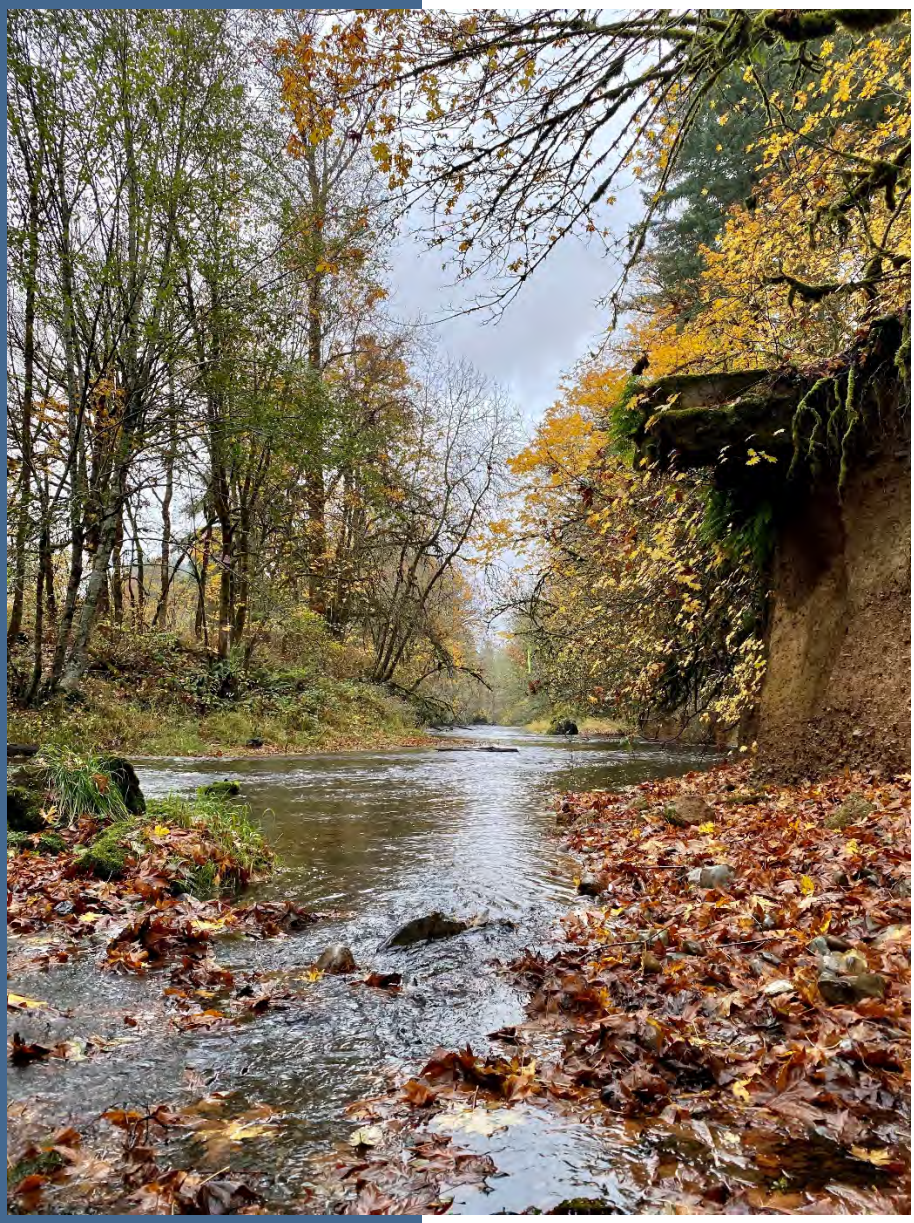

Watershed Restoration and Enhancement Plan

WRIA 14
Kennedy - Goldsborough Watershed

Final Draft Plan
~~February 3~~April 21, 2021

Publication Information

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Cover photo credit: Confluence of the historic mouth of Coffee Creek and Goldsborough Creek, Allison Cook (Washington Department of Fish and Wildlife)

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Acknowledgements

This watershed plan was written as a collaboration between the Department of Ecology, the WRIA 14 Committee, and the technical consultants. We express our sincere gratitude to those that supported the development of the plan and supplemental materials.

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Executive Summary

In January 2018, the Washington State Legislature passed the Streamflow Restoration law (RCW 90.94) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. The law, directs the Department of Ecology to lead local planning Committees to develop Watershed Restoration and Enhancement Plans that identify projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over the next 20 years (2018 – 2038) and provide a net ecological benefit to the watershed[2]. This Watershed Restoration and Enhancement Plan was written to meet the guidance and policy interpretations as provided by the Department of Ecology.

The Department of Ecology (Ecology) established the Watershed Restoration and Enhancement Committee (Committee) to collaborate with tribes, counties, cities, state agencies, and special interest groups in the Kennedy-Goldsborough watershed, also known as Water Resource Inventory Area (WRIA) 14. The WRIA 14 Committee met for over 2 years to develop a watershed plan.

To allow for meaningful analysis of the relationship between new consumptive use and offsets, the WRIA 14 Committee divided the watershed into seven subbasins. Subbasins help describe the location and timing of projected new consumptive water use, the location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects.

This watershed plan projects 4,294 permit exempt (PE) well connections over the 20-year planning horizon. The projects and actions in this watershed plan will address and offset the consumptive water use from those 4,294 PE well connections. The projected new consumptive water use associated with the new PE well connections is 759 acre-feet per year in WRIA 14, which the Committee determined to be the "most likely" estimate. This equates to 1.05 cubic feet per second (cfs) or 677,591 gallons per day (gpd). This watershed plan also presents a higher adaptive management goal for project implementation of 1,034 acre-feet per year (1.43 cfs or 923,096 gallons per day) in order to support streamflows.

This watershed plan includes projects that provide an anticipated offset of 891 acre-feet per year to benefit streamflows and enhance the watershed. Additional projects in the plan include benefits to fish and wildlife habitat, such as several thousand feet of streambed improvements,

[2] Some members of the WRIA 14 Committee have different interpretations of RCW 90.94.030. Statements from entities and other documents provided in the Compendium provide more information on their interpretations, which apply throughout this plan.

dozens of acres of restoration and protection, and many miles of riparian restoration across WRIA 14.

The project offset benefits provide an estimated offset of 891 AFY and exceeds the "most likely" consumptive use estimate at the WRIA scale. The project offset benefits do not meet the higher adaptive management goal consumptive use estimate. At the subbasin scale, estimated offsets exceed both the "most likely" and higher adaptive management goal consumptive use estimates in the Goldsborough, and Hood, subbasins. Conversely, estimated offsets fall short of both the "most likely" and higher adaptive management goal consumptive use estimates in all other subbasins.

To increase the reasonable assurance for plan implementation and tracking progress, this watershed plan includes policy and regulatory recommendations and an adaptive management process. The nine policy and regulatory recommendations are included to contribute to the goals of this watershed plan, including streamflow restoration and meeting net ecological benefit. These recommendations enhance water conservation efforts; improve research, monitoring, and data collection; plan for better drought response; and finance plan implementation. The watershed plan describes an adaptive management approach, which identifies a lead organization to coordinate an ongoing implementation group to support implementation, a tracking and reporting structure to assess progress and make adjustments as needed, and a funding mechanism to adaptively manage implementation.

