility adjacent to the City-owned parcel to an area for infiltration and groundwater recharge.

Johnson Farm Springbrook Creek MAR Project

The Johnson Farm Springbrook Creek MAR project is situated within the Johnson Farm property located southwest of the intersection of Fletcher Bay Road NE and NE Twin Ponds Road. The property has an existing storage pond that is used to supply irrigation water to the farm during the summer. The property has a surface water right to withdraw 0.2 cfs and 40 acre-feet from Springbrook Creek to irrigate 20 acres. The period of use is from June 1 to September 30. The Johnson Farm site has the potential for additional surface water storage and infiltration of stored water.

M&E Farm Manzanita Creek Stormwater Infiltration Project

The M&E Farm Manzanita Creek Stormwater Infiltration project is located at the historic M&E Tree Farm site situated northeast of the intersection of State Route 305 and NE Lovgreen Road. The project centers around the collection of stormwater runoff from an adjacent residential area for infiltration and subsequent groundwater recharge in a constructed infiltration facility.

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

The following estimate of offset benefits is provided for the three identified project locations. These estimates can be supplemented if/when additional Bainbridge Island MAR and/or stormwater infiltration opportunities are identified.

Manzanita Creek Miller Road Parcel Infiltration Project

The Manzanita Creek Miller Road Parcel Infiltration project would function by diverting flow from a tributary to Manzanita Creek that is currently piped and directing it to an adjacent City-owned parcel. It is unclear if the tributary is a natural stream or a constructed drainage feature. The tributary is not identified on the Statewide Washington Integrated Fish Distribution website (WDFW 2020b). An infiltration facility would be constructed on that site to recharge groundwater. A stormwater pond may be required for flow equalization and settling out fine particles which may plug an infiltration facility. An initial geologic review indicated there is potential for groundwater recharge. A more detailed geotechnical and hydrogeologic evaluation would be required to confirm the site suitability and provide recommendations on the design of the infiltration facility.

To estimate the volume of diverted streamflow that may be available for recharge, streamflow data on Manzanita Creek from Kitsap PUD was used. Average monthly flows in Manzanita Creek were multiplied by the ratio of the drainage area at the point of diversion to the Manzanita Creek drainage area. Table E-1 summarizes the anticipated average monthly yield at the project site based on the area-discharge relationship from Manzanita Creek.

Table E-1
Estimated Average Monthly Yield at Miller Road Parcel (AF)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14	7.1	3.7	4.3	1.5	0.9	0.6	0.5	0.7	1.5	4.8	9.2

Two assumptions were made in estimating the potential groundwater recharge. The first is that the infiltration facility would operate in the winter and early spring (November to March) and the second is that 50 percent of the runoff could be infiltrated. The quantity that can be infiltrated will not be known until more detailed investigations are completed. With those assumptions, up to 19.4 AF per year could be recharged. The average rate of recharge would be

0.065 cfs (29 gallons per minute [gpm]). Averaged throughout the entire year, the average rate of recharge would be 0.027 cfs (12 gpm).

Based on these assumptions, the water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 19.4 AF per year.

Johnson Farm Springbrook Creek MAR Project

The Johnson Farm Springbrook Creek MAR project would function by diverting water from an existing storage pond to an area on the farm for infiltration during the winter and early spring season (November to March). The project would require reconfiguration to provide a source of water by gravity or pumping to an infiltration basin during the winter. The initial geologic review indicated there is potential for groundwater recharge. A more detailed geotechnical evaluation would be required to confirm the site suitability and provide recommendations on the design of the infiltration facility.

The City of Bainbridge Island (Berg, 2021) indicated that the average flow in the tributary that conveys water to the existing storage pond is approximately 0.3 cfs. Based on this average flow, Table E-2 summarizes the anticipated average monthly yield at the project site.

Table E-2
Estimated Average Monthly Yield at Johnson Farm (AF)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.4	16.7	18.4	17.8	18.4	17.8	18.4	18.4	17.8	18.4	17.8	18.4

Two additional assumptions were made in estimating the potential groundwater recharge. The first is that the infiltration facility would operate in the winter and early spring (November to March) and the second is that 50 percent of the runoff could be infiltrated. The quantity that can be infiltrated will not be known until more detailed hydrologic and geotechnical investigations are completed. With those assumptions, up to 44.8 AF per year could be recharged. The average rate of recharge would be 0.15 cfs (67 gpm). Averaged throughout the entire year, the average rate of recharge would be 0.062 cfs (28 gpm). It is not known at this time whether it is feasible to infiltrate at that rate. The two reservoir rights associated with this parcel are allowed to store 22.33 AFY. The project would have to allow the reservoirs to be full at the end of the high flow season so they can be used to irrigate their certificated acreage. The runoff volume is large enough to allow 91 AFY to be infiltrated during the winter months and for the storage of 22.33 AFY for irrigation during the summer months.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 44.8 AF per year.

M&E Farm Manzanita Creek Stormwater Infiltration Project

The M&E Farm Manzanita Creek Stormwater Infiltration project would function by collecting stormwater from an adjacent residential area and directing it to a city-owned parcel (the historic M&E Tree Farm) near the upper reaches of Manzanita Creek. An infiltration facility would be constructed on that site to recharge groundwater. A stormwater pond may be required for flow equalization and settling out fine particles which may plug an infiltration facility. The initial geologic review indicated there is potential for groundwater recharge. A more detailed geotechnical evaluation would be required to confirm the site suitability and provide recommendations on the design of the infiltration facility.

To estimate the volume of stormwater runoff that may be available for recharge, the National Resource Conservation Service (NRCS) runoff equation was used, as described by NRCS (2004). The NRCS runoff equation estimates total runoff from total rainfall using input parameters based on land use, soil group, and precipitation characteristics. Table E-3 summarizes the anticipated average yield for the period from November through March at the project site based on the NRCS runoff equation.

Table E-3
Estimated Average Monthly Yield at M&E Tree Farm Site (AF)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.0	1.3	1.2	NA	NA	NA	NA	NA	NA	NA	1.7	1.8

NA = not applicable.

Assumptions inherent to the monthly yield analysis include the following:

- The infiltration facility would operate in the winter and early spring (November to March).
- Average monthly precipitation rates reported for Washington Climate Station No. 457488 (Seattle WB City) are applicable to the project site.
- The site is underlain by Group D Hydrologic Soils.
- For runoff curve number (CN) development, land use associated with the stormwater collection area was assumed to be residential with an average lot size of 1/4 acre (NRCS 2004).
- Based on the boundaries of the drainage area provided by the City of Bainbridge Island, a stormwater collection area of 29 acres was assumed.
- Monthly precipitation totals were assumed to consist of storm increments adapted from the 6-hour storm (0.5 year recurrence interval) reported by the City of Seattle (2017) for the City of Seattle's SeaTac rain gage location.

The precise quantity that can be infiltrated will not be known until more detailed geotechnical investigations are completed. However with those assumptions, approximately 8.0 AF per year

of annual groundwater recharge is estimated. This is approximately 9 percent of the annual precipitation and 13 percent of the seasonal (November through March) precipitation at Washington Climate Station No. 457488.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 8.0 AF per year.

Cumulative Offset Benefits

The cumulative offset benefit for the Bainbridge Island MAR and Stormwater Infiltration Opportunities is 72.2 AF per year, as described for the three project components listed above. Incorporation of additional MAR project opportunities, if identified in the future, would increase the projected offset.

It is assumed that, for each project component that is implemented, an MAR feasibility study will be conducted consistent 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.

The site location is shown below.

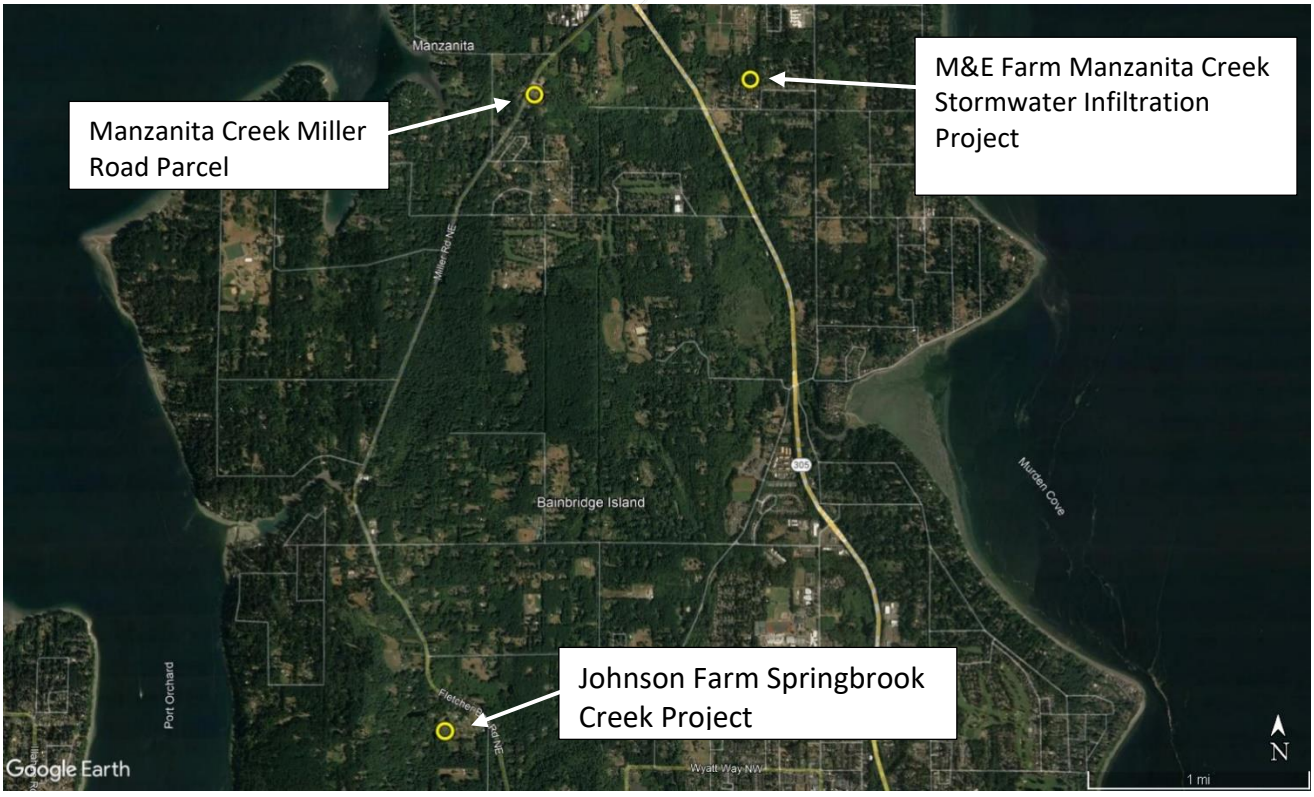

Figure E-5. Project site locations.

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in various streams within the Bainbridge Island subbasin. As described above for the three project components, streamflow benefits in the form of increased baseflow would occur within Manzanita Creek and Springbrook Creek. Groundwater recharge could also enhance wetlands associated with groundwater discharge areas.

Performance goals and measures.

The performance goals are to increase water storage in alluvial and/or glacial aquifers adjacent to Bainbridge Island subbasin streams by infiltrating water through MAR facilities and a stormwater pond to augment subbasin baseflow. The performance measures will be an increase in streamflow in targeted streams, which include Manzanita Creek and Springbrook Creek for the opportunities currently identified. Specific quantities and timing for surface water diversion would be determined during a feasibility study.

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

Streams within the Bainbridge Island subbasin are inhabited by Coho Salmon, Fall Chum Salmon, and winter steelhead (WDFW 2020a and 2020b). Specifically, The Washington Department of Fish and Wildlife (WDFW 2020) has identified that Coho Salmon are present in both Manzanita Creek and the SF Manzanita Creek; the Endangered Species Act (ESA) listed Puget Sound winter steelhead are present in Manzanita Creek (although Manzanita Creek is not listed as critical habitat); and Chum Salmon are present at the mouth of Manzanita Creek.

Springbrook Creek is one of the most productive fish-bearing streams on Bainbridge Island. It supports cutthroat trout, Coho Salmon, Chum Salmon, sculpin, lamprey, and historically supported ESA-listed Puget Sound winter steelhead (Bainbridge Island Land Trust [BILT] 2018). Springbrook Creek also contains one of two reaches on Bainbridge Island that are designated as critical habitat for Puget Sound steelhead (BILT 2018).

The salmonids and other aquatic species in Manzanita Creek, Springbrook Creek, and elsewhere within the Bainbridge Island subbasin are subject to limiting factors present in the watershed. In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA 2007), and groundwater recharge and streamflow are important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. Increased groundwater recharge would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve both productivity and survival of juveniles.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. MAR is an identified project type that could address the new consumptive water use and achievement of NEB.

The barriers to completion include evaluation of the MAR and stormwater recharge feasibility, obtaining funding for construction and O&M costs, and obtaining necessary permitting from the Washington State Department of Ecology, which could include water right permitting depending on project design. Streamflow mitigation could be required, consistent with the Foster Decision, if the projects cause transient impairment of minimum instream flows.

Potential budget and O&M costs.

Potential budget and O&M costs will depend on the recharge opportunities that are selected for implementation. For the three project components described herein, the following preliminary estimates have been developed:

Manzanita Creek Miller Road Parcel Infiltration Project

The total construction costs of a stream diversion, pipeline and infiltration facility is estimated to be around $200,000. An additional 35% would be added for design, construction services and administrative costs, for a total of $270,000. The annual O&M cost is estimated to be $20,000. All costs are based upon a conceptual level of understanding of the project and may change once additional feasibility studies are completed.

Johnson Farm Springbrook Creek MAR Project

The total construction costs of the pond reconfiguration, piping and infiltration facility is estimated to be around $400,000. An additional 35% would be added for design, construction services and administrative costs, for a total of $540,000. The annual O&M cost is estimated to be $30,000. All costs are based upon a conceptual level of understanding of the project and may change once additional feasibility studies are completed. The costs would also change if the project is scaled back.

M&E Farm Manzanita Creek Stormwater Infiltration Project

The total construction costs of an interceptor ditch, stormwater pond and infiltration facility are estimated to be around $200,000. An additional 35% would be added for design, construction services and administrative costs, for a total of $270,000. The annual O&M cost is estimated to be $20,000. All costs are based upon a conceptual level of understanding of the project and may change once additional feasibility studies are completed.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the water storage and potential 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 moderately durable, based on the following:

- The reliability of the water sources, for example during low water years, has not been evaluated.
- The feasibility of MAR has not been evaluated.
- 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).
- Land use changes external to the project sites likely 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:

- Diversion typically would occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase, on the order of several feet or less, would not impact project function.

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

The City of Bainbridge Island is a potential project sponsor. However, the City of Bainbridge Island indicated that their readiness to proceed at the time of this plan is relatively low.

Documentation of sources, methods, and assumptions.

Bainbridge Island Land Trust (BILT). 2018. Springbrook Creek Watershed Assessment, Final Report December 26, 2018. SRFB Project #14-1517. Available from: https://www.bi-

landtrust.org/wp-content/uploads/2019/02/Springbrook-Creek-Assessment-Report-Narrative-1.pdf

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NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

United States Department of Agriculture Natural Resources Conservation Service (NRCS), 2004. Part 630 Hydrology National Engineering Handbook. Publication 210-VI-NEH. July.

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

Washington State 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

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

WDFW. 2020b. Statewide Washington Integrated Fish Distribution (SWIFD). http://geo.wa.gov/datasets/4ed1382bad264555b018cc8c934f1c01_0

Belfair Wastewater Reclamation Facility Managed Aquifer Recharge Project (15-SS-OP1)

WRIA 15 WRE Subbasin
South Sound Subbasin

Water Offset
70 acre-feet (AF) per year

Project Status
The Belfair Wastewater Reclamation Facility MAR Project is currently at the conceptual level and additional technical studies will be needed to determine its feasibility and design. Project information is limited.

Narrative Description

The Belfair Wastewater and Water Reclamation Facility (WWRF) is authorized to distribute Class A reclaimed water to public and private entities for commercial and industrial uses, to apply reclaimed water to land for irrigation at agronomic rates, and/or for groundwater recharge by surface percolation at locations listed in its reclaimed water permit. Current authorized uses are shown in Table E-4.

Table E-4. Current authorized reclaimed water uses.

Customer	Use	Location	Average Monthly Flow
Mason County – Forest Irrigation Field	Irrigation and groundwater recharge	39-acre irrigation site just east of reclamation plant	0.125 MGD
Mason County – Belfair Reclamation Plant	Supply to hose bibs, equipment wash, toilet flushing, plant processes, fire flow, and irrigation	25200 NE State Route 3	Not Available

The conceptual basis for the project is to convey recycled water from the Belfair WWRF to a designed infiltration facility for groundwater recharge of the shallow aquifer system and subsequent increased groundwater discharge to area stream(s).

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

Currently, the Belfair WWRF is operating at about half capacity and produces approximately 70 AF of reclaimed water per year to supply the irrigation use portion summarized in Table E-1. Therefore, there would be a maximum of 70 AF per year available for future uses. Assuming all

of this remaining capacity is used for MAR projects and that all of the infiltrated water emerges in target stream(s), the potential offset benefit is 70 AF per year.

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

Figure E-6 provides the location of the Belfair WWRF. At this stage of project planning, location(s) for potential MAR facilities have not been identified.

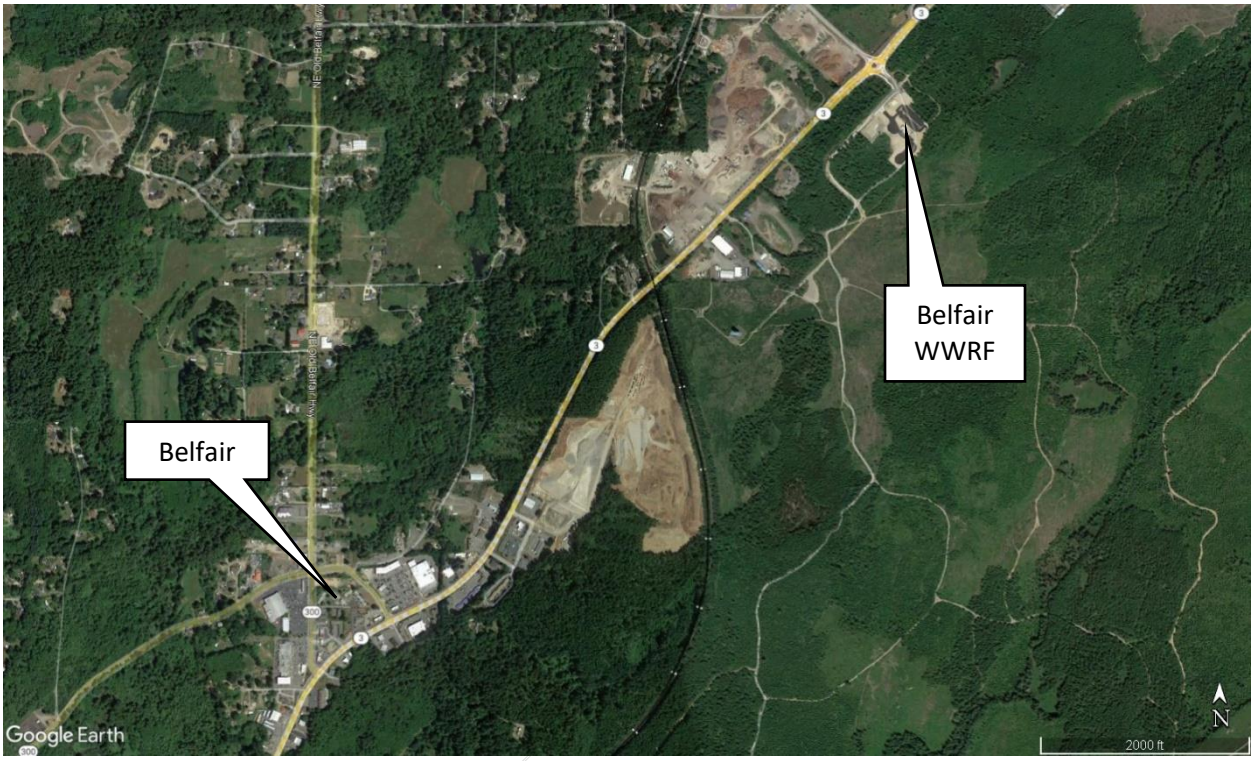

Figure E-6. Belfair Wastewater Reclamation Facility location.

Description of the anticipated spatial distribution of likely benefits.

Infiltration of reclaimed water at one or more MAR facilities will increase groundwater levels in the shallow aquifer system and associated groundwater discharge to hydraulically connected streams.

Performance goals and measures.

The project's performance goal is to increase reclaimed water production for infiltration at one or more MAR facilities at a rate of up to 70 AF per year, which will be precisely measured through installed metering. A second metric of performance will be an increase in baseflow in summer months in benefitting streams.

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

The Union River is the primary stream adjacent to the Belfair WWRF and surrounding area. It is inhabited by rainbow trout, Fall Chinook Salmon, Fall Chum Salmon, Summer Chum Salmon, winter steelhead, Coho Salmon, Pink Salmon, and resident coastal cutthroat (WDFW, 2021).

In the Puget Sound Salmon Recovery Plan, the NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased baseflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. MAR and source exchanges are identified as project types that potentially could address new consumptive water use and achievement of net ecological benefit (NEB).

Barriers to implementation could include feasibility of MAR-based infiltration, procurement of suitable parcels for MAR facility construction, the availability of funding for project construction costs as well as operations and maintenance (O&M) costs, project permitting, and the feasibility of adding distribution facilities to transfer the reclaimed water from the treatment plant to the application sites. Feasibility considerations would need to be studied and addressed during one or more technical investigations.

Potential budget and O&M costs.

Potential budget and O&M costs have not been evaluated at this time.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the reclaimed water project to maintain the estimated water offset over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). Through imprecisely defined at this time, we anticipate that the proposed project has the potential to be durable, based on the following:

- The water source will be controlled by Mason County or other municipal entity and should be reliable, even during low water years.
- Reclaimed water delivery would be precisely maintained through engineering controls and conveyed with minimal loss to the use/recharge location.
- Infiltration facilities would be maintained through an O&M program.
- Land use changes external to the reclaimed water delivery sites likely would have negligible impact on project function.

- O&M presumably would be funded through ratepayers.

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:

- The water source is not limited by seasonal or longer-term low streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project sites and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase, on the order of several feet or less, likely would not impact project function.

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

The project is currently at the conceptual level and additional technical studies will be needed to determine its feasibility and design. No sponsor has been identified.