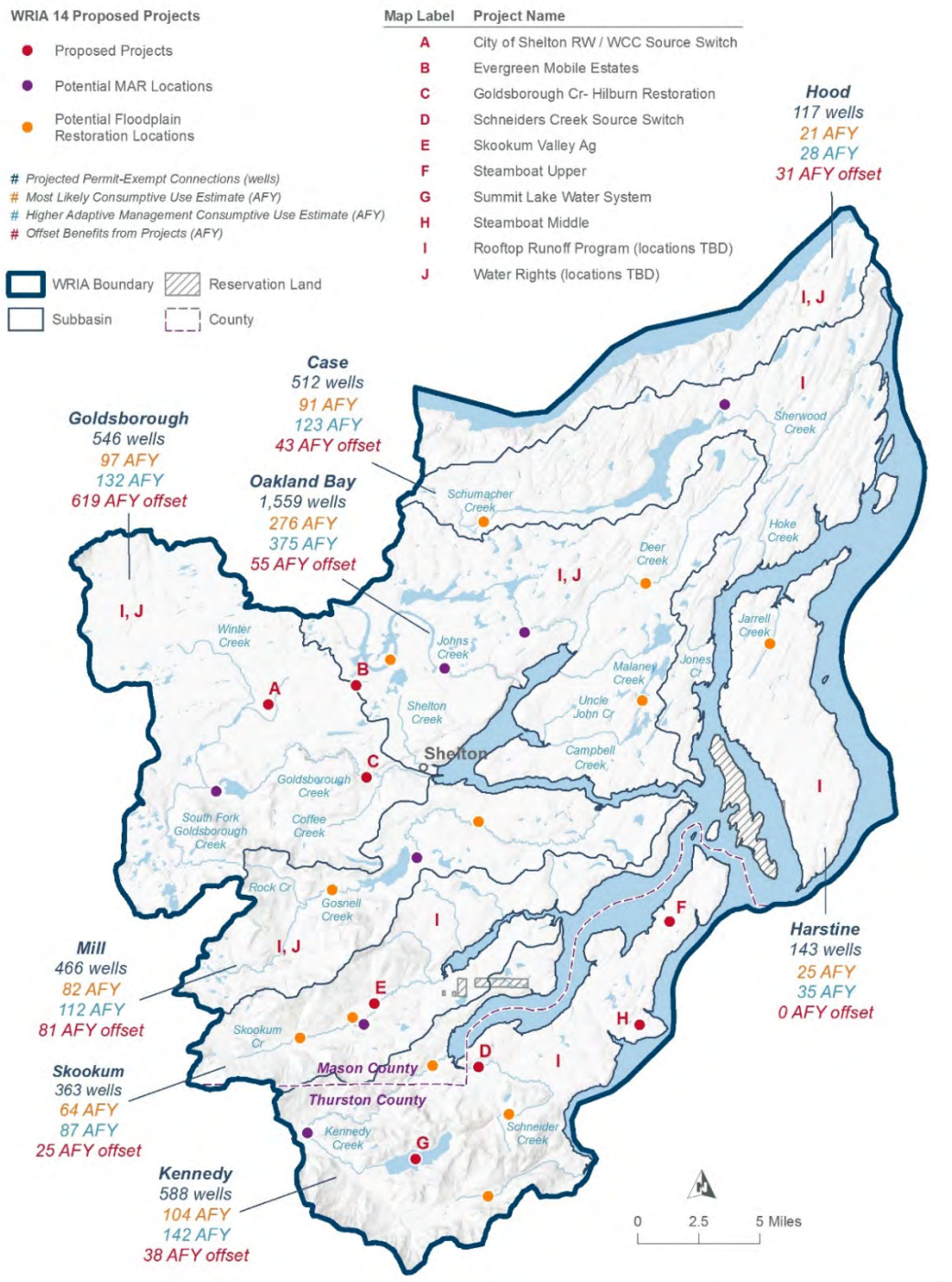

Figure ES 1: Summary of findings of the WRIA 14 Watershed Restoration and Enhancement Plan, including estimates for new domestic permit exempt well growth, consumptive use estimates, and project offset benefits.

Chapter One: Plan Overview

1.1 Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 14 Watershed Restoration and Enhancement Plan is to identify projects and actions needed to offset the impacts of new domestic permit-exempt wells to streamflows. The watershed restoration and enhancement plan is one requirement of RCW 90.94. Watershed restoration and enhancement plans must identify projects to offset the potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over 20 years (2018-2038), and provide a net ecological benefit to the WRIA. The WRIA 14 watershed restoration and enhancement plan (watershed plan) considers priorities for salmon recovery and watershed recovery, while ensuring it meets the intent of the law.[3]

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally, reducing flows (Barlow and Leake 2012). Consumptive water use (that portion not returned to the aquifer) reduces streamflow, both seasonally and as average annual recharge. A well pumping from an aquifer connected to a surface water body can either reduce the quantity of water discharging to the river or increase the quantity of water leaking out of the river (Barlow and Leake 2012). Projects to offset consumptive use associated with permit-exempt domestic water use have become a focus to minimize future impacts to instream flows and restore streamflow.

While this watershed plan is narrow in scope and is not intended to address all water uses or related issues within the watershed, it provides a path forward for future water resource planning.

~~[Language to be included when appropriate]:~~ The WRIA 14 Watershed Restoration and Enhancement Committee (Committee), by completing the watershed plan, has developed, and come to consensus[4] on, a path forward for a technically and politically complex issue in water resource management. That success sets the stage for improved coordination of water resources and overall watershed health in our WRIA.

This watershed plan is divided into the following chapters:

1. Plan Overview;
2. Overview of the plan purpose and scope, and plan development process, and streamflow;

[3] Some members of the WRIA 14 Committee have different interpretations of RCW 90.94.030. Statements from entities and other documents provided in the Compendium provide more information on their interpretations, which apply throughout this plan.

[4] The levels of consensus used by the WRIA 14 Committee is described in the Operating Principles in Appendix D.

3. Summary of the subbasins,
4. Growth projections and consumptive water use estimates;
5. Description of the recommended actions and projects identified to offset the future permit-exempt domestic water use in WRIA 14;
6. Explanation of recommended policy, monitoring, adaptive management and implementation measures; and
7. Evaluation and consideration of the net ecological benefits.

1.1.1 Legal and Regulatory Background for the WRIA 14 Watershed Restoration and Enhancement Plan

In January 2018, the Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 (session law 2018 c 1). This law was enacted in response to the State Supreme Court's 2016 decision in Whatcom County vs. Hirst, Futurewise, et al. (commonly referred to as the "Hirst decision"). As it relates to this Committee's work, the law, now primarily codified as RCW 90.94, clarifies how local governments can issue building permits or approve subdivisions for homes intending to use a permit-exempt well for their domestic water supply. The law also requires local watershed planning in fifteen WRIAs across the state, including WRIA 14.[5]

1.1.2 Domestic Permit-Exempt Wells

This watershed restoration and enhancement plan, RCW 90.94, and the Hirst decision are all concerned with the effects of new domestic permit-exempt water use on streamflows. Several laws pertain to the management of groundwater permit-exempt wells in WRIA 14 and are summarized in brief here for the purpose of providing context for the WRIA 14 watershed plan.

First and foremost, RCW 90.44.050, commonly referred to as "the Groundwater Permit Exemption," establishes that certain small withdrawals of groundwater are exempt from the state's water right permitting requirements, including small indoor and outdoor water use associated with homes. Although these withdrawals do not require a state water right permit, the water right is still legally established by the beneficial use. [6] Even though a water right

[5] ESSB 6091 includes the following: "*AN ACT Relating to ensuring that water is available to support development; amending RCW 19.27.097, 58.17.110, 90.03.247, and 90.03.290; adding a new section to chapter 36.70A RCW; adding a new section to chapter 36.70 RCW; adding a new chapter to Title 90 RCW; creating a new section; providing an expiration date; and declaring an emergency." (p. 1)*

[6] Washington State follows the doctrine of prior appropriation, which means that the first users have rights "senior" to those issued later. This is called "first in time, first in right." If a water shortage occurs, "senior" rights are satisfied first and the "junior" rights can be curtailed. Seniority is established by priority date — the original

permit is not required for small domestic uses under RCW 90.44.050, there is still regulatory oversight, including from local jurisdictions. Specifically, in order for an applicant to receive a building permit from their local government for a new home, the applicant must satisfy the provisions of RCW 19.27.097 for what constitutes evidence of an adequate water supply.[7]

RCW 90.94.030 adds to the management regime for new homes using domestic permit-exempt well withdrawals in WRIA 14 and elsewhere. For example, local governments must, among other responsibilities relating to new permit-exempt domestic wells, collect a $500 fee for each building permit and record withdrawal restrictions on the title of the affected properties. Additionally, this law restricts new permit-exempt domestic withdrawals in WRIA 14 to a maximum annual average of up to 950 gallons per days per connection, subject to the five thousand gallons per day and ½-acre outdoor irrigation of non-commercial lawn/garden limits established in RCW 90.44.050. Ecology has published its interpretation and implementation of RCW 19.27.097 and RCW 90.94 in Water Resources POL 2094 (Ecology, 2019a). For additional information, readers can review those laws and policy for comprehensive details and agency interpretations.