Documentation of sources, methods, and assumptions.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington Department of Fish and Wildlife). 2021. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Rocky Creek Managed Aquifer Recharge Project (15-SS-OP2)

WRIA 15 WRE Subbasin
West Sound and South Sound Subbasins

Water Offset
150 acre-feet (AF) per year

Project Status
The Rocky Creek Managed Aquifer Recharge (MAR) Project is currently at the conceptual level and additional technical studies will be needed to determine its feasibility and design. Project information is limited.

Narrative Description
The Rocky Creek MAR Project is situated on an unnamed tributary (herein designated the tributary) of Rocky Creek in Kitsap County, Washington. The project is located south of Trophy Lake Golf Course approximately 5 ½ miles east-northeast of the community of Belfair. The tributary has a drainage area of approximately 1,200 acres upstream of its confluence with Rocky Creek. As currently envisioned, the project would function by diverting flows from the tributary during winter months and conveying diverted water to an MAR facility for infiltration to the underlying shallow aquifer system. Infiltrated water then would migrate downgradient and emerge as groundwater recharge to Rocky Creek and/or its tributaries. The MAR facility would be sited, and infiltration timed, so that benefitting streams would receive additional baseflow during low flow periods.

Geologic mapping from the Washington State Department of Natural Resources (DNR, 2021) indicate deposits of relatively coarse-grained glacial outwash outcrop in a number of locations surrounding the project and presumably are interbedded with glacial till and peat throughout the area. If unsaturated glacial outwash is present underlying the proposed MAR facility, infiltration rates potentially could support MAR.

A preliminary assessment has identified candidate parcels for MAR facility development. These properties currently are owned by Alpine Evergreen, a forestry management company, and Selig Real Estate, a development company.

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 MAR facility will result in a streamflow benefit to Rocky Creek and/or its tributaries by diverting and temporarily storing excess water within the shallow alluvial aquifer system in hydraulic connection with surface water. Assumptions made in estimating the potential water offset to Rocky Creek and/or its tributaries included the following:

- The MAR facility will operate in the winter and early spring (November to March). During this seasonal period, the facility will operate 50 percent of the time to account for periods that minimum flows are not met in Rocky Creek.
- The infiltration rate through the MAR facility will be 1 cubic foot per second (cfs) for on average, 15 days each month or approximately 30 AF per month. The above infiltration rate is based upon a soil infiltration rate of 1 inch per hour and an infiltration basin size of one acre.
- All water infiltrated at the MAR facility will emerge in Rocky Creek and/or its tributaries.

Given these assumptions, the anticipated offset volume for this project is 150 AF per year, estimated using Equation 1:

Annual Volume = Infiltration Rate x Duration of Diversion Equation 1

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). The magnitude and temporal distribution of the retimed streamflow benefit will be precisely estimated during the feasibility study. As such, the diversion rate and offset benefit presented in this project description are for planning purposes and may be modified during feasibility evaluation.

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

The potential area identified for MAR facility development, as well as the approximate locations of Trophy Lake Golf Course and Rocky Creek, are shown in the Figure E-7.

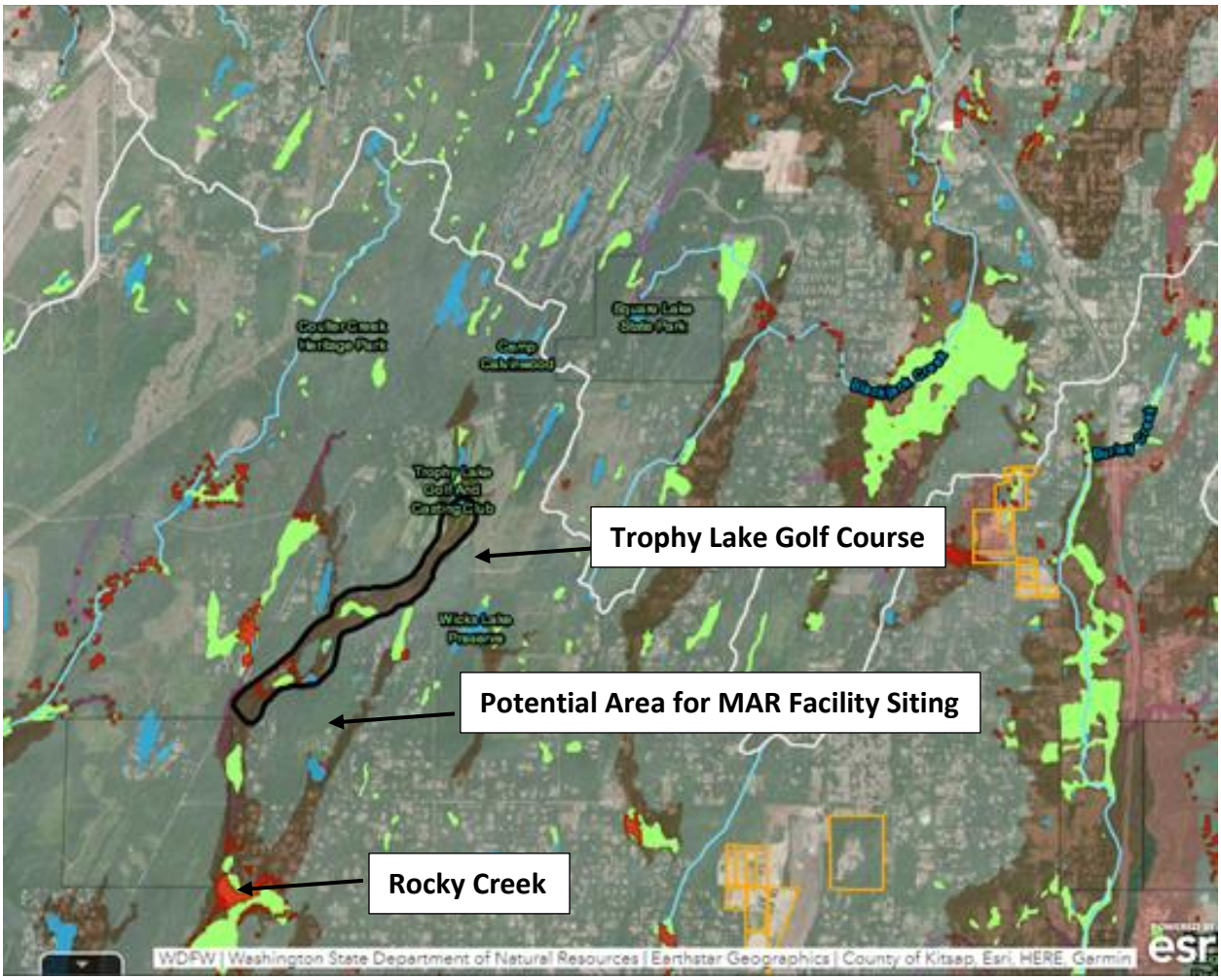

Figure E-7. Rocky Creek MAR Project Area

Description of the anticipated spatial distribution of likely benefits.

Infiltration of diverted water at one or more MAR facilities will increase: (1) groundwater storage in the shallow aquifer system; and (2) associated groundwater discharge to hydraulically connected streams such as Rocky Creek and its tributaries.

Performance goals and measures.

The project's performance goal is to increase baseflow to target streams through infiltration at one or more MAR facilities. baseflow. The performance measure will be an increase in streamflow in target streams, which could include Rocky Creek and its tributaries. Specific quantities and timing for surface water diversion, as well as refined estimates for baseflow augmentation, will be determined during a feasibility study.

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

Rocky Creek is subject to a minimum instream flow requirement per WAC 173-515 and is closed to further consumptive use from mid-June through October. Rocky Creek is inhabited by Coho

Salmon and resident coastal cutthroat (WDFW, 2021). The tributary is not listed as a salmonid bearing stream within Salmonscape (WDFW, 2021).

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased baseflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. MAR is identified as a project type that potentially could address new consumptive water use and achievement of net ecological benefit (NEB).

Barriers to implementation could include feasibility of MAR-based infiltration, procurement of suitable parcels for MAR facility construction, the availability of funding for project construction costs as well as operations and maintenance (O&M) costs, project permitting, and the feasibility of constructing conveyance infrastructure from a diversion location to one or more MAR facilities. Feasibility considerations would need to be studied and addressed during one or more technical investigations.

Potential budget and O&M costs.

Potential budget and O&M costs have not been evaluated at this time.

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 hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- The reliability of the water sources, for example during low water years, has not been evaluated.
- The feasibility of MAR has not been evaluated.
- 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).

- Land use changes external to the project sites likely 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:

- Diversion typically would occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Project function would not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.
- Sea level increase, on the order of several feet or less, likely would not impact project function.

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

The project is currently at the conceptual level and additional technical studies will be needed to determine its feasibility and design. No sponsor has been identified

Documentation of sources, methods, and assumptions.

DNR (Washington State Department of Natural Resources). 2021. Washington State Google Earth geology overlays. Accessed on October 15, 2021. Accessed at: https://www.dnr.wa.gov/programs-and-services/geology/publications-and-data/publications-and-maps#geologic-maps.3

KPUD (Kitsap Public Utility District). 2021, KPUD Daily Discharge Data. Accessed on October 15. 2021. Accessed at: http://kpudhydrodata.kpud.org/APSFED_DISCHARGE.aspx

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

Washington State Department of Ecology (Ecology). 2019a. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079.

http://leg.wa.gov/JointCommittees/WRM/Documents/EcologyFinalGuidanceForDeterminingNEB.pdf.

Washington State Department of Ecology (Ecology). 2019b. Streamflow Restoration Policy & Interpretative Statement, POL-2094, Water Resources Program Policy & Interpretative Statement. Washington State, Department of Ecology. https://appswr.ecology.wa.gov/docs/WaterRights/wrwebpdf/pol-2094.pdf.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Accessed at: http://apps.wdfw.wa.gov/salmonscape/

Mason County Rooftop Runoff (15-SS-OP3)

WRIA 15 WRE Subbasin
South Hood Canal and South Sound Subbasins

Conversions
1 acre-foot (AF) = 325,851 gallons = 43,560 cubic feet
1 AF per year = 893 gallons per day (gpd) = 0.0014 cubic feet per second (cfs)

Water Offset
71 AF per year

Project Status
Mason County has proposed a possible modification to the Mason County building code to require conveyance and infiltration of rooftop runoff from new rural residential development. This project is summarized in a Technical Memorandum by HDR (2021), which has been excerpted to form portions of this project description.

Narrative Description
Mason County's proposed Rooftop Runoff project recommends a possible modification of the Mason County building code to require capture of roof runoff from new rural residential (RR) development, typically on 5-acre parcels or greater, with direct connection to home site infiltration facilities. Home site infiltration facilities could consist of dry wells, infiltration trenches, infiltration galleries, rain gardens, or other approved infiltration structure. This proposed code revision would typically require conveyance and infiltration facilities that infiltrate a minimum of 85 percent of the annual average rooftop runoff for new rural residential development, with a reduced percentage possible in less permeable soils. The infiltrated runoff will recharge the shallow aquifer system, with an assumed downgradient surface water benefit to the baseflow of receiving streams.

Rooftop runoff capture is not specifically required within Mason County at the current time since the County is not a NPDES MS4 Phase II community. Therefore, this water offset is only possible with Mason County's actions to create this requirement as an offset for consumptive water use from rural residential growth.

Mason County encompasses portions of both WRIA 14 and WRIA 15. Those portions of Mason County within WRIA 15 are the subject of the analyses summarized in this project description.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.
HDR used MGSFlood (a Washington State Department of Ecology-approved continuous simulation hydrologic model) to simulate the infiltration potential associated with new rural residential development. The model simulated basin-scale infiltration characteristics under existing (baseline) development requirements and under the Rooftop Runoff project to

estimate the water offset associated with implementation of this project. The analysis and underlying assumptions are described in detail in a technical memorandum (memo) produced by HDR (see Attachment A). For WRIA 15, HDR estimates that the projected water offset for 926 new PE wells will be approximately 79 AF per year, which is equivalent to about 70,550 gpd. Of the projected 79 AF per year offset, approximately 72 AF per year is anticipated in the South Hood Canal subbasin and 7 AF per year is anticipated in the South Sound subbasin, as summarized in Table E-5 (HDR, 2021).[2]

Table E-5. Estimated water offset volumes by subbasin above the baseline condition that results from the project activities within WRIA 15 (adapted from Table 4 from HDR [2021] memo).

Subbasin	Projected No. of PE Wells	Soil Type Proportion	Well Proportion	Projected Offset (AFY)C	Subbasin Offset (AFY)
South Hood Canal	834	A: 22% B: 76% C: 1%	A: 186 B: 637 C: 11	A: 7 B: 63 C: 2	72
South Sound	92	A: 46% B: 52% C: 2%	A: 42 B: 48 C: 2	A: 2 B: 5 C: 0	7
Total	**926**			**A: 9** B: **68** C: **2**	**79**

Ecology considers it likely that some small number of parcels associated with new permit-exempt domestic wells will not support roof runoff infiltration facilities due to limiting site conditions. As such, Ecology directed HDR to reduce the projected water offset estimates for each of the subbasins by 10 percent. This reduction is to account for the fact that the county's new modified building code (if adopted) will likely allow exceptions due to limitations involving depth to groundwater, steep slopes, property setbacks, etc. It is anticipated that such exempted properties will be few, since the footprints of the infiltration facilities will be relatively small (0.005 to 0.014 acre on 5-acre sites) and parcels that are suitable for building construction generally should accommodate infiltration facilities as well. Factoring in this 10% reduction, the project offset will be 71 AF per year, which is equivalent to about 63,400 gpd. Of the projected 71 AF per year offset, approximately 65 AF per year is anticipated in the South Hood Canal subbasin and 6 AF per year is anticipated in the South Sound subbasin, as summarized in Table 2 (HDR, 2021).[3]

[2] Quantities obtained from HDR (2021) Table 4 for WRIA 15 subbasins
[3] Quantities obtained from HDR (2021) Table 5 for WRIA 15 subbasins

Table E-6. Projected water offsets with a 10% reduction (adapted from Table 5 from HDR [2021] memo).

Subbasin	Offset (AFY)	Offset with 10% Reduction (AFY)
South Hood Canal	72	65
South Sound	7	6
Total	**79**	**71**

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

The portion of Mason County included within WRIA 15 is shown in Figure E-8.

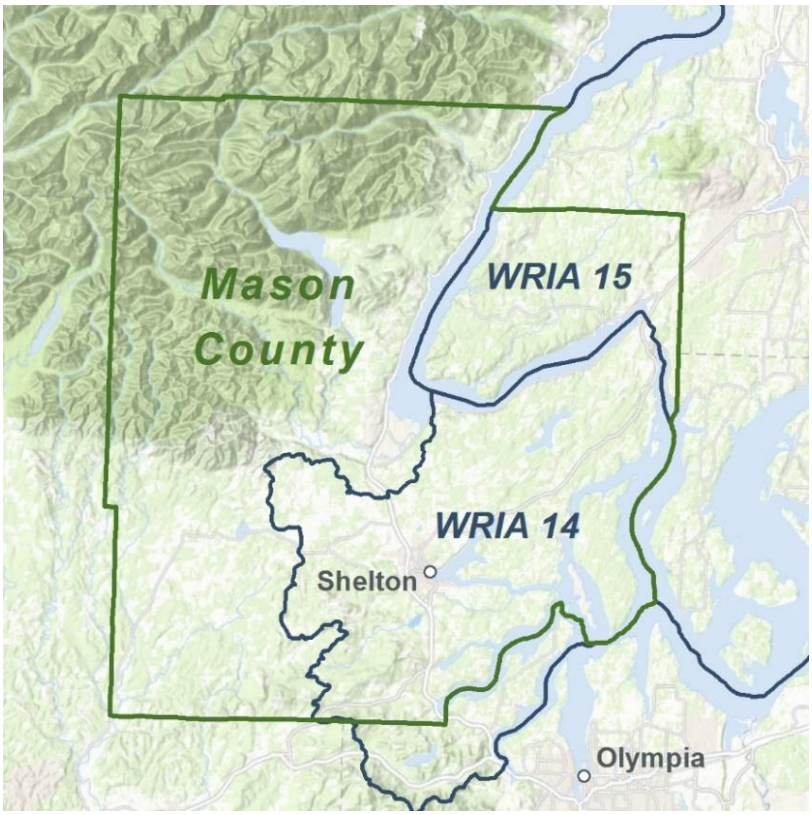

Figure E-8. WRIA 15 boundaries within Mason County (Figure 1 from HDR [2021] memo).

Portions of the WRIA 15 South Sound and South Hood Canal subbasins are within Mason County, as shown in Figure E-9.

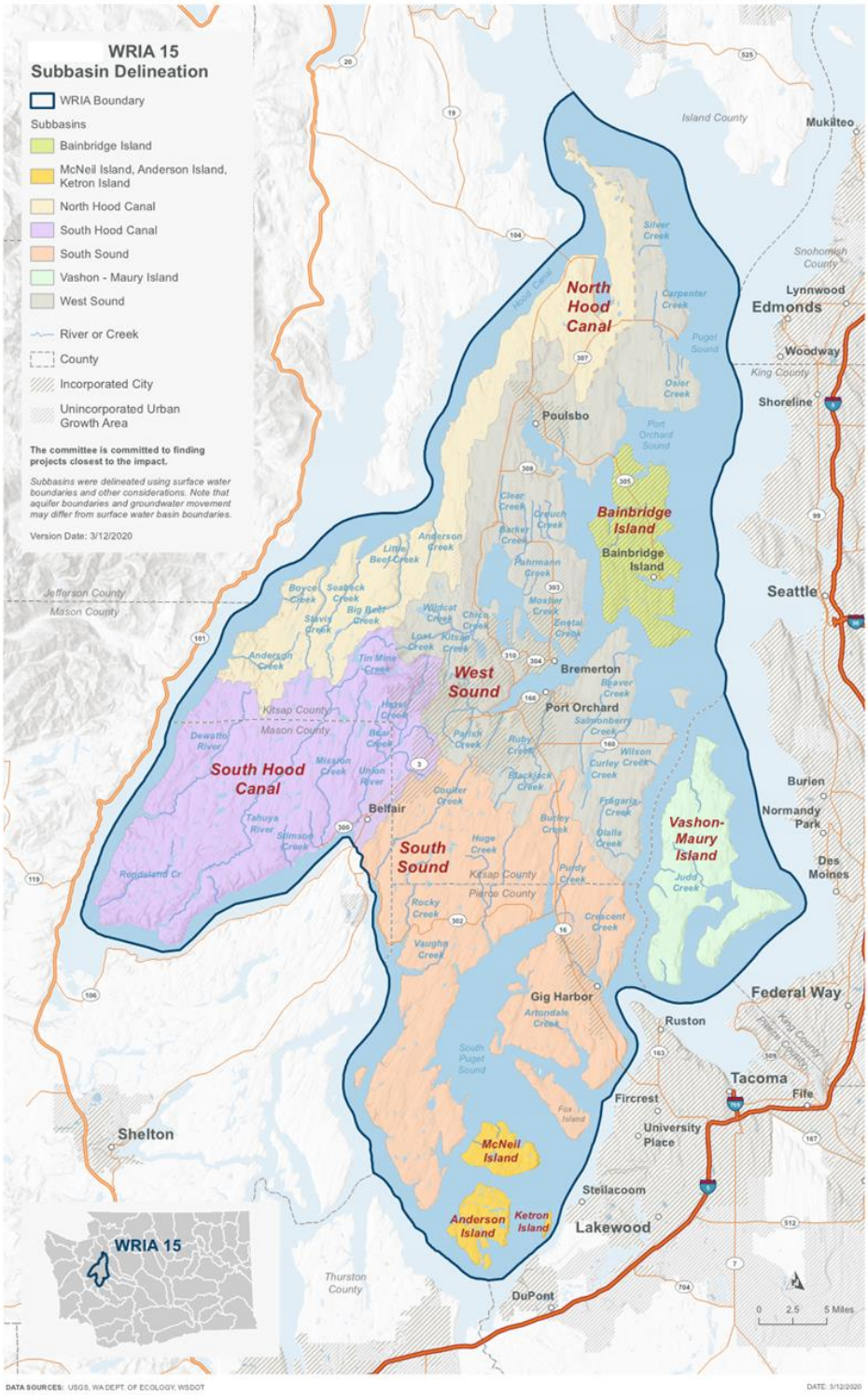

Figure E-9. WRIA 15 subbasins (Figure 3 from HDR [2021] memo).

Description of the anticipated spatial distribution of likely benefits.

Groundwater recharge associated with infiltration of rooftop runoff will increase: (1) groundwater storage in the shallow aquifer system under the South Hood Canal and South Sound subbasins; and (2) associated groundwater discharge to streams in hydraulic connection with the shallow aquifer system. This increased shallow aquifer recharge (and subsequent increased baseflow discharge) will occur on the same parcels where the new consumptive uses will arise as new rural development takes place throughout the subbasins.

Performance goals and measures.

The project's performance goal is to increase streamflow in streams within the South Hood Canal and South Sound subbasins.

A project performance measure will be the number of new homes within WRIA 15 that are equipped with rooftop runoff capture and infiltration infrastructure because of Mason County's Rooftop Runoff project. HDR (2021) estimates the number of homes within WRIA 15 will be approximately 926.

A second performance measure will be an increase in streamflow in WRIA 15 streams. Specific quantities and timing for the streamflow increase will vary by stream and location as a function of new home density and local hydrologic characteristics.

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

Streams within WRIA 15's South Hood Canal and South Sound subbasins are inhabited by Fall Chum Salmon, Summer Chum Salmon, Fall Chinook Salmon, Coho Salmon, Pink Salmon, winter steelhead, rainbow trout, and resident coastal cutthroat (WDFW, 2021).

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project, as proposed by Mason County, is in alignment with the goals of the Streamflow Restoration Act. Shallow aquifer recharge is identified as a project type that potentially could address new consumptive water use and achievement of net ecological benefit (NEB).

Barriers to implementation could include applicability of roof runoff infiltration to areas with poor infiltration characteristics and resistance from prospective homeowners and/or the home construction community.

Potential budget and O&M costs.

HDR (2021) provided estimates for implementation of Mason County's Rooftop Runoff project. HDR assumed that all project costs will be associated with the initial cost of construction for new homes and that construction cost will vary as a function of hydrologic soil group. Assuming that an infiltration facility costs $15 per square foot (sf) to construct, implementation costs could range from $3,780 to $9,300 per home depending on hydrologic soil group, as summarized below:

- Homes with Group A Soils = 252 sf x $15/sf = $3,780
- Homes with Group B Soils = 420 sf x $15/sf = $6,300
- Homes with Group C Soils = 620 sf x $15/sf = $9,330

The estimated cost to implement the Rooftop Runoff Infiltration Program in WRIA 15 is $5,316,591, as summarized in Table 3.

Table E-7: Estimated cost of project implementation within WRIA 15 (Table 7 from HDR [2021] memo).

Hydrologic Soil Group	Num. of Rural Permit-Exempt Wells	Unit Cost Per Home	Costs
Group A	228	$3,780	$862,950
Group B	685	$6,330	$4,338,073
Group C	12	$9,330	$115,567
Total	**926**		**$5,316,591**

Anticipated durability and resiliency.

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

- Rooftop runoff would be conveyed from rooftop to infiltration structure with minimal loss to the recharge location.
- Land use changes external to the project sites likely would have negligible impact on project function.
- The quantity of infiltrated water will fluctuate as a function of short-and long-term trends in precipitation.
- Groundwater recharge rate can be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, long-term infiltration capacity will

depend on the homeowner's commitment to maintaining the infiltration structures over the lifespan of the home.

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 moderately resilient to the potential impacts of climate change based on the following:

- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project sites could impact project function.
- Sea level increase, on the order of several feet or less, likely would not impact project function.
- Project function could be impacted by a decrease in seasonal and/or annual precipitation.

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

The project will be implemented by individual homeowners. However, Mason County will administer rooftop runoff requirements as a component of the Mason County building code.

Documentation of sources, methods, and assumptions.

HDR. 2021. Technical Memorandum, Mason County WRIA 14 and 15 Rooftop Runoff Infiltration Recharge Analysis for Streamflow Augmentation of Net Benefits. Technical Memorandum prepared by HDR for the Washington State Department of Ecology. September 21. 12 p.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Accessed at: http://apps.wdfw.wa.gov/salmonscape/

Attachment A:

HDR Technical Memorandum Dated September 21, 2021

Date:	September 21, 2021
Project:	Watershed Restoration & Enhancement Plan Technical Support
To:	Angela Johnson, Stacy Vynne McKinstry (Ecology)
From:	Chad Wiseman, Jerry Bibee, PE, and Grace Doran, EIT (HDR)
Subject:	Mason County WRIA 14 and 15 Rooftop Runoff Infiltration Recharge Analysis for Streamflow Augmentation Net Benefits

Background

This memorandum describes the evaluation of net water offset recharge benefit associated with Mason County's proposed Rooftop Runoff Infiltration Program requirement for new rural development. Mason County has proposed a possible modification of the County building code to require capture of roof runoff from new rural residential (RR) development, typically on 5-acre parcels or greater, with direct connection to home site infiltration facilities (i.e., parcel dry wells, infiltration trenches, infiltration galleries, or rain gardens). This proposed code revision would typically require infiltration facilities that achieve recharge of 85 percent of the annual average rooftop runoff for new RR parcel development roof, with some reduction possible in less permeable soils to limit infiltration facility sizes. Similar to assumptions regarding permit exempt well consumptive use withdrawals, the infiltrated runoff is assumed to result in shallow groundwater recharge to interflow, with an assumed down-gradient surface water benefit to receiving waters base flow augmentation.

RR growth outside of urban growth areas (UGAs) within Mason County has been projected by the Mason County Comprehensive Plan and for the development of the Watershed Resource Inventory (WRIA) 14 and 15 Watershed Restoration and Enhancement (WRE) Plans (HDR 2020a and 2020b). HDR modeled hydrologic response and infiltration potential for new RR parcel development under existing (baseline) development requirements and under the proposed infiltration program, and in variable soil types, to estimate water offsets to be gained through this low-impact development (LID) best management practice (BMP). The typical infiltration quantities per RR parcel for each respective soil type were then applied to the projected RR growth in rural Mason County and associated hydrologic soil group (HSG) types. The resulting net increases in recharge benefits (proposed minus baseline) were applied to projected RR growth in Mason County at the WRIA and subbasin scales. Mason County encompasses

portions of WRIA 14 and WRIA 15, respectively (Figure E-7). The WRIAs have nested subbasins (**Error! Reference source not found.** and E-11).

The application of LID BMPs within the County are not specifically required at the current time since the County is not a NPDES MS4 Phase II community tied to onsite stormwater management practices otherwise required in the 2019 Ecology *Stormwater Management Manual for Western Washington* (SWMMWW). Therefore, this water offset would not have occurred, if it were not for Mason County's proposal to create this requirement as a contribution to offsetting consumptive water use from rural residential growth. For the purposes of the WRIA 14 and 15 Watershed Restoration and Enhancement (WRE) Plans, the net infiltration recharge of rooftop runoff is equivalent to a water offset per RCW 90.94. The water offset benefits could be credited incrementally with continued RR growth under the current Mason County NPDES program status and implemented Rooftop Runoff Infiltration Program.

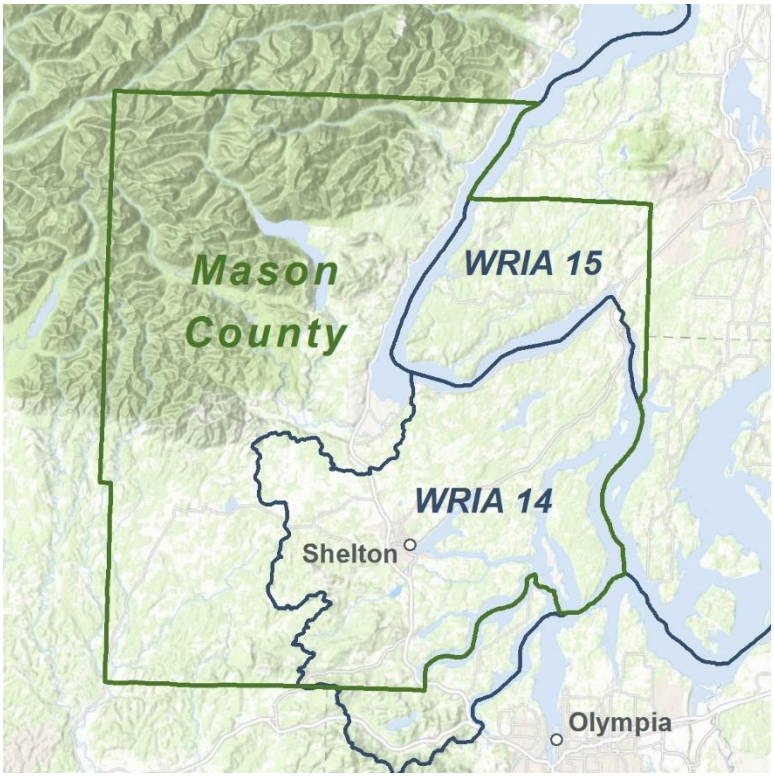

Figure E-10: WRIA and Washington Counties within Project area

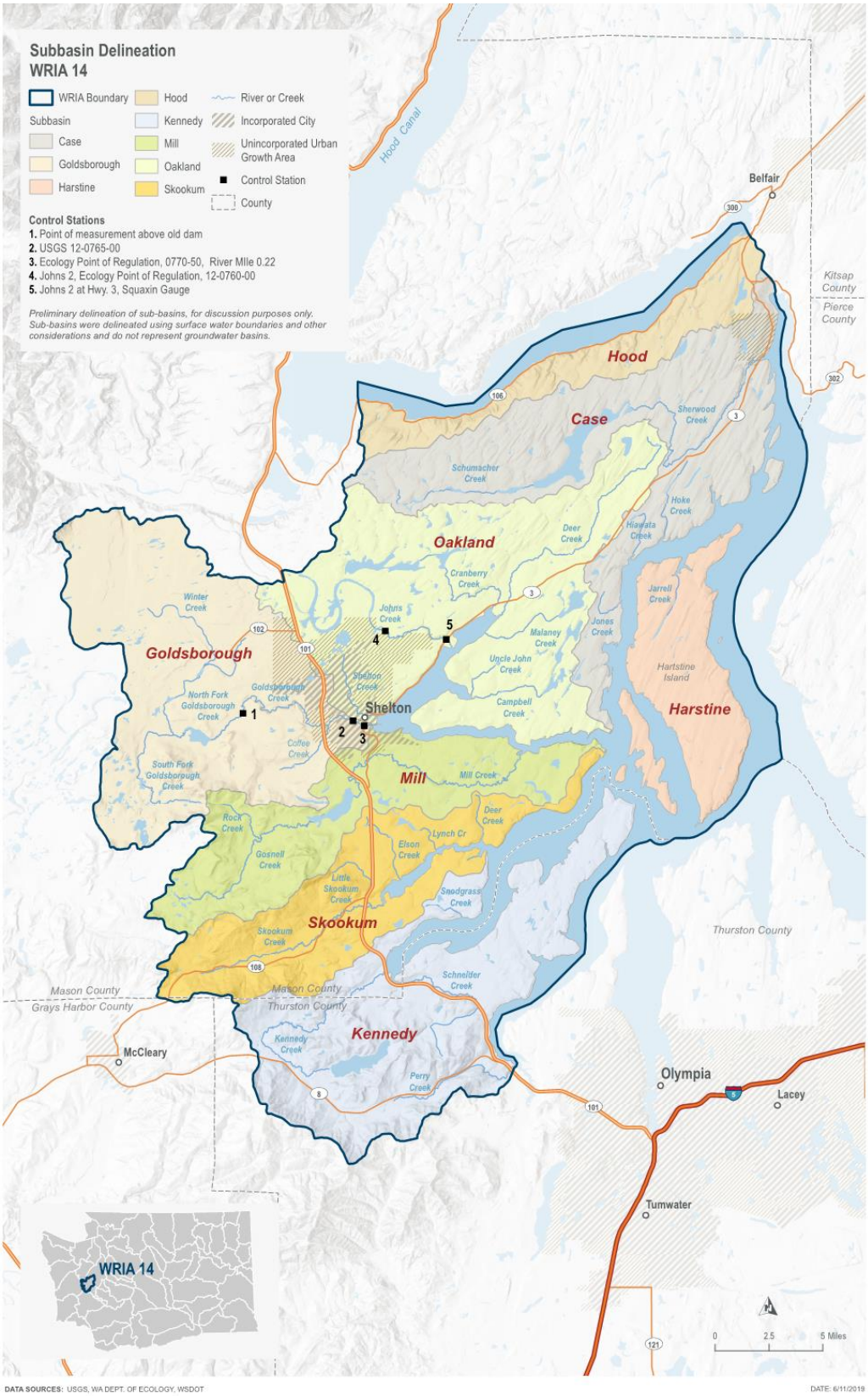

Figure E-11: WRIA 14 subbasins

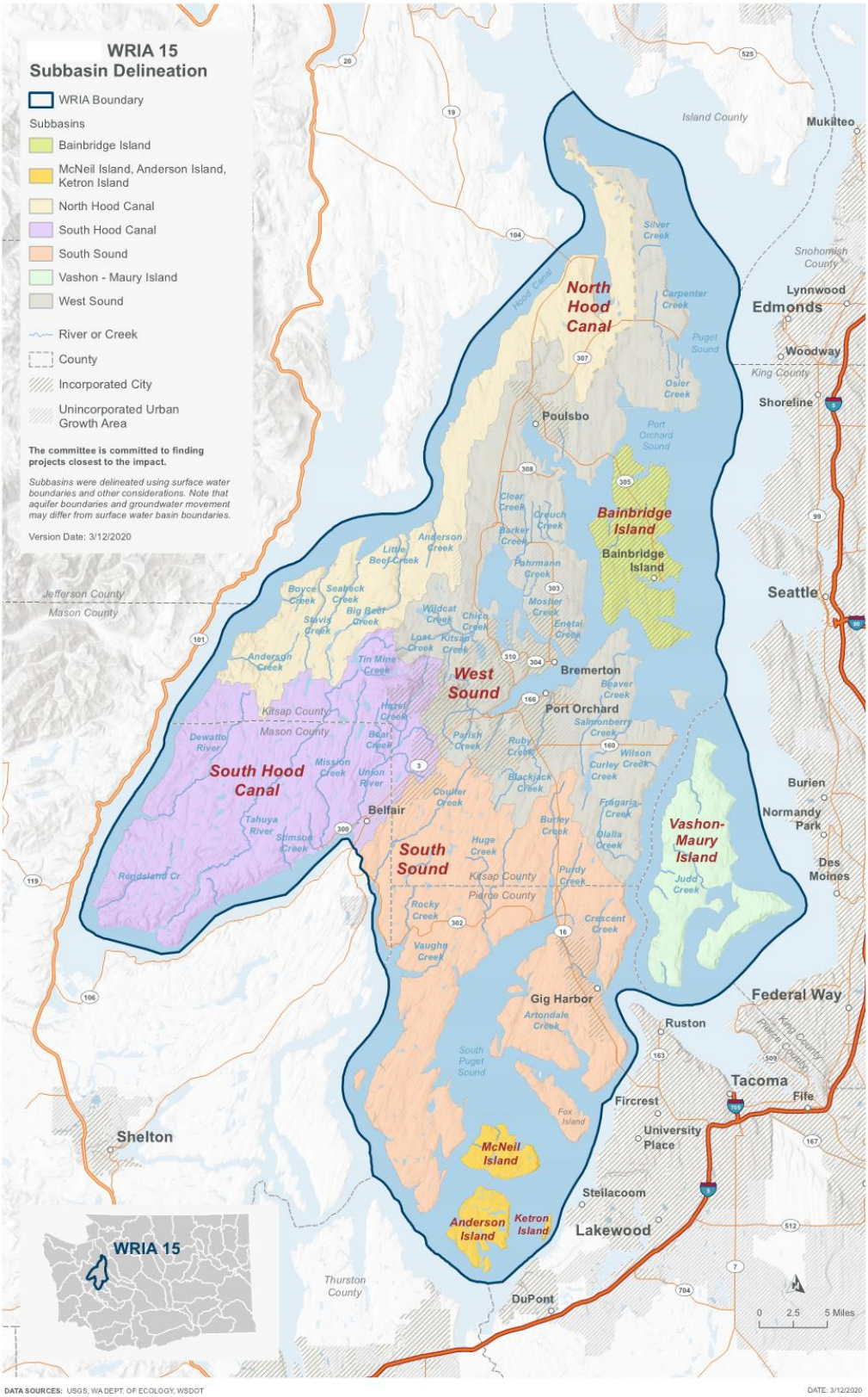

Figure E-12: WRIA 15 subbasins

Analysis Methods and Assumptions

The following subsections describe the methods, conditions, and key assumptions underlying the Mason County Rooftop Runoff Infiltration Program analysis.

Analysis Approach Overview

Infiltration recharge volume estimates have been made for existing baseline conditions and standards, and for a proposal by Mason County to modify development standards to require direct infiltration of roof runoff. The analysis was conducted under an assumed set of typical parcel development conditions and under variable soil types. The resulting infiltration recharge volumes for each analysis condition were compared to establish the potential water offset net recharge benefit per RR development parcel under the evaluated soil types. Those parcel-level analysis results were then expanded to the WRIA 14 and 15 subbasins for characterization of the potential cumulative water offset benefits associated with this Mason County program proposal.

Characterization of Rural Residential Growth and Buildable Lands

The Mason County requirement to infiltrate rooftop runoff applies to buildable RR zoned lands, typically 5 acre and greater in parcel size (Figure E-10). That collective land use totals approximately 186,000 acres of rural residential developable lands (Table E-8), and with a total of 3,692 wells projected to service that area between 2018 and 2038. The projected 3,692 wells do not include the permit exempt wells that are anticipated to go into urban growth areas over that same period. The quantity of rural residences projected to be built in 2018–2038 in each subbasin were defined in the WRE Plan permit-exempt well and connection growth and consumptive use analysis (HDR 2020). The composition of HSG types (SWMMWW, Volume III-2.2) within the buildable lands were characterized within each subbasin (**Error! Reference source not found.**). Group A, B, and C soils were evaluated, where Group A are outwash soils, Group B soils are transitional outwash to till soils, Group C are till soils. The transition in soils permeability from outwash to till soils ranges from high level to low level, with factored design infiltration rates ranging from 6.0 to 0.5 inches per hour evaluated. Group D soils are saturated/wetland soils and were not evaluated since achieving significant infiltration through them is not technically feasible.

Table E-8: Total WRIA 14 and 15 RR developable area summarized by Hydrologic Soil Group

Hydrologic Soil Group	Cumulative Area of Soil Group (acres)
Group A	60,158
Group B	96,746
Group C	26,781
Group D	2,138
Total	**185,823**

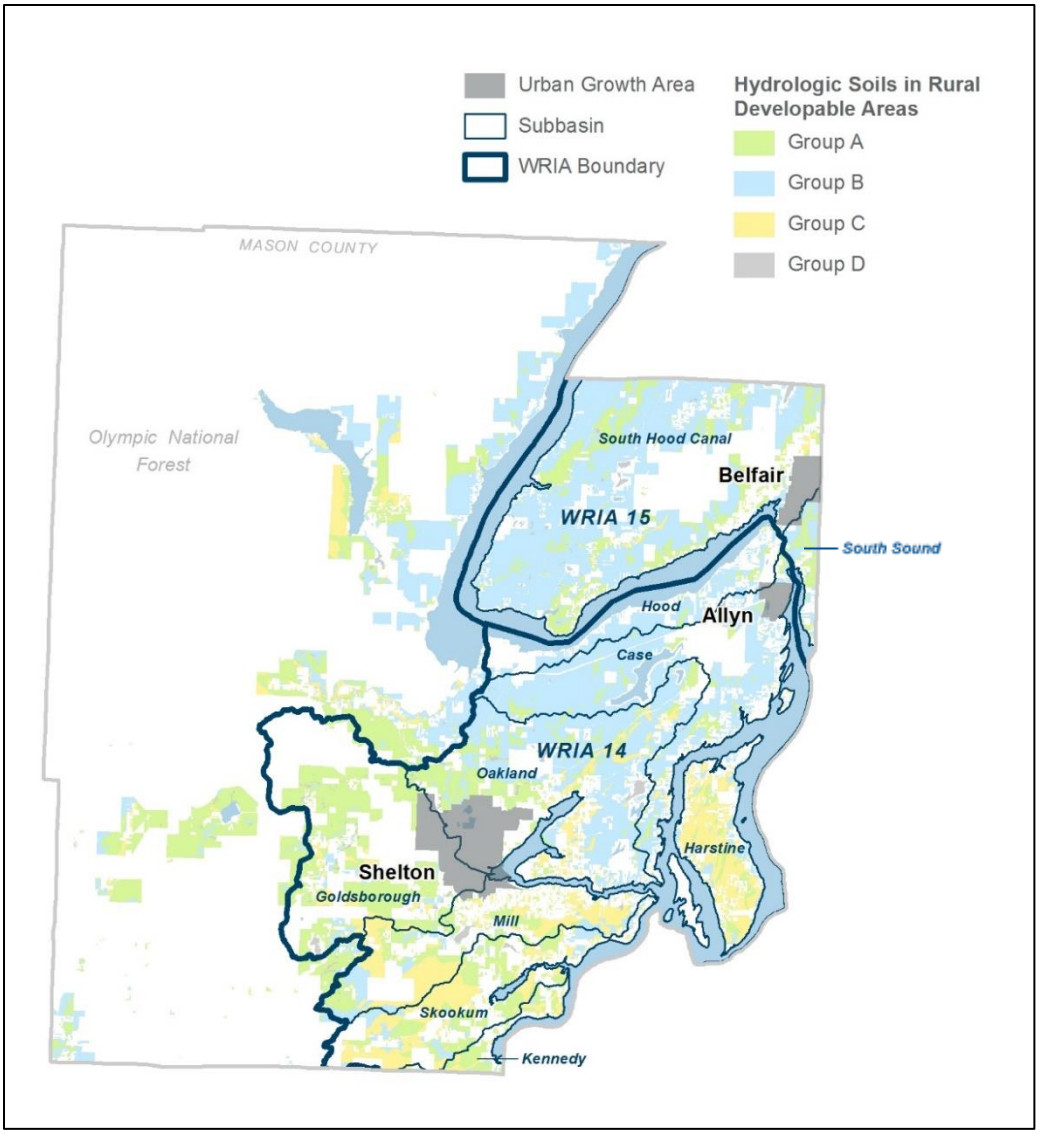

Figure E-13: Rural residential buildable lands classified by hydrologic soil type.

Hydrologic Modeling Analysis Methods and Assumptions

MGSFlood, an Ecology-approved continuous simulation hydrologic model, was used to simulate RR parcel development area runoff and recharge through permeable surfaces in estimating the annual water balance to be applied to the WRIA subbasins rural residential developable lands. The analysis was conducted for a typical 5-acre developed parcel with typical land surface cover conversions as shown below. The analysis was conducted for the Group A, B, and C hydrologic soil classes, respectively, and using pervious land vegetation classes noted below. The following key assumptions were made for the MGSFlood hydrologic modeling analysis:

- Mean Annual Precipitation (MAP) is 70 inches (5.83 ft/yr)
- Individual parcel size is 5 acres
    - Cleared area of parcel is 1 acre (ac)

    - Typical house non-pollution generating impervious surface (NPGIS) area is 2,200 sf (0.05 ac)
    - Typical garage NPGIS roof area is 600 sf (0.014 ac)
    - Typical driveway pollution generating impervious surface (PGIS) is 1,200 sf (0.028 ac) (driveways were not considered for direct runoff recharge since they are pollution-generating surfaces)
    - Remainder of cleared site is grass
    - Remaining 4 acres is forested with native soil type
- Group A, B and C soils were evaluated with this analysis. For parcel runoff and infiltration simulation from pervious surfaces beyond roof runoff separately analyzed, Group B soils were proportionally split between outwash and till soils (the MGSFlood model does not include a Group B soil class)
- Group D soils were not included
- Soil permeability factored design rates for rooftop runoff infiltration trench analysis:
    - Group A = 4, 5, and 6 inches/hour (in/hr)
    - Group B = 1, 2, and 3 in/hr
    - Group C = 0.5 in/hr
- Infiltration facility depth of 2 feet
- The depth to water table beneath the infiltration facility is 5 feet or greater
- Filter strip soil permeability was assumed to be 3 in/hr to simulate a typical lawn topsoil or amended native soil, unless underlying native soil permeability was lower, in which case, it was set equivalent to that lower value

Parcel rooftop runoff was simulated using the MGSFlood model to evaluate rooftop runoff targeted for infiltration in each HSG, both under existing baseline condition development standards, and under the Mason County's proposed rooftop runoff modified development standard condition. The difference in recharge between those two conditions was used to assess the net increased benefit in recharge achieved. Separately, runoff from other parcel development area surfaces was evaluated as described in the following section, but since the infiltration characteristics of those surfaces under the two development standard conditions would not change, that analysis does not enter into the net recharge benefit evaluation.