1.1.3 Planning Requirements Under RCW 90.94.030

While supplementing the local building permit requirements, RCW 90.94.030(3) goes on to establish the planning criteria for WRIA 14. In doing so, it sets the minimum standard of Ecology's collaboration with the WRIA 14 Committee in the preparation of this watershed plan. In practice, the process of plan development was one of broad integration, collectively shared work, and a striving for consensus described in the WRIA 14 Committee's adopted operating principles, which are further discussed below.

In addition to these procedural requirements, the law and consequently this watershed plan, is concerned with the identification of projects and actions intended to offset the anticipated impacts from new permit-exempt domestic groundwater withdrawals over the next 20 years and provide a net ecological benefit.[8] In establishing the primary purpose of this watershed plan, RCW 90.94.030 (3) also details both the required and recommended plan elements.

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date a water right application was filed, or the date that water was first put to beneficial use in the case of claims and the groundwater permit exemption. Although groundwater permit-exempt uses do not require a water right permit, they are always subject to state water law. In some instances, Ecology has had to regulate permit exempt water users when they interfere with older, "senior" water rights, including instream flow rules. More information is available on the Department of Ecology's website: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability.

[7] RCW 19.27.097 states that "Evidence may be in the form of a water right permit from the department of ecology, a letter from an approved water purveyor stating the ability to provide water, or another form sufficient to verify the existence of an adequate water supply."

[8] The planning horizon for planning to achieve a NEB is the 20 year period beginning with January 19, 2018 and ending on January 18, 2038. The planning horizon only applies to determining which new consumptive water uses the plan must address under the law. The projects and actions required to offset the new uses must continue beyond the 20-year period and for as long as new well pumping continues. (Ecology, 2019b; page 7)

Regarding the WRIA 14 Committee's approach to selecting projects and actions, the law also speaks to "high and lower priority projects." The WRIA 14 Committee understands that, as provided in the Final Guidance on Determining Net Ecological Benefit (Ecology 2019b), "use of these terms is not the sole critical factor in determining whether a plan achieves a NEB… and that plan development should be focused on developing projects that provide the most benefits… regardless of how they align with [these] labels" (page 12). It is the perspective of the WRIA 14 Committee that this watershed plan satisfies the requirements of RCW 90.94.030.

1.2 Requirements of the Watershed Restoration and Enhancement Plan

RCW 90.94.030 of the Streamflow Restoration law directs Ecology to establish a watershed restoration and enhancement committee in the Kennnedy - Goldsborough watershed and develop a watershed restoration and enhancement plan (watershed plan) in collaboration with the WRIA 14 Committee. Ecology determined that the intent was best served through collective development of the watershed plan, using an open and transparent setting and process that builds on local needs.

At a minimum, the watershed plan must include projects and actions necessary to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on streamflows and provide a net ecological benefit (NEB) to the WRIA.

Ecology issued the Streamflow Restoration Policy and Interpretive Statement (POL-2094) and Final Guidance on Determining Net Ecological Benefit (GUID-2094) in July 2019 to ensure consistency, conformity with state law, and transparency in implementing RCW 90.94. The Final Guidance on Determining Net Ecological Benefit (hereafter referred to as Final NEB Guidance) establishes Ecology's interpretation of the term "net ecological benefit." It also informs planning groups on the standards Ecology will apply when reviewing a watershed plan completed under RCW 90.94.020 or RCW 90.94.030. The minimum planning requirements identified in the Final NEB Guidance including the following (pages 7-8):

> Streamflow Restoration law RCW 90.94.030(3)
>
> (b) At a minimum, the plan must include those actions that the committee determines to be necessary to offset potential impacts to instream flows associated with permit-exempt domestic water use. 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. Lower priority projects include projects not in the same basin or tributary and projects that replace consumptive water supply impacts only during critical flow periods. The plan may include projects that protect or improve instream resources without replacing the consumptive quantity of water where such projects are in addition to those actions that the committee determines to be necessary to offset potential consumptive impacts to instream flows associated with permit-exempt domestic water use.
>
> (c) Prior to adoption of the watershed restoration and enhancement plan, the department must determine that actions identified in the plan, after accounting for new projected uses of water over the subsequent twenty years, will result in a net ecological benefit to instream resources within the water resource inventory area.
>
> (d) The watershed restoration and enhancement plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050.
>
> (e) The watershed restoration and enhancement plan must include estimates of the cumulative consumptive water use impacts over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050.

1. Clear and Systemic Logic. Watershed plans must be prepared with implementation in mind.
2. Delineate Subbasins. [The Committee] must divide the WRIA into suitably sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets.
3. Estimate New Consumptive Water Uses. Watershed plans must include a new consumptive water use estimate for each subbasin, and the technical basis for such estimate.
4. Evaluate Impacts from New Consumptive Water use. Watershed plans must consider both the estimated quantity of new consumptive water use from new domestic permit-exempt wells initiated within the planning horizon and how those impacts will be distributed.
5. Describe and Evaluate Projects and Actions for their Offset Potential. Watershed plans must, at a minimum, identify projects and actions intended to offset impacts associated with new consumptive water use.

The WRIA 14 Committee has developed this watershed plan with the intent to ensure full implementation, either through projects and actions, or adaptive management.

The law requires that all members of the WRIA 14 Committee approve the plan prior to submission to Ecology for review. Ecology must then determine that the plan's recommended streamflow restoration projects and actions will result in an NEB to instream resources within the WRIA after accounting for projected use of new permit-exempt domestic wells over the 20 year period of 2018-2038.

RCW 90.94.030 (6). This section [90.94.030] only applies to new domestic groundwater withdrawals exempt from permitting under RCW 90.44.050 in the following water resource inventory areas with instream flow rules adopted under chapters 90.22 and 90.54 RCW that do not explicitly regulate permit-exempt groundwater withdrawals: 7 (Snohomish); 8 (Cedar-Sammamish); 9 (Duwamish-Green); 10 (Puyallup-White); 12 (Chambers-Clover); 13 (Deschutes); 14 (Kennedy Goldsborough); and 15 (Kitsap) and does not restrict the withdrawal of groundwater for other uses that are exempt from permitting under RCW 90.44.050.

1.3 Overview of the WRIA 14 Committee

1.3.1 Formation

The Streamflow Restoration law instructed Ecology to chair the WRIA 14 Committee, and invite representatives from the following entities in the watershed to participate in the development of the watershed plan:

- Each federally recognized tribal government with reservation land or usual and accustomed harvest area within the WRIA.

- Each county government within the WRIA.
- Each city government within the WRIA.
- Washington State Department of Fish and Wildlife.
- The largest publically-owned water purveyor providing water within the WRIA that is not a municipality.
- The largest irrigation district within the WRIA.[9]

Ecology sent invitation letters to each of the entities named in the law in September of 2018.

The law also required Ecology to invite local organizations representing agricultural interests, environmental interests, and the residential construction industry. Businesses, environmental groups, agricultural organizations, conservation districts, and local governments nominated interest group representatives. Local governments on the WRIA 14 Committee voted on the nominees in order to select local organizations to represent agricultural interests, the residential construction industry, and environmental interests. Ecology invited the selected entities to participate on the WRIA 14 Committee.

The WRIA 14 Committee members are included in Table 1. This list includes all of the members identified by the Legislature that agreed to participate on the WRIA 14 Committee.[10]

Table 1: WRIA 14 Entities and Membership

Entity Name	**Representing**
Skokomish Tribe	Tribal government
Squaxin Island Tribe	Tribal government
Mason County	County government
Thurston County	County government
City of Shelton	City government
Mason County Public Utility District 1	Water purveyor
Washington Department of Fish and Wildlife	State agency
Washington Department of Ecology	State agency
Olympia Master Builders Association	Residential construction
Washington State Chapter of the Sierra Club	Environmental interests
Mason-Kitsap Farm Bureau	Agricultural interests
Mason Conservation District (ex officio)	Not applicable
Washington State Department of Health (ex officio)	Not applicable
Green Diamond (ex officio)	Not applicable

[9] There are no irrigation districts in WRIA 14.

[10] All participating entities committed to participate in the process and designated representatives and alternates.

The WRIA 14 Committee roster with names and alternates is available in Appendix C.

The WRIA 14 Committee invited the Mason Conservation District, Washington State Department of Health, and Green Diamond (pending) to participate as "ex-officio" members. Although not identified in the law, the ex officio members provide valuable information and perspective as subject matter experts. The ex officio members are active, but non-voting participants of the WRIA 14 Committee.

The law does not identify a role for the Committee following development of the watershed plan.

1.3.2 Committee Structure and Decision Making

The WRIA 14 Committee held its first meeting in October 2018. Between October 2018 and ~~January~~ April 2021 ~~[UPDATE LAST MEETING DATE, IF NEEDED]~~, the WRIA 14 Committee held 27 Committee meetings open to the public. The WRIA 14 Committee met monthly, and as needed to meet deadlines.

The two and a half years of planning consisted of training, research, and developing plan components. Ecology technical staff, WRIA 14 Committee members, and partners presented on topics to provide context for components of the plan such as hydrogeology, water law, tribal treaty rights, salmon recovery, and planning.

In addition to serving as WRIA 14 Committee chair, Ecology staff provided administrative support and technical assistance, and contracted with consultants to provide facilitation and technical support for the WRIA 14 Committee. The facilitator supported the WRIA 14 Committee's discussions and decision-making, and coordinated recommendations for policy change and adaptive management. The technical consultants developed products that informed WRIA 14 Committee decisions and development of the plan. The technical consultants developed all of the technical memorandums referenced throughout this plan. Examples include working with counties on growth projections, calculating consumptive use based on multiple methods, preparing maps and other tools to support decisions, and researching project ideas. The technical consultants brought a range of expertise to the Committee including hydrogeology, GIS analysis, fish biology, engineering and planning.

During the initial WRIA 14 Committee meetings, members developed and agreed by consensus to operating principles.[11] The operating principles set forward a process for meeting, participation expectations, procedures for decision-making of the WRIA 14 Committee, communication, and other needs in order to support the WRIA 14 Committee in reaching consensus on a final plan.

The WRIA 14 Committee established technical and project workgroups to support planning efforts and to achieve specific tasks throughout plan development. The workgroups were open

[11] Agreed upon operating principles can be found in Appendix D

to all WRIA 14 Committee members as well as non-Committee members that brought capacity or expertise not available on the Committee. The workgroups made no binding decisions, but presented information to the Committee as either recommendations or findings. The WRIA 14 Committee acted on workgroup recommendations, as it deemed appropriate.

This planning process, by statutory design, brought diverse perspectives to the table. As the legislation requires that all members of the WRIA 14 Committee approve the final plan prior to Ecology's review,[12] it was important for the WRIA 14 Committee to identify a clear process for making decisions. The WRIA 14 Committee strived for consensus, and when consensus could not be reached, the chair and facilitator documented agreement and dissenting opinions. All consensus and dissenting opinions were documented in meeting summaries that were reviewed and approved by the Committee. The Committee recognized that flexibility was needed in terms of timeline, and if a compromise failed to reach consensus within the identified timeline, the Committee agreed to allow the process for developing the plan to move forward while the work towards consensus continued. The Committee agreed to revisit decisions where consensus was not reached at a later date. Consensus during the foundational decisions during plan development served as the best indicators of the Committee's progress toward an approved plan.

~~[Language to be included when appropriate]:~~ The WRIA 14 Committee reviewed components of the watershed plan and the draft plan as a whole on an iterative basis. **[Language to be determined]:** Once the WRIA 14 Committee reached initial agreement on the final watershed plan, broader review and approval by the entities represented on the WRIA 14 Committee was sought as needed. The WRIA 14 Committee reached final approval on the Watershed Restoration and Enhancement Plan on ~~XX DATE~~April 21, 2021.

[12] RCW 90.94.030[3] "…all members of a watershed restoration and enhancement Committee must approve the plan prior to adoption"

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 14

Water Resource Inventory Areas (WRIAs) are large watershed areas formalized under Washington Administrative Code (Water Resources Code of 1971) for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeological regimes, levels of development, and variable natural resources. WRIA 14, also referred to as Kennedy-Goldsborough, is one of the 62 designated major watersheds in Washington State, formed as a result of the Water Resources Act of 1971 (Figure 1). The 381 square mile Kennedy-Goldsborough Watershed is within Mason and Thurston counties and includes an extensive network of independent streams that issue from springs, wetlands, small lakes, and surface water drainages (Figure 1). These streams originate from the hills located between the inlets of southern Puget Sound and the Olympic Mountains to the north, emptying into shallow bays and inlets. Principal drainages include Cranberry, Goldsborough, Kennedy, Perry, Mill, Sherwood, Johns, Deer, Alderbrook, Shumocher and Skookum Creeks. The Kennedy-Goldsborough Watershed has no major river system.

2.1.1 Land Use in WRIA 14

The upland portion of the watershed generally consists of forested land with large acreages of second and third growth coniferous trees. Land uses shift to rural and urban developments in the lower portions of streams near salt water bays. Rural residential development has primarily occurred in the unincorporated areas of Mason and Thurston counties (Figure 1).