Parcel Hydrologic Modeling Analysis (Beyond Roof)

To determine runoff and recharge for the entire 5-acre parcel, an MGSFlood model simulation was run to analyze the full recharge potential of the parcel. The roof infiltration changes from the baseline to proposed conditions was analyzed in a separate model simulation and was

therefore not included in the full parcel analysis. Beyond the roof area, the analysis did not change between the baseline and proposed conditions. The land cover breakdown of a typical 5-acre parcel used for the MGSFlood analysis, excluding the 0.064 acres of roof area (house area, 0.050 ac, plus garage area, 0.014 ac), is shown in Table E-9. Assuming 1 acre of the parcel would be developed, the soil group types of the remaining 4 acres of forested land was determined based on GIS analysis. As stated in the assumptions, Group B soil type was portioned out between Group A (outwash) and Group C (till) soils.

Table E-9: MGSFlood Soils-Land Cover Input for typical 5-acre parcel development without roof area

MGSFlood Input	Area (ac)
Till Forest	1.232
Till Grass	0.230
Till Pasture	0.678
Outwash Forest	2.768
Impervious (beyond roof)	0.028
Total	**4.936**

Rooftop Runoff Baseline Condition Analysis

To complete the roof runoff recharge analysis for the assumed 0.064-acre roof area, a baseline analysis was completed to estimate how much runoff would infiltrate using existing Mason County development standards (Mason County Code, Title 14, Chapter 14.48). The Downspout Dispersion System BMP from the SWMMWW (BMP T5.10B) was considered the most representative for comparative analysis of infiltration recharge potential. This BMP for a single roof down-drain is applicable for 700 square foot (sf) of roof and requires a minimum 20 sf infiltration trench area. The developed parcel roof area was assumed to be 0.064 acres (2,800 sf), so 80 sf of infiltration trench area (2-foot width by 40-foot length) was modeled for the entire roof for baseline conditions applicable to all soil groups. For the baseline analysis, a filter strip (SWMMWW BMP T9.40) was linked downstream of the infiltration trench to route overflow runoff from the trench across it as sheet flow. As a linked element in MGSFlood, the filter strip only receives excess flow that is not infiltrated within the infiltration trench. The filter strip was conservatively assumed to have an area of 4,000 sf, 40 ft in width by 100 ft in length, and was intended to mimic a typical developed lawn surface (with topsoil or compost-amended native soil).

The infiltration recharge analysis was completed for each soil group, using the assumed design permeability rates applied to the infiltration trench area. The filter strip was analyzed with a typical topsoil infiltration rate of 3 in/hr. However, where the underlying native soils have a lower infiltration rate than 3 in/hr, the permeability of the filter strip was set to the limiting subgrade soils value.

Rooftop Runoff Proposed Condition Analysis

The proposed analysis was conducted under Mason County's proposed modified development standard requiring increased rooftop runoff infiltration. For this analysis, it was also assumed that a 0.064-acre roof is connected to an infiltration trench that would accommodate the majority of the roof annual runoff volume. This was analyzed using the MGSFlood model infiltration trench BMP element without consideration of a filter strip downgradient of the infiltration trench for supplemental overflow infiltration benefit. The recharge analysis was completed for each soil group applying assumed design permeability rates.

The proposed condition infiltration analysis was initially conducted for a range of roof runoff values, ranging from 85 percent to 100 percent annual average infiltration volume in 5 percent increments to determine the required area of the infiltration trench or equivalent infiltration gallery area. Based on the analysis findings, Ecology staff consulted with Mason County staff on the desired target annual recharge value, and direction was subsequently provided by Ecology to HDR to use an 85% annual roof runoff infiltration target value. An exception to that was requested by Mason County for Group C soils, where annual recharge is limited by a maximum requested infiltration facility area footprint of 620 square feet.

Analysis Results

Parcel Runoff Analysis Findings

For the typical developed 5-acre parcel under the modeling assumptions listed above, it was estimated that the annual recharge volume over pervious surfaces, without including roof infiltration, is approximately 14.2 ac-ft/yr. This represents about 50 percent of the annual precipitation volume over the parcel area. This component of the analysis results remains the same between baseline and proposed development conditions. This analysis was completed to show that the change in rooftop runoff recharge is a smaller component of the overall typical 5-acre parcel infiltration recharge volume.

Rooftop Runoff Analysis Findings

For typical developed parcel roof recharge analysis, soil infiltration rates were the key factor in estimating infiltration trench BMP size needs and the net recharge gain. As the soil infiltration rate decreases, the size of the infiltration facility increases. As stated previously, the Group C soil infiltration facility was sized at 620 sf, equivalent to the 1 in/hr infiltration rate facility size, resulting in 69 percent average annual infiltration volume (versus the standard 85 percent). The net average annual recharge gain compared to baseline was greatest for soils with the lowest infiltration rates (Table E-10 and Figure 11).

Table E-10: Baseline and proposed (85 percent infiltration) roof recharge

Per Parcel Roof 85% Proposed Recharge*												
Hydrologic Soil Group	Baseline							Proposed		Net Average Annual Recharge Gain		
	Infiltration Facility		Filter Strip			Total						
	Area (SF)	Average Annual Recharge (ac-ft/yr)	Infiltration Rate (in/hr)	Area (SF)	Average Annual Recharge (ac-ft/yr)	Average Annual Recharge (ac-ft/yr)	Percent Recharge	Infiltration Facility Area (SF)	Average Annual Recharge (ac-ft/yr)	ac-ft/yr	cfs	gpm
Group A - 6 in/hr	80	0.219	3.0	4,000	0.037	0.256	76%	227	0.285	0.030	4.1E-05	0.018
Group A - 5 in/hr		0.204			0.041	0.245	73%	252	0.285	0.040	5.5E-05	0.025
Group A - 4 in/hr		0.188			0.046	0.234	70%	294	0.285	0.052	7.1E-05	0.032
Group B - 3 in/hr		0.167			0.053	0.220	66%	337	0.285	0.065	9.0E-05	0.041
Group B - 2 in/hr		0.140	2.0		0.046	0.186	56%	420	0.285	0.099	1.4E-04	0.061
Group B - 1 in/hr		0.102	1.0		0.031	0.133	40%	620	0.285	0.152	2.1E-04	0.094
Group C - 0.5 in/hr*		0.072	0.5		0.019	0.090	27%	620	0.230	0.140	1.9E-04	0.087
*Proposed C soils infiltrate 69%												

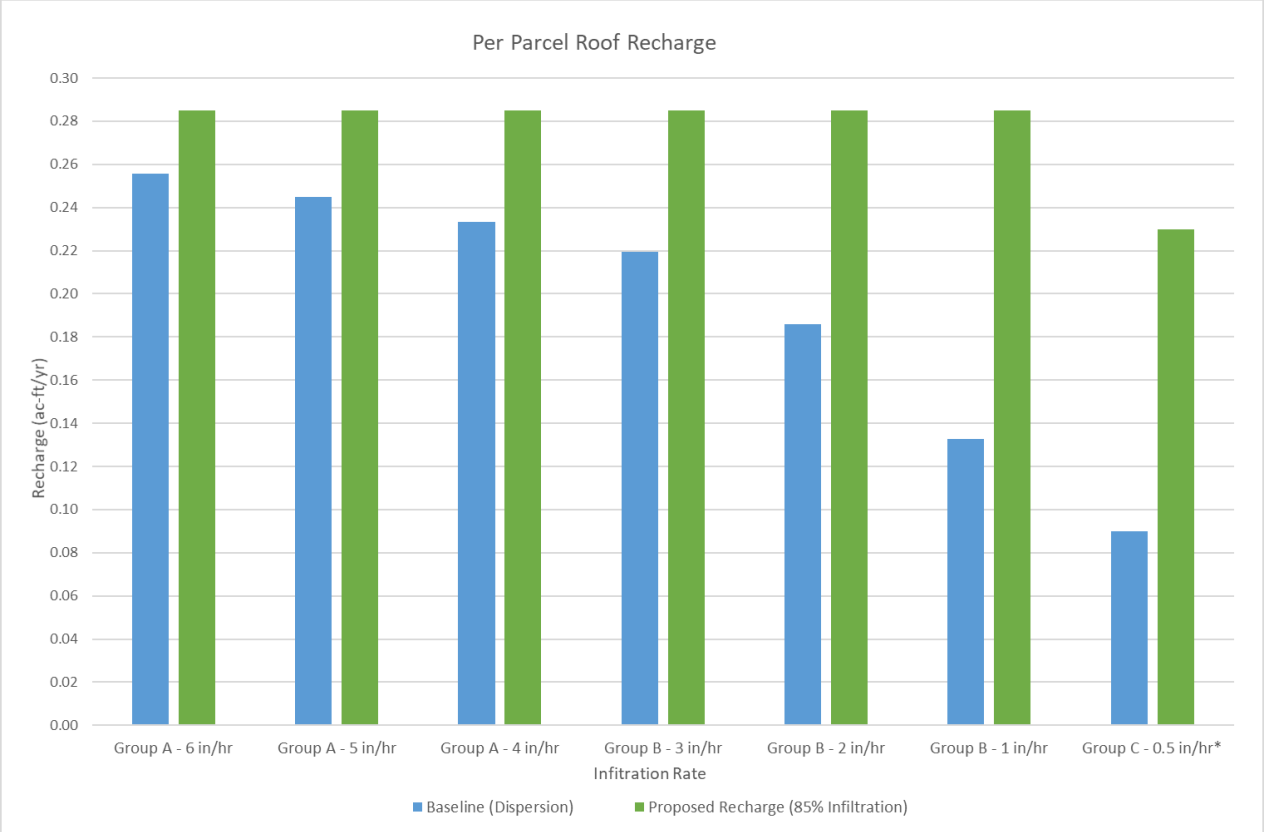

Figure E-14: Parcel roof recharge comparison by soil group

Based on the parcel level analysis results, the typical net recharge gain for collective parcels in each soil group were extrapolated to the projected RR growth areas in the Mason County portions of WRIAs 14 and 15. The net recharge gain for proposed conditions infiltration capture compared to baseline conditions was used to estimate the projected offset for each soil group within each subbasin. For that evaluation, and the total potential offset for collective parcels apportioned to the estimated number of wells were estimated in accordance with the analysis assumptions. The average of each soil group infiltration rate was used to complete this analysis, with 5 in/hr for Group A soils, 2 in/hr for Group B soils, and 0.5 in/hr for Group C soils being applied.

Based on 2,766 wells apportioned to assumed full parcel buildout within the WRIA 14 Project area, this yielded a total potential projected water recharge offset of 248 ac-ft/yr, at 85 percent recharge on an average annual basis. (Table E-10).

Based on 926 wells apportioned to assumed full parcel buildout within the WRIA 15 Project area, this yielded a total potential projected water recharge offset of 79 ac-ft/yr, at 85 percent recharge on an average annual basis. (Table E-10).

Ecology considers it likely that some small number of parcels associated with new permit-exempt domestic wells will not support roof runoff infiltration facilities due limiting site conditions. As such, Ecology directed HDR to reduce the projected water offset estimates for

each of the subbasins (the right column in Table E-10) by 10 percent. This reduction is to account for the fact that the county's new modified building code (if adopted) will likely allow exceptions due to limitations involving depth to groundwater, steep slopes, property setbacks, etc. It is anticipated that such exempted properties will be few, since the footprints of the infiltration facilities will be relatively small (0.005 to 0.014 acre on 5-acre sites) and parcels that are suitable for building construction generally should accommodate infiltration facilities as well. Table E-11 indicates the estimated offset benefits by subbasin, including the 10 percent reduction factor.

Table E-11a: WRIA 14 project area roof 85 percent estimated recharge and projected water offset from baseline by subbasin

Subbasin	Projected N. of PE Wells	Soil Type Proportion	Wells in Soil Type	Projected Offset (AFY)	Total Offset (AFY)
Case	396	A: 11%, B: 88%, C: 2%	A: 42, B: 347, C: 7	A: 2, B: 34, C: 1	37
Goldsborough	338	A: 82%, B: 8%, C: 11%	A: 276, B: 26, C: 37	A: 11, B: 2, C: 5	19
Harstine	143	A: 14%, B: 18%, C: 69%	A: 20, B: 25, C: 98	A: 1, B: 2, C: 14	17
Hood	78	A: 9%, B: 91%, C: 1%	A: 7, B: 71, C: 0	A: 0, B: 7, C: 0	7
Kennedy	59	A: 61%, B: 5%, C: %	A: 36, B: 3, C: 20	A: 1, B: 0, C: 3	4
Mill	434	A: 30%, B: 19%, C: 51%	A: 132, B: 80, C: 221	A: 5, B: 8, C: 31	44
Oakland	955	A: 24%, B: 67%, C: 10%	A: 226, B: 636, C: 93	A: 9, B: 63, C: 13	85
Skookum	363	A: 39%, B: 14%, C: 47%	A: 141, B: 51, C: 172	A: 6, B: 5, C: 24	35
Total for all	2766				79

Table E-11b: WRIA 15 project area roof 85 percent estimated recharge and projected water offset from baseline by subbasin

Subbasin	Projected N. of PE Wells	Soil Type Proportion	Wells in Soil Type	Projected Offset (AFY)	Total Offset (AFY)
Sough Hood Canal	834	A: 22%, B: 76%, C: 1%	A: 186, B: 637, C: 11	A: 7 B: 63, C: 2	37
South Sound	92	A: 46%, B: 52%, C: 2%	A: 42, B: 48, C: 2	A: 2, B: 5, C: 0	19
Total for all	926				79

*Proposed C soils only infiltrate 69%

Table E-12a: WRIA 14 projected water offsets with a 10% reduction.

Subbasin	Offset (AFY)	Offset with 10% Reduction (AFY)
Case	37	33
Goldsborough	19	17
Harstine	17	15
Hood	7	7
Kennedy	4	4
Mill	44	40
Oakland	85	77
Skookum	35	31
Total for all	79	223

Table E-12b: WRIA 15 projected water offsets with a 10% reduction.

Subbasin	Offset (AFY)	Offset with 10% Reduction (AFY)
Sough Hood Canal	37	65
South Sound	19	6
Total for all	79	71

Project Costs

At this time, all estimated project costs are expected to be included in costs of construction for new homes. Assuming that an infiltration facility costs $15 per square foot to construct, could range from $3,780-$9,300 per home.

Homes with Group A Soils = 252 sf x $15/sf = $3,780

Homes with Group B Soils = 420 sf x $15/sf = $6,300

Homes with Group C Soils = 620 sf x $15/sf = $9,330

For WRIA 14, the total projected PE well growth and distribution of new homes in Group A, B, and C soil types results in a total of $17.2 million for the total project (7). For WRIA 15, the total projected PE well growth and distribution of new homes in Group A, B, and C soil types results in a total of $5.3 million for the total project (Table E-14).

Table E-13: WRIA 14 estimated costs of project implementation.

Hydrologic Soil Group	Num. of Rural Permit-Exempt Wells	Unit Cost Per Home	Costs
Group A	879	$3,780	$3,320,836
Group B	1,240	$6,330	$7,847,947
Group C	648	$9,330	$6,042,760
Total	**2,766**	**NA**	**$17,211,543**

Table E-14: WRIA 15 estimated costs of project implementation.

Hydrologic Soil Group	Num. of Rural Permit-Exempt Wells	Unit Cost Per Home	Costs
Group A	228	$3,780	$862,950
Group B	685	$6,330	$4,338,073
Group C	12	$9,330	$115,567
Total	**926**	**NA**	**$5,316,591**

Beall Creek Flow Improvement (15-VM-OP1)

WRIA 15 WRE Subbasin

Vashon-Maury Island Subbasin

Water Offset

26 acre-feet (AF) per year

Project Status

In May 2018, a Preliminary Design Report for the Beall Creek Flow Improvement Project was completed for Water District 19's (the District's) upstream irrigation diversion at river mile (RM) 0.30 (Fisheries Engineers, 2018). The report included a number of proposed modifications to the District's Beall Creek diversion, including a new concrete dam, a proposed roughened channel for upstream fish passage, a new vertical plate fish screen installed within the existing water intake basin to physically exclude fish from the pumped water intake, a sand and silt sluicing system to facilitate the District's maintenance of the water supply intake, and a new water delivery system to the District's Water Treatment Plant 1 (Fisheries Engineers, 2018).

The Beall Creek Flow Improvement Project proposes to implement the modifications proposed in the 2018 Preliminary Design Report. The approximate location of the project is presented in Figure 1.

Narrative Description

Beall Creek is a first order stream situated along the eastern shore of Vashon Island in King County with a drainage basin of approximately 211 acres. Historically, Beall Creek likely supported a fish community that included cutthroat trout, Coho Salmon, and steelhead.

A plastic sheetpile dam across Beall Creek currently impounds water for the District's irrigation diversion at RM 0.30. The approximate location of the dam is shown in Figure 2. There are no fish passage facilities at the District's irrigation diversion, which results in a complete barrier to upstream fish passage at this location (Kerwin and Nelson, 2000; Salmonscape, 2020). The Beall Creek Flow Improvement Project is intended to improve upstream and downstream fish passage within Beall Creek, eliminate fish migration into existing District facilities, and improve the District's water withdrawal capabilities.

A partial fish passage at Beall Creek RM 0.02 (shown in yellow in Figure 2) was also identified by the Washington State Department of Fish and Wildlife (WDFW) in June 2017 (Salmonscape, 2020). There are currently no plans to address the partial barrier at RM 0.02 and it is not included herein.

The Beall Creek Flow Improvement Project proposes to provide fish passage at the existing sheetpile dam. To do so, a roughened channel will be installed that will require a minimum 48-gallon per minute (gpm) bypass flow to be maintained. Maintaining this bypass flow will increase Beall Creek streamflow during the periods of low flow and result in a water offset.

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

Implementation of the Beall Creek Flow Improvement Project would open approximately 0.60 miles of stream habitat for migratory fish upstream of the District's Beall Creek diversion (Figure 2). The proposed roughened channel would allow for upstream fish passage and the new vertical plate fish screen installed within the existing water intake basin would physically exclude fish from the pumped water intake, reducing or eliminating fish mortality.

Improved diversion measuring capabilities will result in a more accurate diversion for District water supply and retain a minimum flow in the stream of 48 gallons per minute. This will result in an increase in bypass flow relative to existing conditions. The estimated offset benefit would be the minimum flow during the dry season when water demands and diversions by the District is highest. Assuming a 4-month dry season (June-September), the offset quantity would be 26 acre-feet.

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

Figure E-15 presents the approximate location of the Beall Creek Flow Improvement Project.

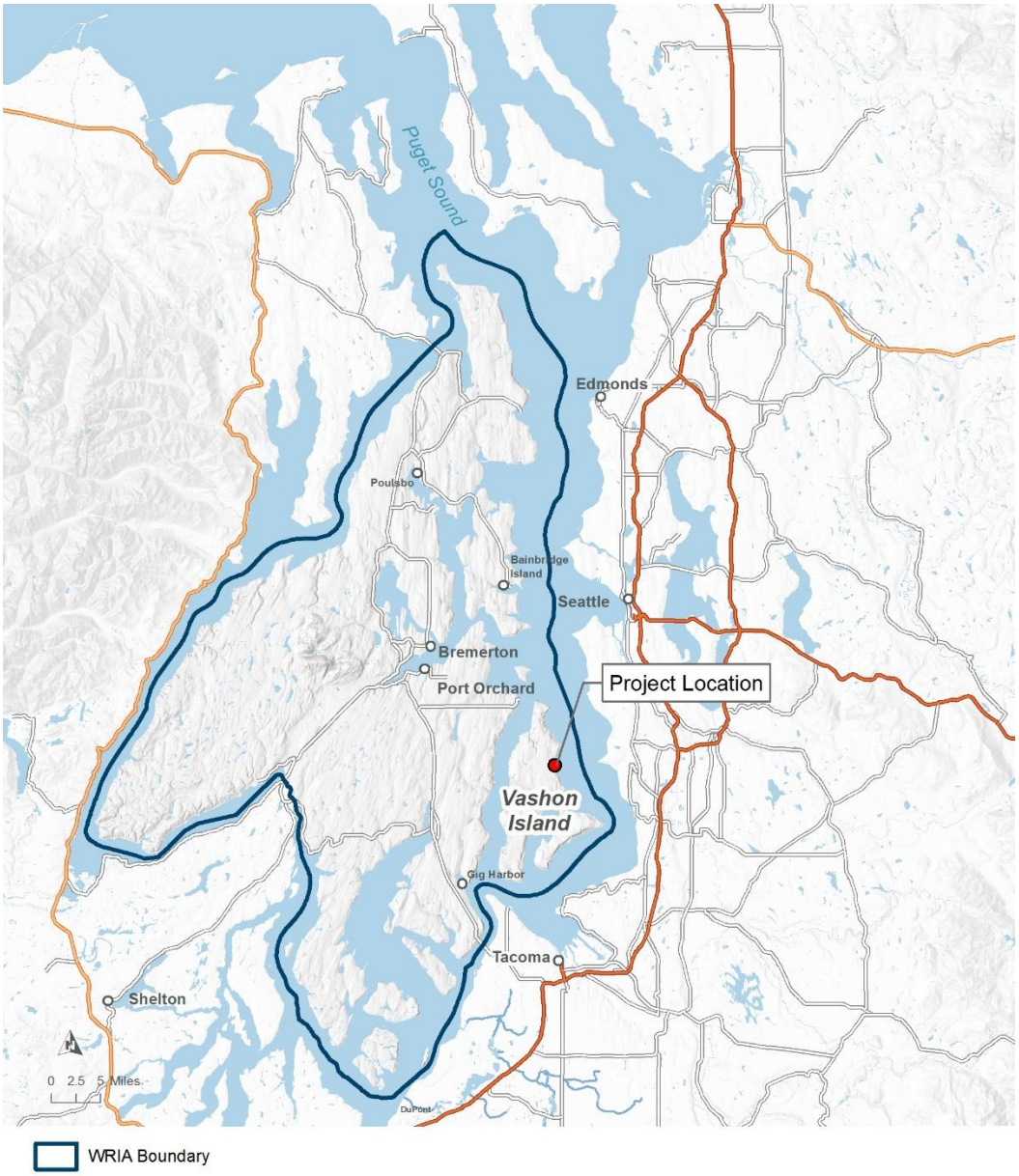

Figure E-15. Approximate project location.

Figure E-16 presents the approximate locations of the partial fish passage barrier at river mile 0.02 (yellow) and the complete fish passage barrier at river mile 0.30 (red).

Figure E-16. Beall Creek approximate fish passage barrier locations.

Description of the anticipated spatial distribution of likely benefits.

The Beall Creek Flow Improvement Project will increase streamflow during low flow conditions in the reach below the existing District diversion. It also will open approximately 0.6 miles of stream habitat upstream of the District's irrigation diversion for migratory fish passage in Beall Creek. This reach is upstream (southwest) of the barrier shown in red in Figure 2.

Performance goals and measures.

Project performance will be measured by the amount of additional streamflow within Beall Creek during the low flow period that results from project implementation. Habitat improvement will be related to the length of stream upstream of the District's irrigation diversion that the project makes accessible to migratory fish populations.

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

WDFW identified the presence of resident coastal cutthroat trout in Beall Creek (Salmonscape 2020).

Identification of anticipated support and barriers to completion.

This project is in alignment with the goals of the Streamflow Restoration Act. Altered water management or infrastructure is an identified water offset project type that could achieve net ecological benefit (NEB).

The District is the primary stakeholder who will coordinate the operations and maintenance (O&M) of the fish passage improvement project. The District will collect, compile, share and report project data. Support for the project from Washington Department of Fish and Wildlife, the Washington State Department of Ecology, and the Puyallup Tribes of Indians is anticipated.

The primary barrier to project implementation is the availability of funding for project construction and operation. The project was identified as a passage barrier in 2017 and a preliminary design and cost estimate was developed in 2018 (Fisheries Engineers, 2018). However, to date the District has been unable to obtain funds for project implementation.

Potential budget and O&M costs.

As of October 2019, the estimated cost for modifying the District's Beall Creek diversion was $110,000 (Fisheries Engineers, 2018; Water District 19, 2019). This cost estimate includes $82,000 for construction, $8,000 for Final Project Design, $6,000 for Project Permits, and $14,000 for Construction Management (Fisheries Engineers, 2018).

Anticipated durability and resiliency.

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

- The project will be designed and constructed using state of the industry engineering and construction practices.
- Project infrastructure will be maintained by the District.
- Land use changes external to the project site likely would have negligible impact on project function.
- O&M presumably would be funded through ratepayers.

Herein, resiliency refers to the capacity of the project to maintain the benefit to Beall Creek 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 improvements can be engineered to operate within a range of stream discharge.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area would not impact project function.
- Sea level increase, on the order of several feet or less, likely would not impact project function.

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

The project sponsor is the District. Project funding needs to be secured before the District is ready to proceed with the project.

Documentation of sources, methods, and assumptions.

Kerwin, John and Nelson, Tom S. (Eds.). December 2000. Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watersheds (WRIA 9 and Vashon Island). Washington Conservation Commission and the King County Department of Natural Resources.

Fisheries Engineers. 2018. Beall Creek Fish Passage Project Preliminary Design Report. Prepared for Water District 19. June 2018.

Water District 19. 2019. Water District 19 meeting minutes from October 8, 2019. http://www.water19.com/wp-content/uploads/2019/12/Comm-Meeting-100819-FINAL.pdf

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Kitsap Public Utility District Streamflow Augmentation (15-WRIA-OP1)

WRIA 15 WRE Subbasin

West Sound, North Hood Canal, South Sound and Bainbridge Island (future project) Subbasins

Water Offset

Minimum of 632 acre-feet per year (AFY)

Project Status

Kitsap Public Utility District (KPUD) has identified at least 10 potential streamflow augmentation projects within their service area boundaries with the potential to add additional sites depending on future water system acquisitions and new water rights. The 10 potential projects are described herein and are shown on the Conceptual Level Map.

Narrative Description

KPUD currently owns and operates 54 public water systems throughout rural portions of Kitsap County. KPUD is proposing to augment streams that are located near transmission mains of their systems. The water would be produced from either existing water-supply wells or new wells installed solely for the purpose of streamflow augmentation. The objective of the project is to provide "water-for-water" offset for future permit-exempt (PE) wells by discharging water indirectly into the stream (i.e., via constructed infiltration trenches, existing stormwater facilities, etc.) to augment streamflow. This project would discharge water throughout summer (i.e., July through October) at a controlled rate to augment streamflow, especially in summer. KPUD has water systems located in the West Sound, North Hood Canal, South Sound and Bainbridge Island subbasins of WRIA 15. Given limitations in KPUD's current water rights portfolio, streamflow augmentation is currently not available for Bainbridge Island. However, this may change within the next 20 years depending on water system acquisitions and new water rights. KPUD also would be willing to drill a dedicated augmentation well on Bainbridge Island provided supporting water rights are obtained. The South Sound subbasin may receive benefit as well due to discharge from water mains in the easternmost portion of the KPUD water system.

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

The following estimate of offset benefits is provided for the 10 identified projects. These estimates can be supplemented if/when additional streamflow augmentation opportunities are identified.

The total cumulative offset benefit for the KPUD Streamflow Augmentation project is currently estimated at 632 AFY. The project requires the occurrence of a target stream in proximity to KPUD water mains or wells, as well as available unperfected (inchoate) water rights for municipal supply. Streamflow augmentation is a statutorily authorized beneficial use of a

municipal water right (RCW 90.03.550). KPUD is willing to dedicate up to 632 AFY of their inchoate municipal water rights to streamflow augmentation. Instead of utilizing this volume of water for future growth, they will deliver cool groundwater to streams during the critical, summer low-flow period. These municipal water rights are senior to Chapter 173-515 WAC instream flows. Currently, there are 10 locations that will likely fulfill these requirements. Table 1 is a list of the KPUD water systems that could be used for streamflow augmentation, the WRIA 15 subbasin location, target stream(s) to augment, and the potential amount of augmentation in AFY, gallons per minute (GPM), and cubic feet per second (CFS). The potential augmentation quantity listed in Table E-16 represents about 88 percent of the total projected consumptive use of the entire WRIA 15.

Table E-16. Potential Streamflow Augmentation Sites and Quantities

KPUD Water System	WRIA Subbasin[1]	Augmented Stream(s)	AFY	GPM	CFS
Newberry Hill	North Hood Canal / West Sound	Little Anderson/ Chico Creeks	100[2]	62	0.138
Seabeck	North Hood Canal	Seabeck Creek	100[2]	62	0.138
West Kitsap	North Hood Canal	Big Beef/Seabeck	100[2]	62	0.138
Gala Pines	West Sound	Dogfish Creek	40	25	0.055
Brianwood	West Sound	Clear Creek[3]	12	7.5	0.017
Avellana	West Sound	Clear Creek[3]	10	6	0.014
Keyport	West Sound	Multiple creeks	100[2]	62	0.138
Long Lake	West Sound	Curley Creek	40	25	0.055
Strawberry Hill	West Sound	Strawberry/Curley (potential)	45	28	0.062
Indian Hills	West Sound	Stream 202	85	53	0.117
		Totals	**632**	**392.5**	**0.872**

Notes:

1. Given limitations in KPUD's current water rights portfolio, streamflow augmentation is currently not available for Bainbridge Island. However, this may change within the next 20 years depending on water system acquisitions and new water rights. KPUD also would be willing to drill a dedicated augmentation well on Bainbridge Island provided supporting water rights are obtained. The South Sound subbasin may receive benefit as well due to discharge from water mains in the easternmost portion of the KPUD system.
2. The listed volume was arbitrarily selected and there is potential for additional augmentation volume.
3. The nearest water main to a tributary of Clear Creek is approximately 500 feet. This relatively long distance, coupled with the relatively small streamflow augmentation volume available for this project, could impact project feasibility.

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

Figure E-17 shows the locations of the potential KPUD streamflow augmentation project locations listed in Table E-16. Each of these project sites is owned by KPUD, have existing groundwater supply wells, and have available inchoate water rights. However, the actual augmentation site(s) could also be at water mains, or nearby with the installation of a water

main to reach sites with appropriate conditions and distances from the stream(s). Ideally, the sites would be sited as far upstream as practical to maximize the length of stream benefitted by the project.

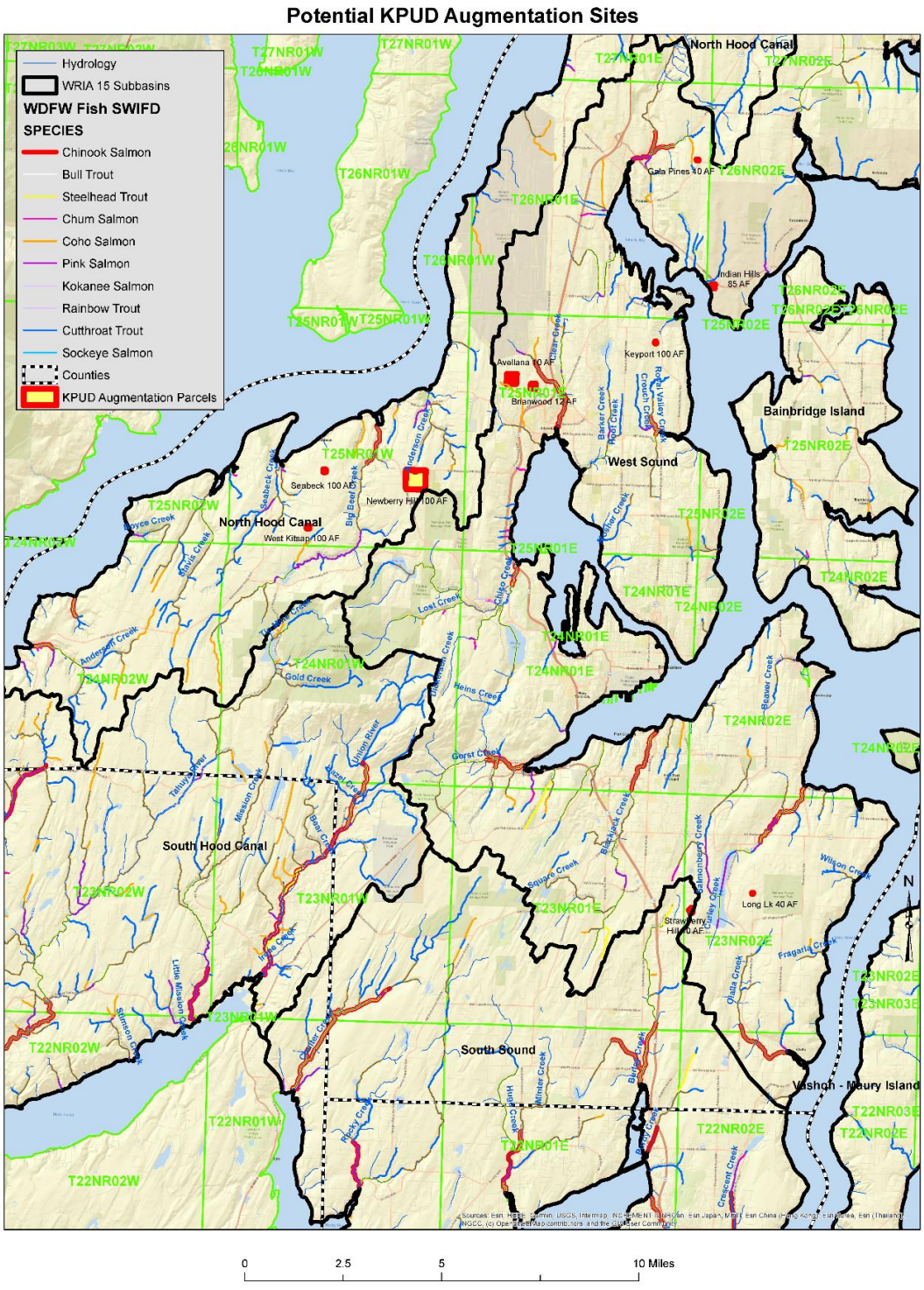

Figure E-17. Potential KPUD Augmentation Sites

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in various streams within the West Sound and North Hood Canal subbasins. As described above for the 10 potential project sites, most streamflow augmentation sites would benefit one stream in the form of increased streamflow. Potentially, if a pond or infiltration site was located on or near the drainage divide of two streams, the streamflow augmentation project could provide streamflow benefit to more than one basin. The streamflow augmentation projects could also enhance or restore wetlands associated with the streams.

Performance goals and measures.

The performance goals are to provide "water-for-water" offset for future PE wells by discharging water indirectly into streams that are located near KPUD water systems that have available inchoate water rights in order to augment and improve streamflows.

The streamflow augmentation amount will be measured and recorded using totalizing flow meters. KPUD currently maintains 29 stream gaging stations in Kitsap County, including most of the major streams in the county. It is unlikely that the improved streamflow (e.g., 0.1 CFS) will be measurable/demonstrable at a stream gage that is located near the mouth of the stream, given the variability of streamflow in Kitsap County that is dependent on the timing and amount of precipitation (i.e., daily, monthly, seasonally, year-to-year) in these drainage basins. However, the increased streamflow should be demonstrable in the upper reaches of the stream if the augmentation occurs near the headwaters of the stream. The augmentation volume, although in some cases small relative to overall streamflow, should reduce water temperatures in target streams during summer and early fall.

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

Streams within the West Sound and North Hood Canal subbasins are inhabited by Chinook Salmon, bull trout, steelhead trout, Chum Salmon, Coho Salmon, Pink Salmon, kokanee salmon, rainbow trout, cutthroat trout and Sockeye Salmon (WDFW 2020a and 2020b). Specific species, life stages, ecosystem structure, composition, or function addressed will vary depending on project location.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. Streamflow augmentation is an identified project type that could address the new consumptive water use and achieve NEB. KPUD is the stakeholder who will coordinate the operations and maintenance of the augmentation sites and will conduct a feasibility assessment of each augmentation project based on property availability, proximity to the stream, access and ease of operations and maintenance. KPUD is willing to entertain alternative sites and water sources in addition to those described herein. In addition, KPUD will collect, compile, share and report project metering data. KPUD has experience with two active augmentation sites that are associated with water right mitigation plans.

The barriers to completion include obtaining funding for construction and O&M costs and the regulatory approval of the method proposed to de-chlorinate treated drinking water before it enters the streams. If a well is dedicated only for augmentation, the water would not be chlorinated. KPUD's intent is to use existing permitted wells located within advertised points of withdrawal for approved water rights or adding additional wells under RCW 90.44.100(3) to existing water rights which would be dedicated to streamflow augmentation purposes.

Potential budget and O&M costs.

The construction costs for conveyance and metering will be variable depending on the length of pipe necessary to reach the appropriate discharge location. A typical augmentation project will have a construction cost of $6,000 to $10,000. The total cost for implementing the 10 potential projects listed in Table 1 is approximately $60,000 to $100,000. The cost for future projects where a new, dedicated streamflow augmentation well is installed is approximately $30,000 to $100,000, depending on the depth of the well. The annual O&M cost for each augmentation site is estimated to be $8,000.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the streamflow augmentation 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 and surface water elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- The project would be actively managed by KPUD.
- The groundwater sources generally would be reliable and not subject to interruption.
- The rate of augmentation would be maintained through engineering controls and measured and recorded using totalizing flow meters.
- KPUD expects to own the augmentation site properties in perpetuity.
- Land use changes would have negligible impact on project function.
- The feasibility of indirect streamflow augmentation has not been evaluated.

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.
- Wildfire damage to the project site and surrounding area would not impact project function and the anticipated water offset.

- Sea level increase, on the order of several feet or less, would not impact project function.

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

The identified project sponsor is KPUD. The sponsor contact is Joel Purdy, Groundwater Resource Manager. The sponsor is willing to proceed with scoping, site assessments, and project management support. KPUD will coordinate site selection with Ecology and Kitsap County Health District. Implementation will be dependent on several factors, including funding.

Documentation of sources, methods, and assumptions.

HDR, Inc. 2020. Technical Memorandum Draft, WRIA 15 PE Growth and Consumptive Use Summary (Work Assignment 2, Tasks 2 and 3. Technical memorandum prepared for Washington State Department of Ecology. Revised edition prepared May 27.

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

WDFW. 2020b. Statewide Washington Integrated Fish Distribution (SWIFD). http://geo.wa.gov/datasets/4ed1382bad264555b018cc8c934f1c01_0

Forests for Streamflow (15-WRIA-OP2)

WRIA 15 WRE Subbasin

Bainbridge Island, North Hood Canal, South Hood Canal, South Sound, Vashon-Maury, West Sound, and South Sound Islands subbasins.

Water Offset

241 acre-feet (AF) per year

Project Status

The Forests for Streamflow Project acquires forest lands and/or modifies forest management practices to preserve stands and/or emphasize a longer harvest interval. These practices can increase streamflow in adjacent streams. To date, more than 20 projects have been identified, as summarized in Table 1.

Narrative Description

This streamflow restoration action centers around forest land acquisitions and forest management practice modifications that preserve stands and/or result in a longer time interval between tree harvests. Preserving and maintaining forests with stand ages more than 40 years can increase dry-season low flows. A portfolio of projects, as well as an estimate of the resulting potential increase in streamflow, is presented herein. Potential streamflow benefits were estimated using average values of streamflow increase per acre estimated from the Visualizing Ecosystem Land Management Assessments (VELMA) hydrologic model for similar projects in the Nisqually Watershed (WRIA 11). As projects move forward for funding considerations, the precision of the water offset estimates presented herein can be increased through a modeling exercise specific to WRIA 15.

Hydrologic modeling performed for Forests for Streamflow Projects in the Nisqually Watershed show that forest management practices that emphasize harvest intervals in excess of 80 years, forest thinning, and robust riparian buffers can significantly increase dry-season low flows (Nisqually Watershed Planning Unit, 2019). These results are consistent with available observed long-term monitoring data in the Pacific Northwest region (Perry and Jones, 2016; Segura et al., 2020). Recent empirical studies in western Oregon have established that young, rapidly growing forests can transpire over three times more water than mature forests. These studies were conducted at relatively small scales, ranging from individual trees and stands of trees (Moore et al., 2004) to small headwater catchments (Perry and Jones, 2016).

Maintaining mature forest cover also provides significant habitat benefits that grow with stand complexity and age. Older trees provide a wider range of niche habitats and create long-term habitat benefits of snags and large woody debris.

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

An estimate of the potential water offset associated with implementation of Forests for Streamflow projects in WRIA 15 was prepared by assuming water offset equivalency with the analyses presented by the Nisqually Watershed Planning Unit (2019). In the WRIA 11 plan, the average age of forest stands was assumed to be 40 years and the water offset per acquired acre of forest was estimated at 0.14 acre-feet per year. Assuming an equivalent water offset per acre, the estimated water offset for the WRIA 15 Forests for Streamflow Project is itemized in Table E-17.

The acreage of potential forest projects identified by sponsors by subbasin, as well as the targeted acreage associated with the identified projects is provided in Table E-17. The total acreage is 1,723 acres, which yields an estimated water offset of approximately 241 AF per year.

Table E-17. Portfolio of Forests for Streamflow Projects in WRIA 15

Subbasin	Project Name (Sponsor, if known)	Description	Acreage	Potential Water Offset (AF per year)
Bainbridge Island	Springbrook Creek Protection and Restoration (Bainbridge Island Land Trust)	Purchase of 22.85 acres of intact stream, wetland, riparian and forest habitat and removal of fish passage barrier culvert in high priority protection site as identified in Springbrook Creek Watershed Assessment (Bainbridge Island Land Trust et al., 2018) and Washington State Department of Ecology Watershed Characterization.	22.85	3.2

Subbasin	Project Name (Sponsor, if known)	Description	Acreage	Potential Water Offset (AF per year)
North Hood Canal	Forests for Streamflow Projects, including: • Crabapple Creek Habitat Acquisition and Restoration • Little Anderson Creek Habitat Protection • Divide Block Habitat Acquisition and Restoration • Port Gamble Heritage Park Timber Rights Acquisition • Boyce Anderson DNR Parcel • Seabeck DNR Parcel • Grovers Creek Mainstem protection and restoration (Sponsors could be Great Peninsula Conservancy, Kitsap County and/or Port Gamble S'Klallam Tribe)	Forests for Streamflow projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Approx. 2,100 acres has been identified as potential projects by sponsors. The target acreage in this subbasin is 500 acres	70
South Hood Canal	Forests for Streamflow Projects, including: • Bear Creek Protection • Tahuya Headwaters (Sponsors could be Great Peninsula Conservancy and/or others)	Forests for Streamflow projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 500 acres	70
South Sound	Forests for Streamflow Projects, including: • Rocky Creek Preserve • Coulter Creek Overton Lands • Key Peninsula Forest Lands (Sponsors could be Great Peninsula Conservancy and/or others)	Forests for Streamflow projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 500 acres	70

Subbasin	Project Name (Sponsor, if known)	Description	Acreage	Potential Water Offset (AF per year)
Vashon-Maury	Forests for Streamflow Projects, including: • Judd Creek Headwaters • Shinglemill Creek Headwaters • Mileta Creek Headwaters • Christiansen Creek Headwaters • Fisher Creek Headwaters • Tahlequah Creek Headwaters (Sponsors could be Vashon-Maury Island Land Trust and/or King County)	Forests for Streamflow projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 100 acres	14
West Sound	Forests for Streamflow Projects, including: • East Branch Ostrich Bay Creek along Skylark Drive W. • Strawberry and L. Anderson Creek Parcel (Sponsors could be Great Peninsula Conservancy and/or others)	Forests for Streamflow projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 50 acres in	7
South Sound Islands	Anderson Island Forests for Streamflow Projects (Sponsors could include Anderson Island Parks District, Great Peninsula Conservancy, and/or Nisqually Land Trust)	Forests for Streamflow projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 50 acres	7
Totals			**Target is 1,723 acres**	**241**

The projects listed in Table E-17 need further evaluation to confirm that the properties meet the criteria of having forest stands greater than 40 years old and subject to harvest. In some cases, thinning could be required to make the acquired properties consistent with the project objectives.

Description of the anticipated spatial distribution of likely benefits.

The Forests for Streamflow Project will increase streamflow in streams adjacent to and downstream of the project locations identified in Table 1.

Performance goals and measures.

Project performance will be measured by the number of acres preserved by the WRIA 15 Forests for Streamflow Project and, by extension, the estimated water offset.

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

Streams within the WRIA 15 subbasins listed in Table 1 are inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW, 2021), which could include Chum Salmon, Chinook Salmon, Coho Salmon, Pink Salmon, steelhead, Bull Trout, kokanee, rainbow trout, and resident coastal cutthroat.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. Strategic land acquisition is an identified non-water offset project type that could achieve net ecological benefit (NEB).

This project has broad support among WRIA stakeholders. Potential project sponsors include the Bainbridge Island Land Trust, the Great Peninsula Conservancy, Kitsap County, the Port Gamble S'Klallam Tribe, the Vashon-Maury Land Trust, King County, Anderson Island Parks District, and the Nisqually Land Trust.