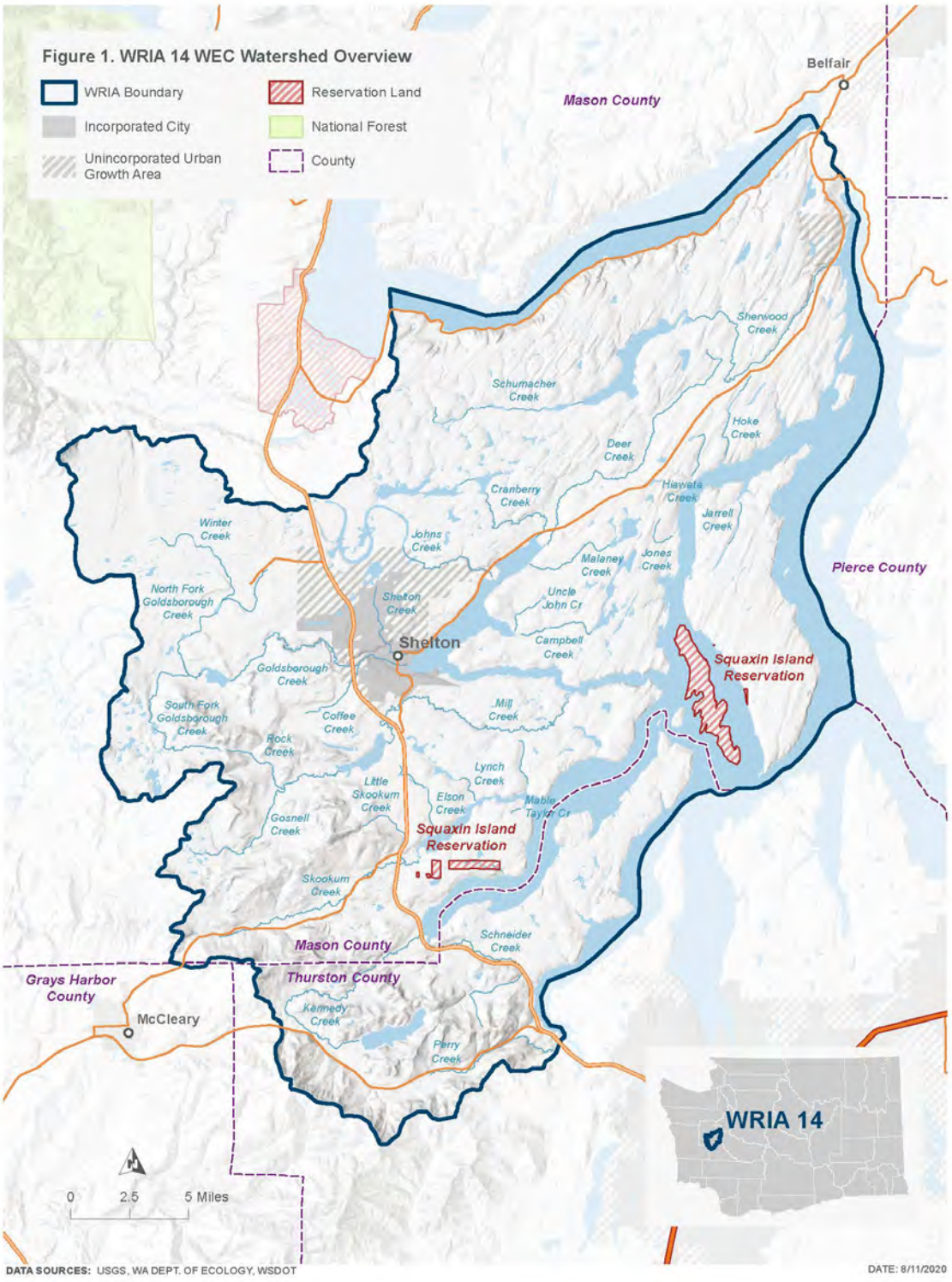

Figure 1: WRIA 14 WRE Watershed Overview

The central portion of the Kennedy-Goldsborough Watershed, near Shelton is predominantly urbanized, characterized by a combination of residential, civic/institutional, commercial, and education land covers. Undeveloped land makes up most of the portion of WRIA 14 that is in Thurston County, while forest land makes up most of the portion of WRIA 14 that is in Mason County. WRIA 14 has both unincorporated urban growth areas and incorporated urban growth areas, totaling approximately 4 percent of the watershed. The Squaxin Island Tribe's Reservation and Off-Reservation trust land occupies approximately 2,162 acres of WRIA 14 (Figure 1*).*

2.1.2 Tribal Reservations and Usual and Accustomed Fishing Areas

Tribes with usual and accustomed fishing areas within WRIA 14 include the Skokomish and Squaxin Island Tribes. These tribes hold reserved fishing rights in WRIA 14 under their treaties with the federal government (Treaty of Point No Point, Treaty of Medicine Creek).

The Tribes hold Treaty-reserved water rights in WRIA 14 under federal law that are necessary to support healthy salmon populations; to support and maintain hunting, fishing and cultural resource harvesting right; and to meet all homeland purposes reserved by the Treaties. These reserved water rights are necessary to fulfill the promises and purpose of the Treaties. Federal Indian water rights retain a senior priority date over all other federal and state water rights holders and state instream flow rules. Although federal Indian water rights in WRIA 14 have yet to be adjudicated, these rights are senior to all other rights and have not been accounted for by the State of Washington in the way in which the State determines water availability, over appropriation, and instream flow rules. [13]

~~The Tribes also possess Treaty-reserved federal water rights in WRIA 14 in quantities that are necessary to support healthy salmon populations. These water rights are necessary to carry out the purposes of their Treaties, which include the guarantee of a self-sustaining homeland and sufficient water to support the fishing right. These rights operate outside of the state water rights system and have the most senior priority date. While these water rights have not yet been quantified by a court, they likely exceed the amounts that are established by state instream flow rules. Indian water rights are property rights held in trust by the United States for the benefit of Indian tribes.~~ [14]

2.1.3 Salmon Distribution and Limiting Factors

The Kennedy-Goldsborough Watershed is an important and productive system for salmonids. Several tributaries provide spawning and rearing habitat for fall and Summer Chum (*Oncorhynchus keta*), Coho (*Oncorhynchus kisutch*), Winter Steelhead (*Oncorhynchus mykiss*) and Coastal Cutthroat (*Oncorhynchus clarkii clarkia*). Chinook salmon (*Oncorhynchus tshawytscha*) are known to occur, but not spawn and rear in these steams. These streams often

[13] Language provided by WRIA 14 Tribes
~~[14] Language provided by WRIA 14 Tribes~~

experience low streamflows during critical migration and spawning time. In addition, damming of wetlands to create man-made lakes and shoreline modifications, conversion of forestland to agricultural or residential land uses have altered streams in WRIA 14.[15] Similar to climate projections for much of the Western United States, WRIA 14 is projected to experience increasing stream temperatures, earlier streamflow timing, increasing flooding and declining summer minimum flows. These changes are likely to cause additional disruption to salmon as they migrate, spawn and rear (Mauger et al., 2015).

Both incorporated and unincorporated municipalities, various small industrial and commercial facilities, and agriculture in the Kennedy-Goldsborough Watershed compete for a finite water supply, causing a strain on surface water availability, especially during low seasonal flows in productive salmonid streams. Many people depend on the salmon fishery. This includes the Squaxin Island Tribe and the Skokomish Indian Tribe, both with usual and accustomed areas in the Kennedy-Goldsborough Watershed (NWIFC 2014).

The Kennedy-Goldsborough watershed primarily supports coho salmon, chum salmon, winter steelhead, coastal cutthroat trout, and chinook salmon, (Tables 2 and 3).

Table 2: Salmonid Species and Status in WRIA 14

Common Name	Scientific Name	Population[1]	Critical Habitat	Regulatory Agency Status
Puget Sound				
Chinook Salmon	Oncorhynchus tshawytscha	Puget Sound Chinook	No	NMFS/ Threatened/1999
Chum Salmon	Oncoryhnchus keta	Puget Sound Chum	No listing	Not listed
Coho Salmon	Oncorhynchus kisutch	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/1997
Steelhead Trout	Oncorhynchus mykiss	Puget Sound Steelhead	Yes/2016	NMFS/ Threatened/2007
Rainbow Trout[16]	Oncorhynchus mykiss	No listing	No listing	No listing
Coastal Cutthroat Trout	Oncorhynchus clarki	No listing	No listing	No listing
Hood Canal				
Chinook Salmon	Oncorhynchus tshawytscha	Puget Sound Chinook	No	NMFS/ Threatened/1999

[15] Salmonid Habitat Limiting Factors WRIA 14.

[16] Note: Resident rainbow trout are the same species as steelhead and have a similar freshwater life history as steelhead. However, they are not anadromous residing in their stream of origin throughout their life.

Common Name	Scientific Name	Population[1]	Critical Habitat	Regulatory Agency Status
Chum Salmon	Oncoryhnchus keta	Hood Canal Chum	No Listing	No Listing
Coho Salmon	Oncorhynchus kisutch	Puget Sound/Strait of Georgia Coho	No	NMFS/ Threatened/1999
Steelhead Trout	Oncorhynchus mykiss	Puget Sound Steelhead	Yes/2016	NMFS/Species of Concern/1997
Rainbow Trout	Oncorhynchus mykiss	No listing	No listing	No listing
Coastal Cutthroat Trout	Oncorhynchus clarki	No listing	No listing	No Listing

Chinook salmon have been documented to occur in some WRIA 14 streams, but there is no known documentation of spawning and rearing. Chinook presence is likely due to strays from other river systems. Estuaries such as the Oakland bay provide key habitat for juvenile rearing during smolt saltwater phases of Puget sound stocks from other rivers and streams.

Coho salmon enter WRIA 14 streams from mid-September to mid-November and spawn from late October to mid-December (Table 3). Incubation occurs through the following April. Juvenile rearing occurs for over a year before smolt outmigration the following spring.

Chum salmon enter WRIA 14 streams in the fall and winter (Table 3). Summer Chum typically enter WRIA 14 streams in the late summer to fall and spawn from September to November. Fall Chum Salmon typically enter WRIA 14 streams in the fall and spawn primarily in November and December. Incubation occurs through the late winter. Juvenile rearing and smolt outmigration occurs from that spring to early summer.