Barriers to project implementation could be acquisition of project funding and the willingness of existing landowners to sell the target acreage.

Potential budget and O&M costs.

The current cost of acquiring forest is estimated to be in the range of $10,000 to $15,000 per acre. Therefore, the total acquisition cost for 1,723 acres would likely be in the range of $17.2 to $25.8 million. These estimates do not include costs associated with site improvement (for example, forest thinning), if required.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the Forests for Streamflow Project Portfolio to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- Forest preservation is anticipated to provide water offset over a range of hydrologic conditions.
- Acquired Forests will be controlled by the purchasing entity and preserved long-term.
- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams 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 moderately resilient to the potential impacts of climate change based on the following:

- Forest preservation is anticipated to provide water offset over a range of climatic conditions.
- Sea level increase, on the order of several feet or less, likely would not impact project function.
- Wildfire damage to the project site and surrounding area would negatively impact project function for a period of years to decades.

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

Potential project sponsors include the Bainbridge Island Land Trust, the Great Peninsula Conservancy, Kitsap County, the Port Gamble S'Klallam Tribe, the Vashon-Maury Land Trust, King County, Anderson Island Parks District, and the Nisqually Land Trust. Sponsors generally are ready to proceed upon funding acquisition.

Documentation of sources, methods, and assumptions.

Bainbridge Island Land Trust, Bainbridge Island Watershed Council, City of Bainbridge Island, Washington Department of Ecology, and Wild Fish Conservancy. 2018. Springbrook Creek Watershed Assessment, Final Report. SRFB Project #14-1517. December 26. 111 p.

Moore, G. W., Bond, B. J., Jones, J. A., Phillips, N., and Meinzer, F. C. 2004. Structural and compositional controls on transpiration in 40-and 450-year-old riparian forests in western Oregon, USA. Tree physiology, 24(5), 481-491.

Nisqually Watershed Planning Unit. 2019. Nisqually Watershed Response to the 2018 Streamflow Restoration Act (RCW 90.94): Addendum to the Nisqually Watershed Management Plan. Olympia, WA.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

Perry, T.D. and Jones, J. A. August 2016. Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA. Ecohydrology, doi: 10.1002/eco.1790.

Segura, C., Bladon, K.D., Hatten, J.A., Jones, J.A., Hale, C., and Ice, G.G. 2020. Long-term effects of forest harvesting on summer low flow deficits in the Coast Range of Oregon. Journal of Hydrology, Volume 585, June 2020.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Accessed at: http://apps.wdfw.wa.gov/salmonscape/

Rain Garden and Low Impact Development (15-WRIA-OP3)

WRIA 15 WRE Subbasin

North Hood Canal, West Sound, Bainbridge Island, South Sound, and South Hood Canal Subbasins

Water Offset

188 acre-feet (AF) per year

Project Status

WRIA 15's Rain Garden and Low Impact Development (LID) Program will expand work being done by the Kitsap Conservation District (KCD), Pierce Conservation District (PCD), and Mason Conservation District (MCD) by increasing funding and expanding LID practices to projects and locations beyond the scope of the current programs.

The Rain Garden and LID Program at KCD works cooperatively with county services, landowners, and local communities to expand knowledge and use of LID practices throughout Kitsap County. With funding from Clean Water Kitsap, the KCD helps landowners to protect local water resources by providing information, technical assistance, and financial incentives toward the installation and maintenance of rain gardens and other LID solutions. Within this program, the KCD offers free site visits to any landowner in unincorporated Kitsap County to assess and discuss what LID projects are feasible for their property.

Between 2010 and 2020, the KCD Rain Garden and LID program has helped landowners fund and install approximately 320 rain gardens (KCD, 2020; KCD, Pers. Comm. with HDR, September 29, 2020). In 2014, the program expanded to include a number of new LID options in addition to rain gardens, such as rain barrels, lawn modification, soakage trenches, and native plants. 163 of these practices have been installed (KCD, 2020).

Based on 10 years of data, the KCD Rain Garden and Low Impact Development Program has cumulatively put 257 acre-feet of water back into the ground. The KCD estimates that they will continue to implement 50 new projects (40 rain garden plus 10 other projects) per year (KCD, Pers. Comm., September 29, 2020).

PCD and MCD also partner with landowners in the design and construction of LID projects. Specific data regarding the number and scope of historic PCD and MCD projects are not currently available.

Narrative Description

Rain gardens and LID retrofit projects are applied to existing homes and driveways, roadways, parking lots and other impervious areas to promote reuse and/or infiltration of stormwater. Project components include green stormwater infrastructure practices and can consist of rain gardens, planter boxes, bio-infiltration swales, permeable pavement, and/or replacement of conventional roadways with green streets. Selected rain garden and LID components are described below:

- Rain gardens are small stormwater facilities that collect, store, and filter rainwater and stormwater runoff from lawns, rooftops, sidewalks, driveways, and other impervious surfaces. Typically designed as shallow, sunken planting beds with rain garden soil, stormwater runoff flows into them from nearby hard surfaces and connected downspouts. Rain gardens can be designed to infiltrate stormwater water, recharging the shallow groundwater system.
- Planter boxes are rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in dense urban areas and as a streetscaping element.
- Bioswales are vegetated, mulched, or xeriscaped channels that provide stormwater treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater. Bioswales can be designed in a linear orientation, making them well suited for placement along streets and parking lots.
- Permeable pavement infiltrates, treats, and/or stores rainwater where it falls (without conveyance). They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. Permeable pavements can be installed in sections of a parking lot and used in conjunction with rain gardens and bioswales installed in medians and along the parking lot perimeter.
- Green streets are created by integrating green infrastructure elements into roadway design to store, infiltrate, and/or evapotranspire stormwater. Green streets can incorporate permeable pavement, bioswales, and/or planter boxes into roadway design.

The goal of this project is to support the implementation of rain garden and LID projects across WRIA 15, with an emphasis on subbasins that will experience the most growth and/or contain priority streams.

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

Within WRIA 15, the average rain garden and/or LID project is estimated to recharge shallow groundwater by 0.15 acre-feet per year (HDR, 2021). This offset assessment assumes that KCD will implement 50 projects (40 rain gardens plus 10 other projects) per year and PCD and MCD will each implement 10 projects per year.

The projected number of projects and potential water offset per subbasin is presented in Table 1. Given program initiation in 2022, the average annual offset by 2038 ranges from 13.5 AF per year in the Bainbridge Island subbasin to 66.5 AF per year in the South Sound subbasin. Total water offset is estimated to be 188 AF per year. This water offset is based on the assumption that the included projects pertain to properties where stormwater management, in the absence of the Rain Garden and LID Project, would be conveyed off-site by stormwater systems that do not recharge groundwater.

Table E-18. Estimated Annual Water Offset by Subbasin

Subbasin	Projected Number of New Projects Per Year	Project Percentage (Percent of total)	Water Offset by 2038 (AF per year)
North Hood Canal	10	14	27
West Sound	20	29	54
Bainbridge Island	5	7	13.5
South Sound	25	36	66.5
South Hood Canal	10	14	27
Total	**70**	**100**	**188**

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

The locations of future rain garden and LID projects have not been determined at the time this plan was prepared. For context, historic locations of KCD projects are provided herein. Figure E-18 presents the current KCD service area for rain gardens and LID projects.

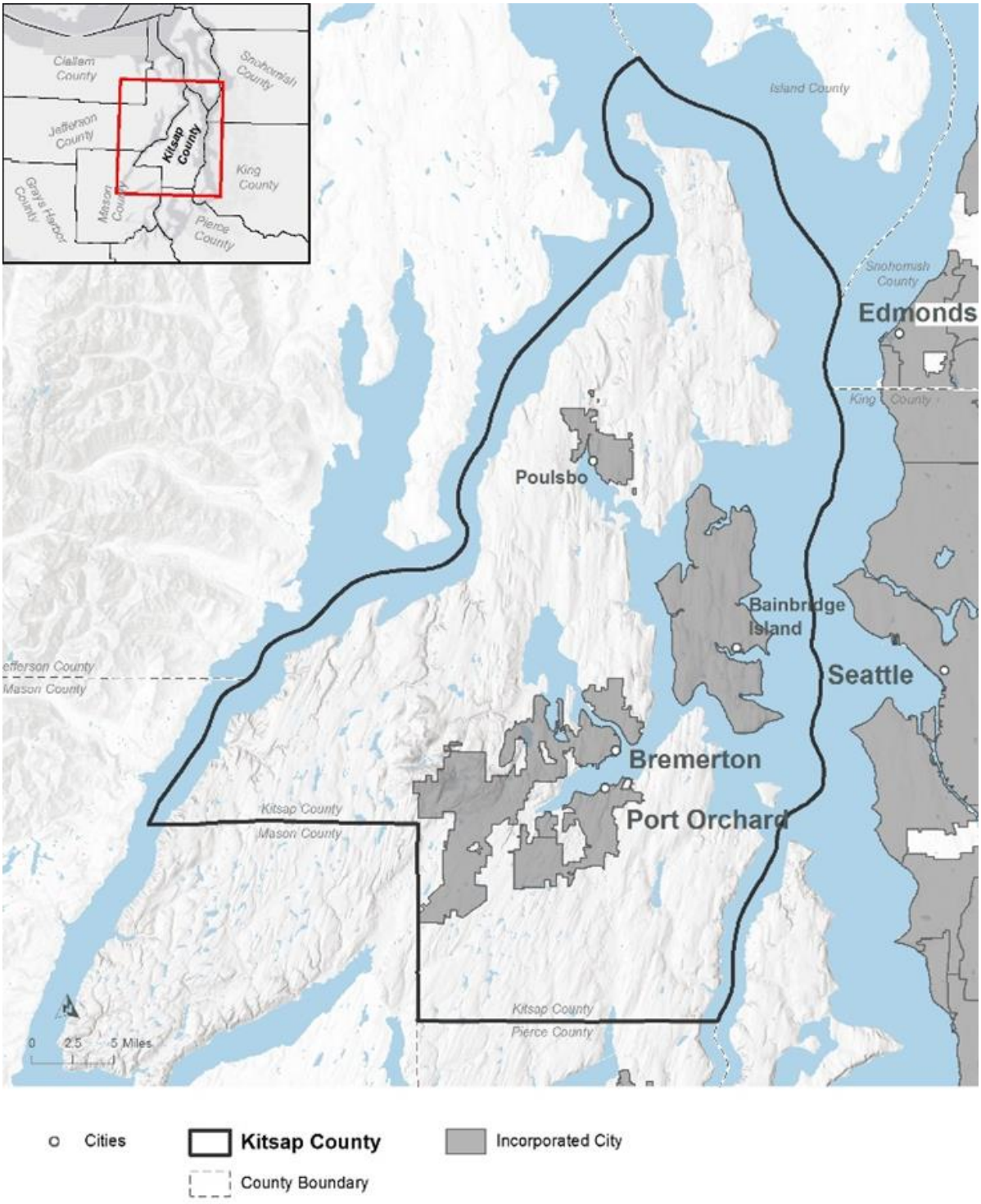

Figure E-18. Current KCD service area.

Figures E-19 through E-21 present the locations of projects associated with KCD's Rain Garden project between the years of 2010 and 2020 for KCD's North District, Central District, and South District, respectively.

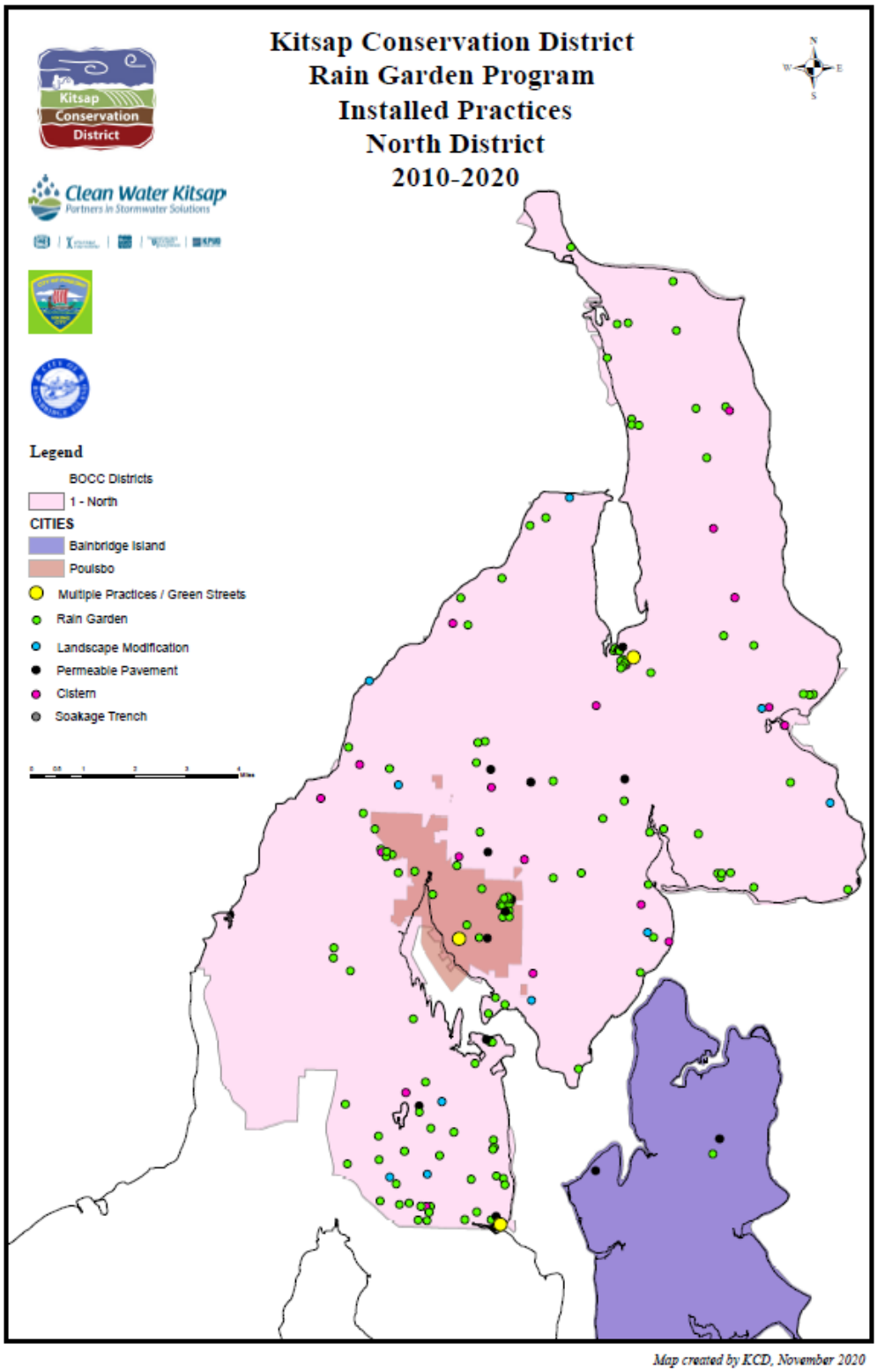

Figure E-19. KCD Rain Garden program projects within the North District (2010-2020).

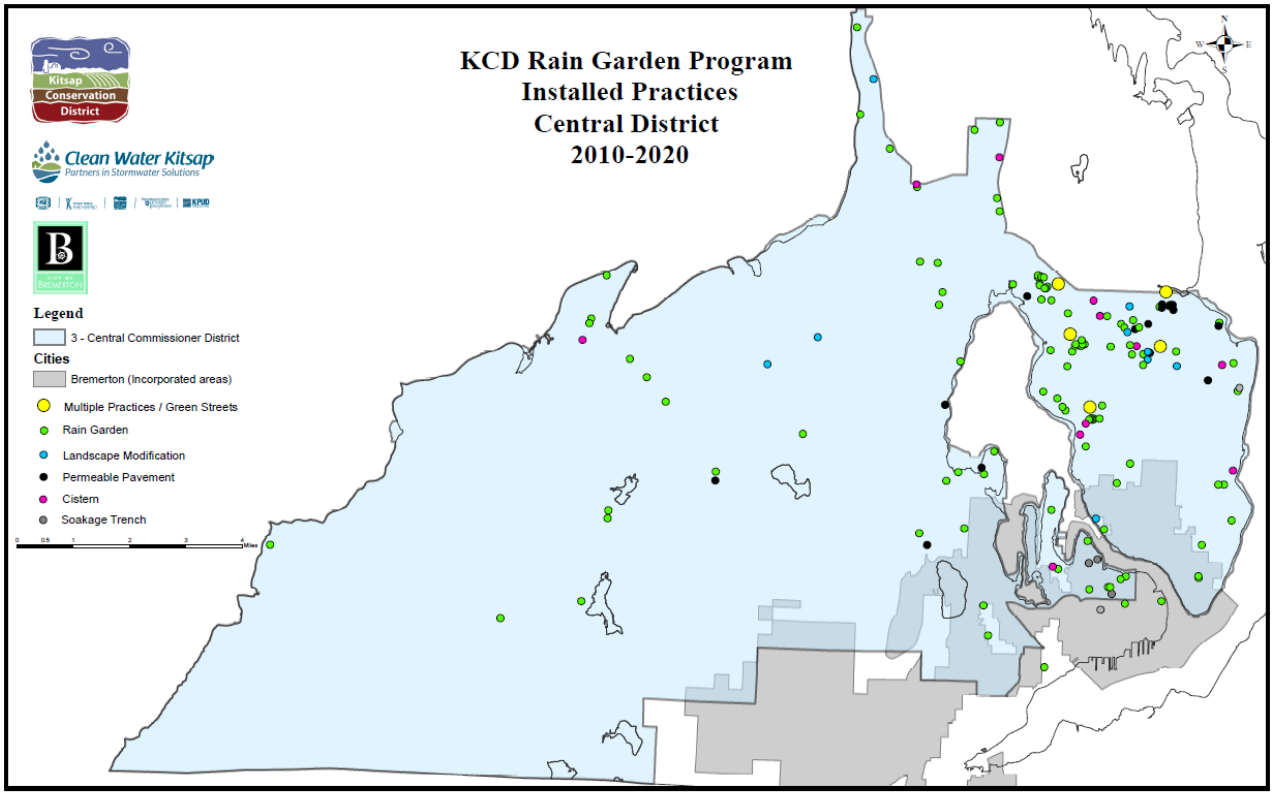

Figure E-20. KCD Rain Garden program projects within the Central District (2010-2020).

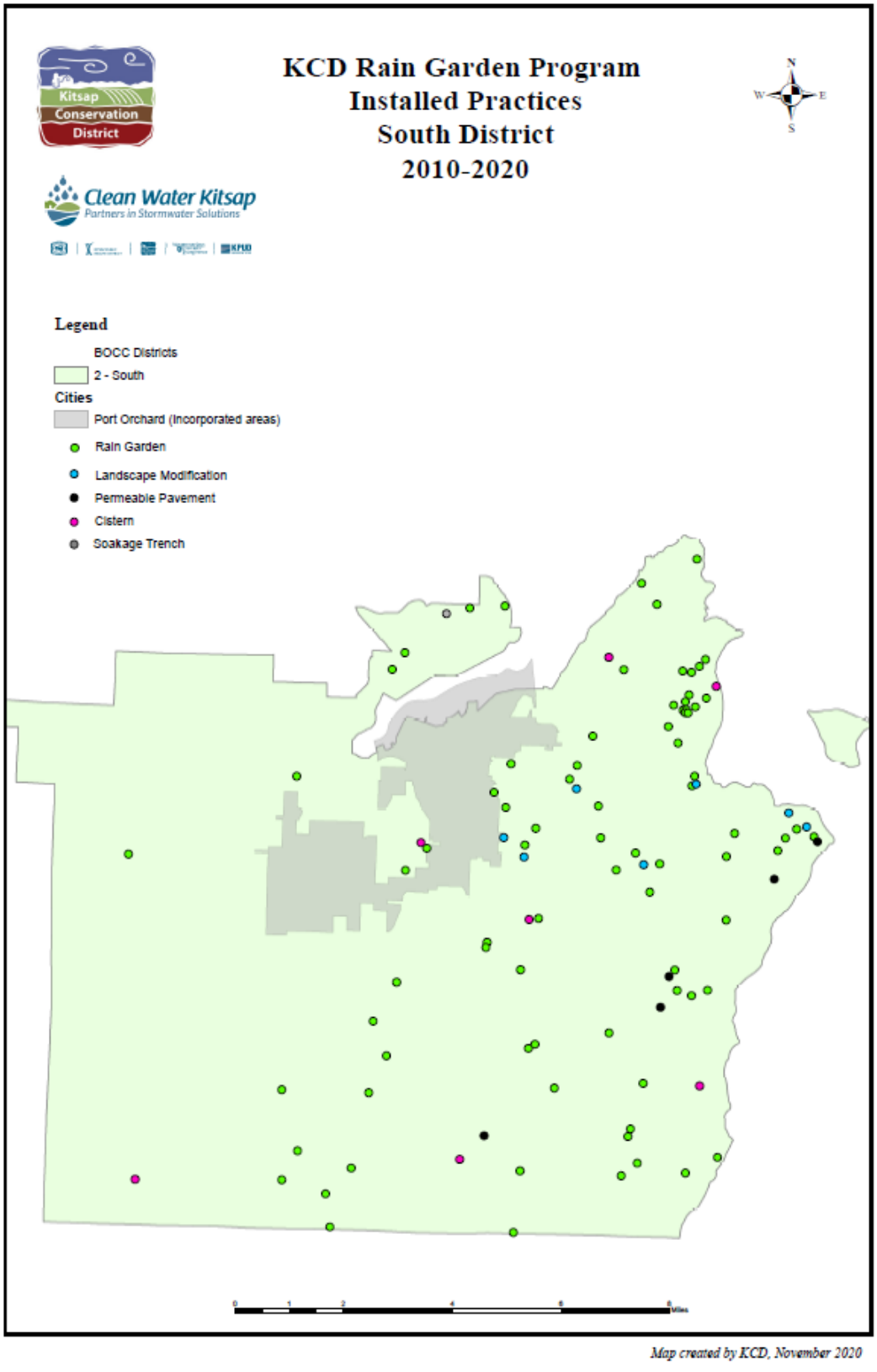

Figure E-21. KCD Rain Garden program projects within the South District (2010-2020).

Description of the anticipated spatial distribution of likely benefits.

WRIA 15's Rain Garden and LID Program will increase streamflow in streams adjacent to and downstream of future project locations. The spatial distribution of water offset benefits from this project would occur throughout the subbasins listed in Table E-18.

Performance goals and measures.

Project performance will be measured by the number of rain garden and LID projects constructed within WRIA 15 and, by extension, the estimated water offset.

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

Streams within the WRIA 15 subbasins listed in Table 1 are inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW, 2021), which could include Chum Salmon, Chinook Salmon, Coho Salmon, Pink Salmon, steelhead, bull trout, kokanee, rainbow trout, and resident coastal cutthroat.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. Water conservation and efficiency projects are an identified non-water offset project type that could achieve net ecological benefit (NEB).

KCD, PCD, and MCD will be the project sponsors and will coordinate the design and construction of the rain garden and LID sites. The districts will collect, compile, share, and report data.

Barriers to implementation of the WRIA 15 Rain Garden and LID Program include the availability of funding for new project construction and the willingness of private landowners to participate in the program.

Potential budget and O&M costs.

Average costs for rain garden and LID project implementation are summarized by the following:

- The estimated cost for relatively small rain garden or LID projects is in the range of $10 to $15 per square foot. Given an assumed project areas of 200 square feet, this yields an estimated construction cost of $2,000 to $3,000.
- The estimated cost for larger commercial projects (that utilize a general contractor) is in the range of $20 to $35 per square foot. Given an assumed project areas of 1,000 square feet, this yields an estimated construction cost of $20,000 to $35,000.

Additional costs would be incurred by the conservation districts for administrative, design and construction inspection.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of WRIA 15 Rain Garden and LID Program to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- Rain garden and LID implementation is anticipated to provide water offset over a range of hydrologic conditions, though the magnitude of the water offset will vary with precipitation amount.
- Rain gardens and LID components will be controlled by the purchasing entity and preserved long-term.
- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams 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 moderately resilient to the potential impacts of climate change based on the following:

- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project sites could impact project function.
- Sea level increase, on the order of several feet or less, likely would not impact project function.
- Project function could be impacted by a decrease in seasonal and/or annual precipitation.

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

Potential project sponsors include KCD, PCD, and MCD. Sponsors generally are ready to proceed upon funding acquisition and identification of willing landowners.

Documentation of sources, methods, and assumptions.

HDR. 2021. Appendix B, Draft Rain Garden and Green Stormwater Infrastructure/Low Impact Development Program. Prepared by HDR for the Washington State Department of Ecology. January 6. 14 p.

Kitsap Conservation District (KCD). 2020. 2010-18 KCD RG Program Practices – South, North, and Central Districts. https://kitsapcd.org/programs/raingarden-lid. Accessed September 28, 2020.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Water Rights Acquisition Project (15-WRIA-OP4)

WRIA 15 WRE Subbasin
Vashon-Maury Subbasin and Bainbridge Island Subbasins

Water Offset
146 acre-feet (AF) per year

Project Status
The Water Rights Acquisition Project acquires sensitive habitats and water rights in the Vashon-Maury Island sub-basin and the Bainbridge Island subbasin with the intent of enhancing instream flows and mitigating out of stream uses (i.e., reductions in flows associated with permit-exempt wells). To date, 27 water rights in 7 priority stream drainages have been identified, as summarized in Table 1, for Vashon Maury subbasin alone. Potential water right acquisition projects have also been identified for the Bainbridge Island subbasin, but details are not included here in order to protect privacy.

Narrative Description
Potential components of the Water Rights Acquisition Project consist of water right acquisition, removal of structures and impervious surfaces, wetland and riparian protection and restoration, and decommissioning permit exempt wells (PEWs). To support identification of potential water right acquisition projects, the Washington State Department of Ecology (Ecology) queried their Water Rights Tracking System (WRTS) database and provided tables and associated GIS data of all active water rights within WRIA 15 to the Watershed Restoration and Enhancement Committee (the Committee). Inactive water rights (for example, previously approved changes, cancelled or withdrawn applications) were excluded from the data by the committee and consultant. Pacific Groundwater Group completed an analysis in coordination with the Committee and local partners to determine the most likely water rights to pursue.

The raw tables of active water rights included over 8,500 water right files within WRIA 15. As an initial screening, water rights under consideration were limited to certificates and permits that included commercial and Industrial (CI), stockwater (ST), and irrigation (IR) uses. The list of water right permits and certificates was further reduced by removing any with a priority date later than the July 24, 1981 adoption date of Chapter 173-515 WAC, the instream flow rule for WRIA 15. Over 1,000 water rights in WRIA 15 met these screening criteria, including 86 water rights (70 surface water rights and 16 groundwater rights) in the Vashon-Maury Island subbasin.

The Committee identified priority streams in the Vashon-Maury Island subbasin for land conservation and water right acquisition projects. From generally north to south, priority streams include Shinglemill Creek, Beall Creek, Judd Creek, Fisher Creek, Christiansen Creek, and Tahlequah Creek on Vashon Island and Mileta Creek on Maury Island. These stream basins were prioritized because of their flow regime and salmon use. The water right list was then reviewed to identify water rights with points of diversion or withdrawal within the drainages of the priority streams, with a focus on water rights located near the headwaters of the streams.

As a result of the Committee's review, selected water rights excluded from the initial screening (e.g., claims and certificates with purposes of use other than commercial/industrial, stockwatering, and irrigation) were added back to the list of water rights for further evaluation. Twenty-seven water rights were identified in the priority stream drainages for the Vashon Maury subbasin. Twenty-six of the water rights authorize surface water diversions and one authorizes a groundwater withdrawal. These selected water rights are grouped by priority stream and the primary purpose of use in Table E-19.

Table E-19. Number of Selected Water Rights in Priority Streams by Primary Purpose of Use for Vashon Maury Subbasin

Priority Stream	Irrigation	Domestic	Stockwater
Beall	1	0	0
Christiansen	2	1	0
Fisher	3	1	0
Judd	3	3	0
Mileta	2	0	0
Shinglemill	3	3	1
Tahlequah	2	2	0
Total	**16**	**10**	**1**

Notes:

Domestic = Domestic General, Domestic Multiple, Domestic Single

The water rights listed in Table E-19 authorize a combined instantaneous diversion rate (Qi) of 1.569 cubic feet per second (cfs). However, only 13 of the 27 selected water rights list the associated annual quantity (Qa). The 14 water rights that do not provide a Qa include the stockwater right, 3 of the 10 domestic rights, and 6 of the 16 irrigation rights.

For Bainbridge Island, a minimum of four water rights were identified for further research. Through conversations with partners in the subbasin, two water rights, both located within the Manzanita Creek drainage, might be worth pursuing.

This project will benefit instream flows in priority streams by acquiring all or a portion of a selected water right and placing it into Ecology's Trust Water Right Program (TWRP). Quantitative benefits to instream flow would depend on the current use of the specific water right. For example, a domestic water right that diverts from a stream for indoor uses only might have a consumptive use (CU) of about 10 percent of total use. If the return flows from this use return to the same stream from which the water was diverted, placing this water right into the TWRP would have only limited benefit to instream flows. Conversely, an irrigation water right may have a CU of about 80 percent of total use (assuming reasonably efficient irrigation practices) and placing this water right into the TWRP would result in greater benefits.

Additionally, the period of use, or seasonality, will affect the portion of the year that instream flow benefits occur.

The project description only provides a general overview of the water rights in order to protect the privacy of the water right holders.

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

Direct benefits to instream flow in a priority stream would be realized through an interruption or retirement of the use of the acquired water rights. Depending on the specific opportunity, the eliminated water use could be supported by fallowing of irrigated fields, reducing hay harvest, changing to an alternate crop that does not require irrigation, removing livestock, or providing an alternate source of supply. The acquired water right would be placed into the TWRP and dedicated to instream flow purposes. By placing it into the TWRP, increases in instream flows realized by a project would be protected from future appropriation.

The potential water offset realized by a project would be limited to the consumptive impact on instream flows under the existing water right uses. A general discussion of the CU associated with irrigation, stockwater, and domestic uses is provided in the following paragraphs. Once a specific project or acquisition is selected, more detailed evaluation would be required to accurately quantify CU and assess the timing and location of instream flow offsets associated with placing a right into the TWRP.

The timing and location of water offset will depend on a number of factors, including:

- The period of use of the water right (for example, seasonal or continuous). A seasonal diversion might affect stream flows for part of the year, while a continuous diversion would likely affect stream flows year-round.
- Whether the right is for surface water or groundwater. Surface water diversions affect streamflow instantaneously. However, the effect of groundwater withdrawal on streamflow flows lags behind the pumping period, such that the effect of seasonal pumping begin a period of time after pumping begins and can persist for weeks to months after pumping ceases. Also, the location where groundwater withdrawal impacts streamflow tends to be more dispersed than a surface water diversion.
- Distance from a groundwater withdrawal to surface water.
- For a groundwater withdrawal, the hydrogeologic characteristics of the aquifer system and degree of hydraulic connection with surface water.

For irrigation water rights, CU is estimated based on the State of Washington Irrigation Guide (WIG) (NRCS, 1997) and Ecology Water Resources Program Guidance 1210 (Ecology, 2005). The WIG lists the crop irrigation requirement (CIR) for a variety of crops at stations throughout the state. The CIR is the amount of water needed from irrigation to support crop growth that is not

provided by precipitation or stored soil moisture. Based on the Bremerton station, CIRs in WRIA 15 range from about 4.51 inches (0.375 feet) for strawberries to 22.3 inches (1.86 feet) for raspberries. The CIR for grass/pasture, the most likely crop grown, is 16.8 inches (1.4 feet).

Guidance 1210 provides typical irrigation application efficiencies (Ea) and percent CU associated with different irrigation methods. The CIR divided by the application efficiency provides the total irrigation water requirement (TIR). Multiplying the TIR by the percent CU yields CU. Assuming sprinkler irrigation with an average Ea of 75 percent, TIRs per acre in WRIA 15 could range from about 0.5 feet to 2.5 feet, with a likely TIR per acre of 1.9 feet. Assuming a percent CU of 80 percent, CU could range from 0.4 feet per acre to 2 feet per acre, with a likely value of 1.5 feet per acre. The total CU for a water right is estimated by multiplying the irrigated acreage by the CU per acre.

For priority stream drainages, Table E-20 provides a summary of the potential ranges in CU, based on the CU per acre described above and the authorized irrigated acreage listed in the respective water rights for Vashon-Maury subbasin only. The CUs presented in Table E-20 are approximate; site-specific evaluations of crop type, irrigation methods, and irrigated acreage would be needed to precisely determine the CU associated with placement of specific water rights into the TWRP.

Table E-20. Authorized Irrigated Acreage and CU by Priority Stream Drainage for Vashon-Maury Subbasin

Stream Sub-Basin	Authorized Acreage	Low-End CU AFY	High-End CU AFY	Likely CU AFY
Beall	8	3.2	16	12
Christiansen	19	7.6	38	28.5
Fisher	42	16.8	84	63
Judd	30	12	60	45
Mileta	7	2.8	14	10.5
Shinglemill	11.5	4.6	23	17.3
Tahlequah	22	8.8	44	33
Total	**139.5**	**55.8**	**279**	**209.3**

Assuming irrigation-based CU reduction occurs in a 5-month period, retiring about 3 acre-feet of CU would equate to an average instream flow benefit of about 0.01 cfs during the irrigation season. The period during which CU impacts streamflow would coincide with the irrigation season (generally May through September) for a surface water diversion. However, as discussed above, there typically is a lag in the water offset timing in the case of a groundwater withdrawal. The magnitude of the lag would need to be estimated through site-specific hydrogeologic analysis.

Typical indoor domestic uses are expected to be about ten percent consumptive. Each of the domestic water rights in the priority stream drainages authorize use of less than 2 AF per year, therefore annual benefits to instream flow would be less than 0.2 AF per year per domestic water right. Acquiring domestic water rights would likely require providing an alternate source of supply (e.g., hookup to a public water system) or acquisition of the residential properties served by the water right. For stockwater rights the benefits would depend on the specific stock operation, including water uses and management and discharge of effluent. Although more limited in the potential amount of water that could be realized by retiring these water rights, domestic and stockwater water rights are expected to provide opportunities for year-round instream flow benefits not presented by irrigation water rights.

While the potential for water right acquisition benefits in WRIA 15 may be higher, Ecology was encouraged by local partners to account for a relatively low offset benefit in the plan. For Vashon-Maury Subbasin, that offset benefit is estimated at 56 AFY (Table E-20) at the request of King County based on the low-end CU estimate. For the Bainbridge Island subbasin, the offset benefit is estimated at 90 AF per year at the request of City of Bainbridge Island based on the most likely projects to proceed. Together, the offset benefit for WRIA 15 is estimated at 146 AF per year. There are likely other water rights in WRIA 15 subbasins that might be pursued by project partners that are not accounted for in this plan.

Description of the anticipated spatial distribution of likely benefits.

The Water Rights Acquisition Project will increase streamflow in the priority streams identified in Table 1 as well as additional streams on Bainbridge Island that are not listed due to privacy concerns.

Performance goals and measures.

Project performance will be measured by the CU retired by the water rights acquired by the project. Based on conservative (low-end) estimate, the projected benefit for both the Vashon-Maury and Bainbridge Island subbasins accounted for in this plan is 146 AFY.

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

Within the Vashon-Maury Subbasin, the Washington Department of Fish and Wildlife (WDFW, 2020a; WDFW, 2020b) has identified that Coho Salmon and Chum Salmon are present in Judd Creek and Shinglemill Creek, and the Endangered Species Act (ESA) listed Puget Sound fall Chinook Salmon are present in Judd Creek, the ESA-listed Puget Sound winter steelhead are present in Judd Creek, Christensen Creek, and Shinglemill Creek, and cutthroat trout are likely present in all Vashon and Maury Island creeks that have perennial flow (noted as present in Fisher Creek, Tahlequah Creek, Shinglemill Creek, Christensen Creek, and Mileta Creek). The Washington Stream Catalog (WDF, 1975) indicates that both Coho Salmon and Chum Salmon were historically present in Judd Creek and other creeks on Vashon Island, although there had been limited surveys of fish populations at that time. East Kitsap creeks were generally noted in the Stream Catalog (WDF, 1975) as having substantial low flow problems, lack of riparian cover, and fine sediment inputs from forestry and agricultural land uses. An impassable fish barrier

culvert is present at about rivermile 1 on Judd Creek and an impassable dam is present at rivermile 0.6 on Beall Creek (WDFW, 2020a), although the Beall Creek barrier has been prioritized for fish passage improvements.

Judd Creek and Fisher Creek are listed as Category 5 for high water temperatures on Ecology's 303(d) list of impaired waterbodies; Judd Creek and Shinglemill Creek are listed as Category 5 and Christensen Creek is listed as a Category 2 for bioassessment (poor quality based on macroinvertebrate sampling). Shinglemill Creek and Tahlequah Creek are listed as Category 1 for water temperature (Ecology, 2020).

Streams within the Bainbridge Island subbasin are inhabited by Coho Salmon, Fall Chum Salmon, and winter steelhead (WDFW 2020a and 2020b). Specifically, The Washington Department of Fish and Wildlife (WDFW 2020) has identified that Coho Salmon are present in both Manzanita Creek and the SF Manzanita Creek; the Endangered Species Act (ESA) listed Puget Sound winter steelhead are present in Manzanita Creek (although Manzanita Creek is not listed as critical habitat); and Chum Salmon are present at the mouth of Manzanita Creek.

Increased base streamflow and riparian and wetland restoration would contribute to reducing water temperatures that would benefit both adult migrants to spawning grounds and juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve survival of adults and both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA, 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration Act. Water right and acquisition and strategic land acquisition are an identified project types that could achieve net ecological benefit (NEB).

This project is anticipated to have broad support among WRIA stakeholders, such as King County and the Vashon-Maury Island Land Trust. Barriers to project implementation could be the availability of project funding and the willingness of existing water right holders/property owners to sell their water rights and/or property.

Potential budget and O&M costs.

Water right acquisition costs are location and market specific. For a planning-level estimate, costs per consumptive acre-foot of irrigation water or stockwater were assumed to be in the range of $1,500 to $6,500 (WestWater Research, 2019). Assuming a CU of 146 AF, this equates to a total project cost of $219,000 to $949,000.

Costs for acquisition of domestic water rights are likely to be strongly affected by the costs of providing an alternate water supply. These costs could be highly variable, depending on the availability and location of an alternate supply.

No ongoing O&M costs associated with water right acquisition are anticipated. O&M costs for property acquisition and associated habitat benefits through removal of structures and impervious surfaces, wetland and riparian protection and restoration, and decommissioning of PEWs will depend on the specific project opportunities and are not estimated herein.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the Water Rights Acquisition Project to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- Water right acquisition is anticipated to provide water offset over a range of hydrologic conditions.
- Acquired water rights will be controlled by the TWRP.
- Acquired property would be controlled by the project sponsor.
- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams 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:

- Water right acquisition is anticipated to provide water offset over a range of climatic conditions.
- Sea level increase, on the order of several feet or less, likely would not impact project function.
- Wildfire damage to the project site and surrounding area would not impact project function.

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

King County and the Vashon-Maury Island Land Trust are potential sponsors of the projects. Both entities have extensive experience with implementing similar projects and would be ready to proceed once funding is secured. Other land trust and environmental organizations in Kitsap County have expressed interest in pursuing water rights in other areas of the WRIA.

Documentation of sources, methods, and assumptions.

Ecology (Washington State Department of Ecology). 2005. Water Resources Program Guidance 1210, Determining Irrigation Efficiency and Consumptive Use. October 11. 11 p.

Ecology (Washington State Department of Ecology). 2020. 303(d) Assessed Waterbodies. Available at: https://apps.ecology.wa.gov/waterqualityatlas/StartPage.aspx

NRCS (United States Department of Agriculture Natural Resources Conservation Service). 1997. National Engineering Handbook, Irrigation Guide. September. 820 p.

WDF (Washington Department of Fisheries). 1975. "A Catalog of Washington Streams and Salmon Utilization, WRIA 15." Accessed at: https://www.streamnetlibrary.org/?page_id=95.

WDFW (Washington Department of Fish and Wildlife). 2020a. Salmonscape. Available at: http://apps.wdfw.wa.gov/salmonscape/map.html

WDFW. 2020b. Priority Habitats and Species on the Web. Available at: https://geodataservices.wdfw.wa.gov/hp/phs/

WestWater Research, LLC. 2019. Valuation of a Proposed Water Release Agreement, Final Report. Report prepared by WestWater Research of Boise, Idaho for the Washington State Department of Ecology and Seattle City Light. January 26. 29 p.

Appendix F: Water Rights Assessment Technical Memo

The following technical memo was developed for the WRIA 15 Committee process. Therefore, final conclusions as presented in this plan may not align with the technical memo.

Technical Memorandum

To: Department of Ecology WRIA 15 Watershed Restoration and Enhancement Committee

From: Burt Clothier, LHG

Joe Morrice, LHG

Re: Water Right Screening Methodology

Date: December 21, 2020

This technical memorandum documents the methodology used to screen and select water rights for potential use to support watershed restoration and enhancement projects in Water Resources Inventory Area (WRIA) 15, Kitsap. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 15 Watershed Restoration and Enhancement (WRE) Committee (the Committee) and the Department of Ecology (Ecology). This work was performed under Ecology Contract Number C1700029, Work Assignment PGG104.

Under RCW 90.94.030, Ecology has the responsibility to convene WRE committees and prepare WRE plans for eight WRIAs in the Puget Sound and Hood Canal areas. The general purpose of the plans is to document and offset projected depletion of instream flows resulting from new, permit-exempt domestic well uses in the WRIAs over the next 20 years.

To support development of the WRE plan for WRIA 15, PGG assisted the Committee in selecting a focused set of water rights for further review to assess potential benefits and suitability in offsetting impacts from permit-exempt wells on instream flows. This memorandum outlines the methodology used to develop the focused list of water rights.

PROCEDURE

Ecology staff queried their Water Rights Tracking System (WRTS) database and provided tables and associated GIS data of all active water rights within WRIA 15. Inactive water rights (e.g., previously approved changes, cancelled or withdrawn applications) were excluded from the data provided by Ecology. Water right claims and pending applications for new water rights or water right changes were also excluded.

The GIS data included the mapped place of use and point(s) of diversion or withdrawal locations, where available. Where Ecology does not have detailed location information for points of diversion or withdrawal, or such has not yet been added to their dataset, the default location is typically the nearest quarter or quarter-quarter section, based on the water right file information.

The Committee's desire was to identify classes or groups of water rights that could potentially be converted, purchased, or retired as mitigation water. The hope being that rights in key sub-basins could be found that, if applicable and available, could be use to off-set the projected impacts of

future permit exempt wells and/or provide an environmental benefit to local surface water bodies. Such mitigation projects require the combination of available water (legally and physically), willing seller and buyers, and methods to apply the water to the proposed mitigation purpose. This ranges from simply retiring the right back to the State where no further action is assumed and the water simply ceases to be used for its prior purpose up to more complex efforts where a right is changed to a new use or a new location (or both) and directly applied to the mitigation project (e.g. streamflow augmentation or groundwater recharge).

The tables of active water rights included over 8,500 water right files within WRIA 15. Following consultation with the Committee, PGG limited the water rights under consideration to certificates and permits[4] that included commercial and Industrial (CI), stockwater (S), or irrigation (IR) uses. Municipal and domestic (or multiple domestic) categories were excluded based on the expectation that these rights would not be available for conversion into sources of mitigation water. Irrigation rights were also classified based on the reported irrigated acreage.

The list of active water right permits and certificates was further reduced by removing any with a priority date later than the July 24, 1981 adoption date of Chapter 173-515 WAC, the instream flow rule for WRIA 15.

The list of active permits and certificates with CI, IR, and/or ST uses was reduced again based on authorized instantaneous (Qi) and annual (Qa) quantities. Water rights with both a Qi of less than 0.1 cfs (45 gpm) and a Qa of less than 10 acre-feet per year were excluded from further consideration. This was an arbitrary cut-off intended to focus on high-value possibilities over smaller ones and provide for more manageably sized lists.

The resulting data was subdivided by the priority subbasins identified by the Committee. The result was a suggested list for each subbasin of between six and 31 water rights. From these, a set of 13 rights were selected as example potential projects. Each of the rights were further researched and described in one- to two-page summaries for Committee review.

The Committee was tasked with review of both the subbasin lists and the 13 suggested water rights. Several committee members and Ecology staff provided comments during review and nine of the selected summaries were eliminated from further consideration. The remaining four were refined for use in the draft report planning. Follow-on conversations with Kitsap Conservation District (KCD) were also held to discuss the possibility that KCD may take on the future project of further organizing and utilizing the water rights lists to find and negotiate purchase or transfer of water rights as mitigation off-sets.

[4] This includes certificates, certificates of change, permits, and superseding permits.