Winter steelhead enter WRIA 14 streams in the late fall through the following spring and spawn in the spring (Table 3). Prior to spawning, maturing adults hold in pools or in side channels to avoid high winter flows. Steelhead tend to spawn in moderate to high gradient sections of streams and spawn higher in the watershed compared to other salmonids. Incubation occurs through the following summer. Juvenile rearing occurs for over a year before smolt outmigration the following spring.

Coastal cutthroat trout enter WRIA 14 streams in the late fall and spawn in the winter and early spring (Table 3). Freshwater rearing occurs for a full year with smolt outmigration occurring the following spring.

Table 3 below lists the run timing and life stages of anadromous salmon and trout present throughout the watershed.

Table 3: Salmonid Presence and Life History Timing in Kennedy-Goldsborough

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin
Coho	Upstream migration									■	■	■		All (except Harstine)
	Spawning	■									■	■	■	
	Incubation	■	■	■							■	■	■	
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration			■	■	■	■							
Chum (summer)	Upstream migration								■	■	■			Oakland
	Spawning									■	■	■		Case
	Incubation	■	■							■	■	■	■	
	Juvenile rearing		■	■	■	■								
	Juvenile outmigration		■	■	■	■	■							
Chum (fall)	Upstream migration										■	■	■	All (except Harstine)
	Spawning	■	■									■	■	
	Incubation	■	■	■	■							■	■	
	Juvenile rearing			■	■	■								
	Juvenile outmigration			■	■	■	■							
Coastal Cutthroat	Upstream migration											■	■	Kennedy
	Spawning	■	■	■	■								■	Skookum
	Incubation	■	■	■	■	■						■	■	Goldsborough
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	Mill
	Smolt outmigration			■	■	■	■							Oakland
Steelhead (winter)	Upstream migration	■	■	■	■								■	All (except Harstine)
	Spawning		■	■	■	■	■							
	Incubation			■	■	■	■	■						
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration			■	■	■								

The Washington State Conservation Commission Limiting Factors Analysis (Kuttel 2002) identified specific limiting factors for specific waterbodies, but also provide the following general themes throughout WRIA 14 streams and rivers on a multi-species basis:

- Fish Passage
- Riparian Canopy Closure
- Streambank Condition
- Floodplain Connectivity

- Substrate Embeddedness
- Large Woody Debris
- Pool Frequency and Quality
- Off-channel Habitat
- Temperature
- Dissolved Oxygen
- Water Quantity/ Dewatering
- Change in Flow Regime
- Biological Processes

Water quantity/ Dewatering was a limiting factor in Skookum Creek, Mill Creek, Goldsborough Creek, Shelton Creek, Johns Creek, and Cranberry Creek. Changes in flow regime were a limiting factor in Skookum Creek, Goldsborough Creek, Shelton Creek, and Cranberry Creek.

2.1.4 Water System Distribution and Impacts in WRIA 14

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally. Surface water availability for streamflow may be influenced by groundwater pumping such that flows are reduced. Consumptive water use (that portion not returned to the aquifer) reduces streamflow, both seasonally and as average annual recharge. A well pumping from an aquifer connected to a surface water body can either reduce the quantity of water discharging to surface water or increase the quantity of water leaking out of the river.[17]. As required by RCW 90.94, this watershed plan includes projects and actions chosen to offset consumptive use associated with permit-exempt domestic water use, to eliminate future impacts to instream flows, and to restore streamflow.

2.2 Watershed Planning in WRIA 14

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 14 for decades. Watershed planning under RCW 90.82 resulted in a draft watershed plan,[18] but a final plan was never approved. It should be noted that RCW 90.82 provided that "the portion of the WRIA where surface waters drain into Hood Canal shall be considered WRIA 14b, and the remaining portion shall be considered WRIA

[17] Department of Ecology, 1995

[18] WRIA 14 Watershed Management Plan – Kennedy–Goldsborough Watershed. Final Draft / February 2006. Prepared under Grant G0000107 for the WRIA 14 Planning Unit by Plateau Technical Communication Services. http://www.plateautechcomm.com/docs/WRIA14_Plan_FinalDraft.pdf

14a. Planning for WRIA 14b under this chapter shall be conducted by the WRIA 16 planning unit." Under RCW 90.98, this division did not occur, and the Plan will address all of WRIA 14.

A brief summary of broad watershed planning efforts as they relate to the past, present, and future water availability in the Kennedy-Goldsborough Watershed is provided in Section 2.2.1.

2.2.1 Current Watershed Planning Efforts in WRIA 14

The WRIA 14 watershed plan is building on many of the past efforts to further develop comprehensive plans for the entire watershed. The Kennedy-Goldsborough Watershed is within two Local Integrating Organizations (LIO), the Alliance for a Healthy South Sound (AHSS)[19] and the Hood Canal Coordinating Council (HCCC). The AHSS is developing an ecological recovery plan and the HCCC adopted an Integrated Watershed Plan in 2014. The LIOs have completed ecosystem recovery plans as part of the Action Agenda for Puget Sound Recovery and are actively working to implement holistic approaches to recovery including projects on salmon and orca recovery, stormwater runoff, shellfish protection, and forest conservation.[20] The planning process to develop an ecosystem recovery plan is community based with engagement by local, state and federal agencies. The community is engaged in a collaborative planning process to help understand priorities and support the health and sustainability of the watershed.

The AHSS and salmon recovery lead entity include many of the same organizations and individuals that participate in the WRIA 14 Watershed Restoration and Enhancement Committee (the Committee). This history of collaborative planning and shared priorities has supported the success of the watershed restoration and enhancement plan development in WRIA 14. The Public Water System Coordination Act of 1977[21] created Critical Water Supply Service Areas (CWSSA). This Act requires each water purveyor in a CWSSA to develop a water system plan for their service area, with the boundaries being in compliance with the provision of the Act. The Washington State Department of Health is primarily responsible for the water system plan approval; however local governments ensure consistency with local growth management plans and development policies. This Act and the water system plans are important for the WRIA 14 watershed planning process as water system service areas and related laws and policies can set stipulations regarding timely and reasonable service as to whether new homes connect to water systems or rely on new permit-exempt domestic wells.[22] There are currently no Coordinated Water System Plans in WRIA 14.

[19] More information on the AHSS can be found here: https://www.healthysouthsound.org/

[20] More information on local integrating organizations and their efforts to recovery Puget Sound is available here: https://www.psp.wa.gov/LIO-overview.php.

[21] RCW 70.116.070

[22] County water system planning information is available for each county.
Mason County: https://www.co.mason.wa.us/health/environmental/drinking-water/public-water-systems.php
Thurston County: https://www.thurstoncountywa.gov/planning/Pages/comp-plan.aspx

2.2.2 Coordination with Existing Plans

Throughout the development of the watershed plan, Ecology streamflow restoration staff have engaged with staff from the Salmon Recovery Lead Entity and the Puget Sound Partnership, providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. The Committee chair conducted outreach to the WRIA 14 Salmon Recovery Lead Entity regarding coordination with the Committee to ensure alignment of salmon recovery priorities and the streamflow planning process. Throughout the planning process, the WRIA 14 Committee has coordinated closely with the lead entity, including inviting the lead entity to participate in meetings and take part as an ex-officio member on the Committee. , The WRIA 14 lead entity participated in the Committee and collaborated by selecting priority streams based on information from the Salmon Recovery Plan, incorporating priority salmon recovery projects in the watershed plan, and reviewing project lists and descriptions.

County comprehensive planning under the Growth Management Act of 1990 identifies where and how future population, housing, and job growth is planned. Development of this plan was also coordinated with the Mason County and Thurston County comprehensive plans. The comprehensive plans set policy for development, housing, public services and facilities, and environmentally sensitive areas, among other topics. The comprehensive plans identify Mason and Thurston County's urban growth areas, set forth standards for urban and rural development, and provide the basis for zoning districts. The Committee used the Mason and Thurston County zoning districts as the basis for determining likely areas of future rural growth.