Appendix G: Policy, Regulatory, and Adaptive Management Recommendations Proposed by the WRIA 15 Committee

The WRIA 15 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 15 partners that may choose to move these recommendations forward.

This language is taken directly from the WRIA 15 draft plan (version March 1, 2021) with only minor revisions to remove references to appendices.

Policy and Regulatory Recommendations

The Streamflow Restoration law lists optional elements that 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 15 Committee included “policy and regulatory recommendations” in the watershed plan to show support for programs, policies, and regulatory actions that would contribute to the goals of this watershed plan, including streamflow restoration and meeting NEB.

When similar concepts arose from multiple Watershed Restoration and Enhancement Committees, the WRIA 15 Committee coordinated with those other Committees to put forward common language for inclusion in the watershed plans, as appropriate. Coordination also occurred for jurisdictions that cross multiple watersheds.

As recommended by Ecology’s NEB Guidance, the WRIA 15 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" (Ecology 2019a). These policy and regulatory recommendations were developed by WRIA 15 Committee members and are not endorsed or opposed by Ecology.

The Committee initially identified a list of potential recommendations based on proposals brought forward by members. Through iterative rounds of discussion and feedback during Committee meetings, one-on-one conversations, and surveys, the Committee narrowed down recommendations to those presented below. Unless otherwise specified, the proposed implementing entity is not obligated by this plan to implement the recommendation; however, the Committee requests consideration of each recommendation by the identified implementing entity.

The WRIA 15 Committee provides the following recommendations (not listed in order of priority):

1. Track the number and location of permit-exempt wells

Proposed implementing entity: Department of Ecology

Recommendation: Change Ecology's well tracking system in the following ways to track the number and location of permit-exempt (PE) wells in use:

- Collect latitude and longitude of wells on well report forms;
- Identify PE wells on well log form; and
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

Purpose: Accurate tracking of the locations and features of PE wells will support the Committee's desire to engage in monitoring and adaptive management after plan adoption.

Funding source: If Ecology does not have capacity do this work with existing staffing and resources, the Committee recommends that the Legislature provide additional funding.

2. Monitoring and Research

Proposed implementing entity: Multiple agencies would likely be involved in monitoring. Ecology would coordinate the development of the strategy.

Recommendation: Develop a research and monitoring strategy for WRIA 15 that addresses topics such as the following:

- Streamflow monitoring (status and trends)
- Groundwater monitoring
- Precipitation and drought conditions
- Water usage and water supply data
- Improvements in modeling of surface and groundwater hydrology

Given the cost and effort involved in developing a comprehensive strategy, this effort may need to be phased and prioritized to address most urgent needs first. The implementation group will further develop details for the monitoring and research plan to provide data that informs adaptive management and implementation of the watershed plan.

Purpose: The WRIA 15 Committee desires monitoring data on the health of the watershed, including status and trends.

Funding source: Funding is needed either through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, or other means.

3. Annual Report on Monitoring

Proposed implementing entity: Ecology, with support from Kitsap PUD, Squaxin Island Tribe, and any other jurisdictions collecting flow data under an approved Quality Assurance Project Plan.

Recommendation: Compile annual monitoring data on the status of water resources and water quality in the basin over the past year, collected by Ecology or provided by partner jurisdictions. Partner jurisdictions are encouraged to provide relevant data to Ecology for inclusion. Monitoring of streamflows, groundwater, precipitation and drought conditions, water usage, and water supply could be included. This information should be provided to the WRIA 15 Committee or a new implementation group, if established.

Purpose: This recommendation provides additional information on water resources that will provide context for addressing adaptive management.

Funding source: It is assumed this can be completed with existing resources.

4. Report on Additional Water Resource Information

Proposed implementing entity: Ecology

Recommendation: By September of 2026, Ecology reports the following information with the support from the Washington Department of Health and local jurisdictions:

- Estimates of:
    - The total number of connections to PE wells currently in use, as described in RCW 90.94.030(3)(b).
    - The number domestic and municipal water rights in use and their current quantity of use, including estimates of inchoate water remaining in municipal water rights, and categorized by whether they are mitigated or not and which subbasin they are in, as described in RCW 90.94.030(3)(c).
    - The cumulative consumptive water use impacts on instream flows from all pre-2018 PE wells and unmitigated municipal water rights, as described in RCW 90.94.030(3)(d)(e).
- An evaluation of the costs of offsetting all new domestic water uses over the next 20 years, as described in RCW 90.94.030(3)(d). The initiation of adjudication would be considered an acceptable substitute for this study.

Purpose: This recommendation collects additional information on water resources that will provide context for addressing adaptive management.

Funding source: Grant funding or a legislative appropriation will be necessary to hire consultant assistance to Ecology for this effort.

5. South Sound and South Hood Canal Planning Study

Proposed implementing entity: State, local, and tribal governments in WRIA 15

Recommendation: Conduct a study of how county and local government planning and permitting influences water management within WRIA 15 and potential opportunities to improve:

1) Water management outcomes that support aquatic habitat and human needs.
2) Efficiencies and potential cost savings.
3) Information sharing among the various governmental entities.

The study should focus on how management can protect and enhance streamflows, groundwater recharge, and other water resource management efforts that support aquatic habitat and water supply.

Purpose: This study could identify opportunities for improved outcomes at potentially lower costs.

Funding source: Grant funding or a legislative appropriation will be necessary to hire consultants to complete this study.

6. Drought Response Planning

Proposed implementing entity: Local governments

Recommendation: Local governments develop and implement a drought response plan if they do not already have one. Local governments review existing drought response plans for potential updates.

- Ecology and Department of Health provide technical assistance.
- The plans should include an education and outreach program to educate and notify the public about water conservation and drought water use limitations and practices.

Purpose: Drought response will be an important component of protecting streamflows. Clear plans and education by all local governments will better prepare the watershed for droughts.

Funding source: Grant funding or other funding may be needed by some local governments.

7. Recycled Water

Proposed implementing entity: Washington State Legislature and/or Ecology

Recommendation: Enact state policies that encourage the development and use of reclaimed water.

Purpose: Using reclaimed water will:

- Offset water that would otherwise be diverted from rivers and streams, thus preserving natural high-quality instream flow;
- Reduce the amount of treated wastewater discharged into receiving water bodies; and Create water supply options, which makes the water supply system more resilient against drought and climate change.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means. Individual projects and construction components will have to be funded with a market-based approach.

8. Water Conservation Education

Proposed implementing entity: Ecology and counties with support from conservation districts and non-governmental organizations.

Recommendation: Ecology should partner 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.

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.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means.

9. Water Conservation Statewide Policy

Proposed implementing entity: Ecology and/or local governments

Recommendation: Implement mandatory water conservation measures in unincorporated areas of the state during drought events. Measures would focus on limiting outdoor water use with exemptions for growing food.

Purpose: Reduce water usage in key subbasins (especially during drought), reduce impacts on stream flows, and increase climate change resilience.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means.

10. Beaver Habitat and Streamflow

Proposed implementing entity: Varies; see details below.

Recommendation:

1. **Map and protect likely beaver habitat:** The Committee recommends a pilot project with Kitsap County and Great Peninsula Conservancy to identify potential easements to purchase and protect as beaver habitat. The Committee recommends combining mapping and

modeling to understand both the water holding potential and beaver habitat suitability of selected areas. Easements would be purchased on a voluntary basis and certain areas of the WRIA need to be protected for drinking water.

2. **Education & outreach:** The Committee recommends a partnership between local organizations to develop and implement an education and outreach program to landowners regarding beavers and beaver management. The partners could also reach out to entities to address known concerns (e.g., tree loss, hazard trees, encroaching on farmland, change of vegetation, flooding) associated with beavers and discuss management options.

3. **Monitoring & research:** The Committee recommends developing a monitoring program for beaver habitats which may include collecting information on fish passage, groundwater levels, vegetation types, permits, and beaver dam analogues versus natural beaver habitat. Streamflow and habitat benefits should be quantified where possible to help define the benefit from a surface water / habitat perspective (e.g., temperature, streamflows, salmon, riparian vegetation, etc.). Implementing entities could include local jurisdictions, tribes, federal or state agencies.

Purpose: Beaver habitat can provide benefits to streamflows. A multi-faceted approach would provide additional tools for jurisdictions and landowners to help manage beavers.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means.

11. Financing

Proposed implementing entity: Legislature and/or Committee members or other stakeholders

Recommendation: The Committee recommends the Legislature provides funding for plan implementation, monitoring, and adaptive management of the plan, including:

- Annual tracking of new PE wells and project implementation by subbasin;
- Staffing for the ongoing Committee;
- Ongoing Committee member participation; and
- Developing a process to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan (e.g., identification and development of alternative projects, etc.).

If necessary, the Committee may also recommend additional funding including grants, fees, shared contributions from members and other stakeholders, and other sources that may emerge.

Purpose: Plan implementation is key to success and it will take ongoing funding.

Funding source: Legislature or others.

Adaptive Management Recommendations

The Committee recommends an adaptive management process for implementation of the WRIA 15 watershed plan. Adaptive management is defined in Ecology's Final NEB Guidance as "*an interactive 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"* (Ecology 2019b). The WRIA 15 Committee set a goal of offsetting consumptive use estimates within each subbasin and agreed that offsets should be as close to impacts (i.e., new wells) to the extent feasible. This watershed plan also has an offset target of 1,218 AF/yr for project implementation in order to benefit to streams. Adaptive management will be necessary to achieve the goal of meeting offset needs within each subbasin and improving streamflow where this watershed plan currently falls short, through the identification, development and implementation of projects throughout WRIA 15.

Adaptive management will:

- Be informed through monitoring, research, tracking and reporting.
- Help address uncertainty.
- Ensure that the goals of this plan are being met.
- Provide more reasonable assurance for plan implementation.
- Provide information to improve implementation of streamflow restoration projects and actions.
- Track implementation costs and developing grant funding opportunities.
- Adaptively manage emerging plan implementation needs.

To support implementation of the watershed plan, RCW 90.94 includes a statement on the Legislature's intent. RCW 90.94 Intent—2018 c 1: "The Legislature intends to appropriate $300 million for projects to achieve the goals of this act until June 30, 2033. The Department of Ecology is directed to implement a program to restore and enhance streamflows by fulfilling obligations under this act to develop and implement plans to restore streamflows to levels necessary to support robust, healthy, and sustainable salmon populations." [2018 c 1 § 304.]"

1. Project, Policy, and Permit-Exempt Well Tracking

The Committee recommends tracking the growth of PE wells in the watershed as well as the projects and policies that were planned to offset the impacts of these PE wells. This data will allow the Committee to determine whether planning assumptions were accurate and whether adjustments to plan implementation are needed.

A. The WRIA 15 Committee recommends tracking the following information on an ongoing basis:
   - New building permits issued that include PE wells and total number of permits issued since January 2018.
   - Status of implementation for each project included in the plan.
   - Status of policy recommendations included in the plan.

- An ongoing list of new PE wells in the WRIA since the enactment of RCW 90.94.
    - The lists of building permits and projects will be organized by subbasin, and (if feasible) represented on a map that includes subbasin delineations. Counties are encouraged to provide parcel or other geographic information in their reports to Ecology to support mapping by subbasin.

  Data may be evaluated at a more refined scale to improve understanding of the impacts and benefits (e.g., Watershed Assessment Unit, subregions or HUC 12).

B. To assess the status of project implementation, the Committee recommends using the Salmon Recovery Portal (https://srp.rco.wa.gov/about), managed by the Washington State Recreation and Conservation Office (RCO), to support project tracking.
    - The Washington Department of Fish & Wildlife (WDFW), in collaboration with RCO, would coordinate the implementation of project tracking through the Salmon Recovery Portal.
    - Project sponsors are expected to support project tracking efforts and data sharing.
    - To improve harmonization of streamflow restoration with ongoing salmon recovery efforts, local salmon recovery Lead Entity Coordinators will be consulted prior to initial data uploads; however, Coordinators will not be expected to provide ongoing support for project entry, maintenance, or reporting.
    - University of Washington data stewards, contracted by WDFW, will conduct data entry, quality assurance, and quality control. If this approach changes, WDFW will propose an alternative method for completing this task.
    - Entities with representation in the WRIA 15 Committee (or an implementation group, if created) are encouraged to assist as needed with coordination, data gathering and input, and tracking.

Table G-1 summarizes the entities responsible for implementing the tracking and monitoring recommendation and associated funding needs.

Table G-1. Entities identified as responsible for implementation actions.

Action	Entity or Entities Responsible	Funding Considerations
Track building permits issued with PE wells (including new connections).	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 sub-basin.	Ecology	Information included with data on new PE wells, provided by local governments. No additional funding is needed.
Maintain a summary of the status of implementation for each project.	Ecology via the Salmon Recovery Portal, with support from WDFW, RCO, and project sponsors	WDFW may need additional funding to support maintaining the Salmon Recovery Portal.
Maintain a summary of the status of each policy recommendation.	Implementation Group	Additional funding may be needed to gather status updates.

2. Reporting and Adaptation

The Committee recommends that Ecology provides the data collected above to all entities represented on the Committee and other interested parties through annual reporting and a self-assessment as described below. These reports and assessments will help determine whether the plan's recommendations are being implemented and whether they are having the intended impacts.

A. The WRIA 15 Committee recommends annual reporting as follows:
    - By September of each year, Ecology will prepare an annual report that includes:
        - A list of total building permits issued in the prior calendar year along with the total number of associated new domestic PE wells, using the information provided to Ecology by the local jurisdictions.
        - A brief description of the status of WRIA 15 projects and actions included in this plan (descriptions may be drawn from the Salmon Recovery Portal, if available).
            - If the project as implemented differs significantly from the original description or assumptions included in the plan, the annual report will also include an estimate of changes to the offset benefit.
        - Other implementation actions to date, including any changes in approach since the last report and any challenges identified that may require adaptation in plan implementation.
        - The lists of building permits and projects, organized by subbasin, and (if feasible) represented on a map that includes subbasin delineations. Counties

are encouraged to provide parcel or other geographic information in their reports to Ecology to support mapping by subbasin.

- The first annual report should include an estimate of expenses necessary for plan implementation and associated funding options. Funding options could include:
  - Local or state fees, including PE well fees
  - Grants
  - State funding
- Ecology will share the report with Committee members and other interested parties.

B. The WRIA 15 Committee recommends preparing a self-assessment every five years as follows:
   - By September of 2026, and every five years thereafter during the planning horizon period, Ecology will compile and report (based on available information from previous reports and partners):
     - All cumulative information required in the annual report.
     - Estimated water offset quantities, consumptive use, and instream flow benefits realized through implementation of projects and actions identified in this plan.
     - A comparison of each item above to the original assumptions included in the plan and a summation of overall ecological benefit (i.e., greater than expected, less than expected, or about the same as expected).

C. The WRIA 15 Committee believes a group of engaged stakeholders and tribal representatives are needed to continue collaboration on the implementation of this plan. The Committee recommends continuing to meet as needed, with participation from all interested WRIA 15 representatives.
   - Interested WRIA 15 Committee members, or a new implementation group if established, will convene annually via telephone to:
     - Review and discuss the annual report.
     - Share updates on project and policy implementation.
     - Discuss or develop recommendations for revisions, additions, or deletions to planned projects or actions.
   - Every five years, interested WRIA 15 Committee members, or a new implementation group if established, will hold a series of meetings to conduct the self-assessment, which includes:
     - Reviewing the five-year assessment report from Ecology.
     - Developing recommendations to adapt projects and actions to meet NEB, including reaching the higher offset targets by subbasin.
     - Updating data and assumptions.
     - Other items identified by Committee members.
   - Additional meetings may be scheduled as needed.
   - Kitsap PUD has offered to play the role of coordinating an implementation group for WRIA 15 using existing capacity and will seek funding opportunities to

support their role. Kitsap PUD will convene interested member entities of the Committee to form the implementation group in the summer of 2021. This group will consider the following activities related to plan implementation:

- Redefining the WRIA 15 Committee, which could include a new name, charter, and/or supporting interlocal agreement.
- Identifying project development lead(s) and supporting project development;
- Identifying triggers for adaptive management and developing responses to emerging challenges;
- Coordinating monitoring and research;
- Coordinating reporting;
- Identifying funding mechanisms to provide capacity for the Committee members and facilitator; and
- Other tasks as needed.

Table G-2 summarizes the entities responsible for carrying out the reporting and adaptation recommendation and associated funding needs.

Table G-2. Implementation of Reporting and Adaptation Recommendation.

Action	Entity or Entities Responsible	Funding Considerations
Annual Reports	• Local jurisdictions provide building permit information to Ecology. • Ecology compiles information on project status, drawn from the Salmon Recovery Portal. • Entities provide monitoring data to Ecology for inclusion in reports. • Ecology combines monitoring data from within the agency with data provided by other entities. • Ecology compiles information into a single report for distribution to the Committee and other interested parties.	• Local jurisdictions are already required to provide building permit information to Ecology (no additional funding needed). • Ecology staff would compile reports using existing resources. • WDFW may need additional funds to manage the Salmon Recovery Portal.
Five-Year Self-Assessment:	• Local jurisdictions provide building permit information to Ecology. • Ecology compiles information on project status, drawn from the Salmon Recovery Portal. • Entities provide monitoring data to Ecology for inclusion in reports. • Ecology combines monitoring data from within the agency with data provided by other entities. • Ecology prepares estimates of the quantity of water, instream flow, and habitat benefits realized through implementation of projects and actions identified in this plan. • Ecology compiles information into a single report for distribution to Committee and other interested parties. • WRIA 15 Committee convenes to prepare adaptation recommendations on changes to planned projects or actions.	• Local jurisdictions are already required to provide building permit information to Ecology (no additional funding needed). • Ecology may need funding to complete the estimate of realized benefits. • State funding or staff support will be needed to reconvene a group to prepare recommendations. • Committee members who cannot participate in meetings using existing resources will need additional funding. • Kitsap PUD may need additional funding to support their role in convening the implementation group.

3. Funding

The WRIA 15 Committee recommends ongoing implementation oversight and a process to adaptively manage the plan as new information emerges. The Committee recommends the Legislature provides funding for monitoring and adaptively managing the plan, including:

- Annual tracking of new PE wells and project implementation by subbasin.
- Staffing for the ongoing Committee.
- Ongoing Committee member participation; and
- Developing a process to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan (e.g., identification and development of alternative projects, etc.).

Table G-3 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table G-3. Summary of WRIA 15 Adaptive Management Funding Recommendation.

Action	Entity or Entities Responsible	Funding Considerations
Funding of Adaptive Management	Legislature	The Legislature should provide funding and authorize plan implementation to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan.

4. Assurance of Plan implementation

The WRIA 15 Committee prepared this watershed plan with the intent that the plan is fully implemented. Members of the Committee provided the following statements to support implementation of the watershed plan:

- Washington Department of Ecology will:
    - Follow NEB Guidance in reviewing the watershed plan and considering plan adoption.
    - Administer the streamflow restoration competitive grant program as authorized under RCW 90.94.060 and Chapter 173-566 WAC.
    - Consider watershed plan recommendations where Ecology is identified as the lead.
    - Report to the Legislature as required under RCW 90.94.050 in 2020 and 2027.
- King County:
    - Supports and participate in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities.
            - Seeking and supporting funding opportunities to achieve implementation.
            - Tracking implementation and identifying areas for improvement.
- Kitsap County:
    - Contingent on funding and resources, Kitsap County commits as follows in support of the Plan:
        - Participate in annual and 5-year Adaptive Management meetings.
        - Participate in intervening meetings or an implementation group and participate in adaptive management actions to support Plan implementation.
        - Support the Department of Ecology in its compilation of the Plan's 5-year self-assessments.
        - Continue to annually report permit data associated with permit-exempt wells to the Department of Ecology.
        - Continue to collect fees and transmit them to the Department of Ecology per RCW 90.94 for residences constructed with permit-exempt wells.
        - Continue to provide permit and parcel data to the Department of Ecology as needed to support the Plan's capital and non-capital projects, and the Plan's adaptive management activities.

        - Support acquisition of funding from the State Legislature and grant sources for plan implementation.
        - Continue design and implementation of the Kingston Treatment Plant Recycled Water project.
        - Partner with the Washington State Department of Fish and Wildlife (WDFW) and the Great Peninsula Conservancy (GPC) to implement the "Beaver Package" including:
            - Ongoing coordination with WDFW and GPC;
            - Mapping of potential beaver habitat to identify candidate sites for easement protection with the expectation that GPC will lead easement acquisition efforts;
            - Examination of the feasibility and possible adaptation of Kitsap County's transfer of development rights program to support the Beaver Package; and
            - Inclusion of beaver pond presence/absence in stream assets in the County's natural resources asset management system currently in development.
        - Propose and consider language regarding coordination with WRIA-15 WREC Plan in the County's 2024 Comprehensive Plan update
        - Provide infiltration design data for the Koch Creek Regional Stormwater Facility, previously completed, for the purpose of calculating offset value toward the Plan's objectives.
        - Complete the Ridgetop Boulevard Green Street LID Retrofit Phase III and provide infiltration design data for project phases 1, 2, and 3 for the purpose of calculating offset value toward the Plan's objectives.
        - Support and consent to the acquisition of Port Gamble Heritage Park timber rights for forest health, preservation, and restoration purposes, subject to existing agreements that may encumber the properties.

- Mason County will:
    - Support collaboration among WRIA 15 members to implement a comprehensive strategy for balancing competing demands for water, while at the same time preserving and enhancing the future integrity of the WRIA 15 watershed basin.
    - Adopt this watershed plan by resolution, formalizing our support of the plan contents.
    - Support and participate in implementation activities, as staff capacity and funding allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities.
            - Seeking and supporting funding opportunities to achieve implementation.

        - Tracking implementation and identifying areas for improvement.
- Pierce County will:
    - Approve this watershed plan by resolution, formalizing our support of the plan contents.
    - Use the plan as a source document for new projects, to be considered bi-annually for inclusion in the Surface Water Improvement Plan (SWIP).
    - Watershed plan becomes one of the guiding project implementation plans for the Surface Water Improvement Plan (SWIP).
    - Evaluate and prioritizes capital projects included in this plan for placement into the Capital Facilities Plan.
    - Support and participate in implementation activities as staff capacity allows, including:
        - Participating in annual implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities.
            - Seeking and supporting funding opportunities to achieve implementation.
            - Tracking implementation and identifying areas for improvement.
- City of Bremerton will:
    - Support and participate in implementation activities, as staff capacity allows, including participating in annual implementation group meetings.
- Squaxin Island Tribe will:
    - Participate in implementation group meetings.
    - Support project development and seek project opportunities.
    - Seek and support funding opportunities that support implementation.
    - Monitor implementation and identify areas for improvement.