There are numerous linkages between growth management and water resource management. The GMA addresses water resources through requirements related to water availability as well as ground and surface water protection. Public facilities, which include domestic water systems must be adequate to serve a proposed development at the time the development is available for occupancy. The requirements also call for the protection of the water quality and quantity of groundwater used for public water systems in addition to critical areas including critical aquifer recharge areas. The GMA further addresses water resources through the protection of shorelines (through integration with the Shoreline Management Act) and critical areas, including fish and wildlife habitat conservation areas, riparian habitat, frequently flooded areas, and wetlands, all of which contribute to surface and ground water quality. In the rural area, GMA further requires a land use pattern that protects the natural water flows along with recharge and discharge areas for ground and surface waters. As discussed in Sections 1.1.1 and 1.1.2, ESSB 6091 was enacted in response to the State Supreme Court's "Hirst decision" (primarily codified as RCW 90.94, and other statutes) and amended the GMA. In addition to GMA, there are other connections between land use codes, water planning and water systems.

2.3 Description of the Watershed - Geology, Hydrogeology, Hydrology, and Streamflow

2.3.1 Geologic Setting

Pleistocene glaciation (2.6 million to 11,700 years ago) played an important role in sculpting the landscape of the Puget Sound Lowlands. Reaching a maximum extent during the Vashon stage of the Fraser Glaciation approximately 16,000 years ago, an ice sheet advanced southward into present day Puget Sound (Pringle, 2008). Multiple advances and retreats of the ice sheet formed the Puget Sound Lowlands, depositing a complex sequence of glacial and inter-glacial sediments on top of older sediments and Eocene age (56 to 33.9 million yeaers ago) basalt bedrock.

The surficial geology of WRIA 14 is dominated by a sequence of unconsolidated glacial and interglacial deposits. Depth to bedrock can exceed 1,000 feet in the eastern part of the WRIA (Welch and Savoca, 2011). Basalt bedrock forming the Black Hills outcrops in the southwestern part of the WRIA and the unconsolidated deposits are thin or absent. Shallow bedrock is also present around the majority of Summit Lake, resulting in irregular and unpredictabe groundwater availability (Gray and Osborne 1991; WDNR 2004). Most residential permit-exempt groundwater wells "…utilize seep developments or dug wells which intercept the shallow groundwaters moving towards the lake… (Noble and Wallace 1966).

Understanding the geologic setting allows characterization of surface and groundwater flow through the basin. Defining the relationships between surface water flow and deeper groundwater are important to understanding how to manage surface water resources and can be helpful in identifying strategies to offset the impacts of pumping from permit-exempt wells.

2.3.2 Hydrogeologic setting

U.S. Geological Survey (USGS) described the hydrogeology of the northern and eastern areas of WRIA 14 in a hydrogeologic framework report for the Johns Creek Subbasin (Welch and Savoca 2011). Surficial geologic maps of most of the WRIA have also been developed by the Washington State Department of Natural Resources.[23] The hydrogeologic units of the area are described as being either water-bearing ("aquifer") and non-water-bearing ("aquitard" or "confining layer") sediments, without regard to geologic origin or age. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments.

Groundwater in shallow, often discontinuous aquifers generally flows toward local surface water bodies (lakes and streams) while groundwater in deeper, more regional aquifers is expected to flow generally eastward toward inlets of Puget Sound or northward toward Hood Canal. In some areas, groundwater may flow in a different direction from surface water. For

[23] e.g., Derkey, et al., 2009a; Derkey, et al., 2009b; Polenz, et al., 2010

example, in upper Goldsborough Creek basin surface waters flow towards the South Sound, but some aquifers flow towards Hood Canal (Plateau 2006).

The USGS describes the hydrogeology of the watershed as eight hydrogeologic units, typically alternating between aquifer and non-aquifer layers. This information is summarized in Appendix E: Regional Aquifer Units in WRIA 14. Four of the aquifers and two of the confining units defined by USGS are present throughout watershed, except in the southwest portion where bedrock is at or near land surface. These four aquifers are the most likely water sources for new permit-exempt wells. The upper three aquifer units (AA, UA, MA) are also the main source of direct recharge or baseflow to the surface water system. The Lower Aquifer does not have surface expressions except below sea level where it projects into Hood Canal.

2.3.3 Hydrology and Streamflow

Numerous small streams that drain into the marine waters of Puget Sound surrounding the Kennedy-Goldsborough Watershed (WRIA 14) characterize the hydrology of the watershed. There are 139 identified streams totaling over 240 linear miles in the watershed. All of the streams are typical lowland types with their headwaters originating from natural springs, surface water drainages, wetlands, or small lakes in foothills. Despite its abundance of creeks, WRIA 14 has no major river systems. The principal drainages are Schumacher, Sherwood, Cranberry, Deer, Johns, Goldsborough, Mill, Kennedy, Perry, Alderbrook, and Skookum Creeks with many smaller streams discharging directly into Puget Sound (Figure 1) (Plateau, 2006). The topography is relatively flat (ranging from sea level to ~300+ feet elevation) except in the westerly portion of the watershed where elevations rise up to 2,400 feet.

The larger streams consist of Goldsborough (mean annual flow of ~125 cfs), Kennedy (mean annual flow of ~65 cfs), and Skookum (mean annual flow of ~55 cfs) Creeks. Approximately 20 percent of streamflows are supported by a relatively constant year-round discharge of groundwater as baseflow varying from 6 percent in the Upper Kennedy catchment (which is underlain primarily by bedrock) to 24 percent in the Case Inlet drainages (which is underlain by sediments) (Golder 2003).

Because snow and snow pack are not a major factor in the watershed, streamflows reflect seasonal variation in precipitation. Annual precipitation ranges from approximately 55 inches near the Puget Sound to approximately 85 inches on the west side of the watershed (Golder 2003). In addition to directly contributing to streamflow maintenance, precipitation also contributes to storage in lakes and aquifers that serve as natural reservoirs, helping to moderate extreme high and low flows. Much of the precipitation that falls in the Black Hills runs off because of the impermeable rock that dominates the landform. This causes many headwater streams originating in the southwestern portion of WRIA 14 to go dry during the summer months. Precipitation that falls on the unconsolidated sediment of the glacial plain tends to percolate into the groundwater, providing perennial flow to lowland streams. Groundwater provides all late summer baseflow to area streams (Molenaar and Noble 1970). Water recharged to the deeper groundwater system may discharge directly to Puget Sound, an ecologically important function that maintains nearshore marine habitat.

Streamflows in WRIA 14 are typically lowest during the late summer and early fall, when precipitation is low and infrequent. Flows are sustained by groundwater during this period, when rearing juvenile coho and late summer spawning chum are most impacted by low flows. Extreme low flows in these streams can occur during years with relatively low precipitation, because of lower water tables and reduced shallow subsurface flows from summer precipitation.

WRIA 14 streams flow into the southern portion of Hood Canal and multiple south Puget Sound inlets (Figure 1: vicinity map). South Puget Sound inlet receiving waters include Case Inlet, Hammersley Inlet (including Oakland Bay), Little Skookum Inlet, Totten Inlet, and Eld Inlet. The South Hood Canal shoreline is the marine receiving waters of many small creeks including Twanoh Falls Creek, Twanoh Creek, Alderbrook Creek, and Happy Hollow Creek, as well as some intermittent streams and seeps (WRIA 16 Planning Unit, 2006). The primary streams that flow into Case Inlet include Sherwood and Shumocher Creeks. Sherwood and Shumocher Creeks are part of the same drainage basin, separated by Mason Lake. Small streams on Harstine and Squaxin Islands also flow into Case Inlet. The primary streams that flow into Hammersley Inlet include Goldsborough Creek, Johns Creek, Cranberry Creek, Deer Creek, and Mill Creek. In the past the South Shore Hood Canal was included as part of WRIA 16 for watershed planning purpose. However, it is designated as part of WRIA 14 and is being addressed as such in this watershed plan.

The Committee further divided WRIA 14 into subbasins for purposes of this watershed plan, and will be described in Chapter 3. The information in this chapter is not based on the Committee's definition of subbasins.

The University of Washington Climate Impact Group has developed numerous downscaled global climate models to forecast streamflow and precipitation changes in the Puget Sound, including WRIA 14. General trends such as increased stream temperatures, earlier streamflow timing, increased winter flooding, and lower summer minimum flows are expected (Mauger, et al. 2015).[24] Water temperatures impact salmonid survival, growth and fitness. Higher temperatures are exacerbated by low stream flow.

Instream flow rules are established to maintain or safeguard aquatic biota and fish, and to support recreational and other beneficial uses. Stream closures or flow limitations were established on nine streams and lakes under the Fisheries Code (RCW 75.20) and water right actions of Ecology (or the predecessor agencies) between 1953 and 1975. Minimum instream flows were established on an additional 14 streams across the watershed in 1984 under Ecology's Instream Resource Protection Program (WAC 173-514). Twenty-one streams are seasonally closed to further (surface water) consumptive appropriation.

[24] Climate forecasts for WRIA 14 can be found here: https://climatetoolbox.org/

USGS provided the streamflow statistics for for Kennedy and Goldsborough Creeks, both of which have at least ten years of continuous stream gauging data and an established minimum instream flow regulation. [25] Streamflow statistics from stream gage data provided by the Squaxin Island Tribe were developed by the Department of Ecology, and are included in Appendix K. The analysis indicated that minimum instream flows in these creeks are not met between 50-60% of the time during the period of record, which was considered to be within a wet cycle of the Pacific Decadal Oscillation (PDO) (Golder 2003) (Kuttel 2002). Kennedy creek is regulated by a discharge structure in Summit Lake, and the shallow underlying bedrock ties the lake and stream together creating a unique situation as it relates to meeting instream flows.

WAC173-514 set minimum instream flows for the Kennedy-Goldsborough watershed and its tributaries, closing streams to further appropriation of surface water. WAC173-515 set minimum instream flows for 10 streams and their tributaries, including lakes. Eight of these 10 streams and their tributaries are closed to further appropriation of surface water for part of the year. An additional 11 streams and their tributaries are closed to further appropriation of surface water from May 1 – October 31.Streams subject to minimum instream flows include Shumocher Creek, Sherwood Creek, Deer Creek, Cranberry Creek, Johns Creek, Goldsborough Creek, Mill Creek, Skookum Creek, Kennedy Creek, and Perry Creek. Many of these streams, including Cranberry Creek, Johns Creek, Goldsborough Creek, Skookum Creek, and Mill Creek, have average monthly flows that are less than the minimum instream flows on a seasonal basis (SIT 2020).

The background of how instream flows and closures were set are described in the Instream Resources Protection Program (IRPP) for WRIA 14 (Ecology 1983). Instream flows were set for streams where continuous flow records existed or correlations of flow to other stream gages were possible and where average annual flows exceeded five cfs. Streams closed by the WAC were previously closed pursuant to water right recommendations or had average annual flows less than five cfs and a known high value for fish production, aesthetics, and other environmental values.

The IRPP does not describe the instream flow setting technique; instream flows are believed to have been set using a combination of Physical Habitat Simulation (PHABSIM), which is a suite of hydraulic and habitat models that compute an index to habitat suitability and discharge, and the toe-width method to determine a habitat based instream flow recommendation. The instream flow recommendations tended to use the 40-50 percent exceedance as a hydrologic limit to the habitat-based instream flow recommendation (Pacheco 2020).

In establishing instream flows by regulation, Ecology used regulatory flows that were higher than the flows commonly seen in the stream and as such, were not designed to be met 100 percent of the time, nor was there an intent to try to achieve the instream flow on any given

[25] USGS streamflow statistics are available here: (https://waterdata.usgs.gov/wa/nwis/sw)

day. Instead, the intent of the regulation was to protect streams from further depletion (e.g., through subsequent appropriations) when flows approach or fall below the recommended discharges (Ecology 1983). When streamflows are below the instream flow, Ecology may manage water use by contacting "junior" water users and inform them of the need to curtail water use. Ecology protects instream flows when issuing new water rights, or denies a water right application if mitigation is not provided.

2.3.4 Water Quality

Ecology evaluates surface waters in WRIA 14 every two years with a water quality assessment. Total Maximum Daily Load (TMDL) plans are part of the Federal Clean Water Act that address concerns identifying and tracking surface waters impaired by pollutants, and create programs to restore them. The assessment evaluates existing water quality data and classified waterbodies into the following categories:

- Category 1: Meets tested standards for clean waters.
- Category 2: Waters of concern; Waters in this category have some evidence of a water quality problem, but not enough to show persistent impairment.
- Category 3: Insufficient Data
- Category 4: Impaired waters that do not require a TMDL
    - Category 4a: already has an EPA-approved TMDL plan in place and implemented.
    - Category 4b: has a pollution control program, similar to a TMDL plan, that is expected to solve the pollution problems.
    - Category 4c: is impaired by causes that cannot be addressed through a TMDL plan. Impairments in these water bodies include low water flow, stream channelization, and dams.
- Category 5: Polluted waters that require a water improvement project.

The latest water quality assessment classified many waterbodies in WRIA 14 (Ecology 2020). Category 4 and 5 assessment results are listed in Appendix F. Category 5 listings are based on exceedance of water temperature, dissolved oxygen, pH, and bacteria water quality standards.

Four TMDLs have been prepared in WRIA 14 to address water quality impairments. These studies include the Cranberry, Johns, and Mill Creeks Temperature TMDL (in preparation), the Totten, Eld, and Skookum Inlets Tributaries Bacteria and Temperature TMDL (Ecology 2006), and the Oakland Bay, Hammersley Inlet Tributaries Bacteria TMDL (Ecology 2011).

Reduced stream flow can lead to degraded water quality. Reduced flow leads to increased pollutant concentrations with the same pollutant load (e.g. bacteria). Reduced stream flow also makes the stream flow more slowly, allowing more time for the water to warm up and for

periphyton (i.e. algae) to cause dissolved oxygen and pH exceedances. These degraded water quality conditions can impact aquatic life if conditions exceed suitable ranges. Therefore, projects that improve water quality also provide a net ecological benefit.

Chapter Three: Subbasin Delineation

3.1 Introduction

To allow for meaningful analysis of the relationship between new consumptive use and offsets per Ecology's Final NEB Guidance,[26] the Committee divided WRIA 14 into subbasins for the purposes of this watershed plan.[27] This was helpful in describing the location and timing of projected new consumptive water use, the location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. The Committee used the subbasin delineations to set priorities for developing water offset projects close to the location of anticipated impacts. In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g., watershed divides).[28] This chapter is based on the Subbasin Delineation Technical Memorandum (Appendix G).

3.2 Approach to Develop Subbasins

The Committee divided WRIA 14 into eight subbasins for the purposes of assessing new PE wells, consumptive use, and project offsets initially using the delineations used in the draft WRIA 14 Watershed Management Plan.[29, 30] The basic considerations of the Committee in delineating subbasin boundaries for this planning process were:

- Existing or concurrent planning efforts may have already delineated subbasins.
- The receiving salt waterbody to which surface waters drain.

Other considerations were:

[26] "Planning groups must divide the WRIA into suitably sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets. Subbasins will help the planning groups understand and describe location and timing of projected new consumptive water use, location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. Planning at the subbasin scale will also allow planning groups to consider specific reaches in terms of documented presence (e.g., spawning and rearing) of salmonid species listed under the federal Endangered Species Act." Final NEB Guidance p. 7.

[27] The term "subbasin" is used by the WRIA 14 Committee for planning purposes only and to meet the requirements of RCW 90.94.030 (3)(b).

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

[29] This is consistent with Final NEB Guidance that defines subbasins as a geographic subarea within a WRIA. A subbasin is equivalent to the words "same basin or tributary" as used in RCW 90.94.020(4)(b).

[30] HDR, 2019. WRIA 14 Draft Subbasin Delineation. June 26, 2019.

- Too few subbasins reduce the understanding of relationships between where pumping effects occur and where benefits of offset projects occur.
- Too many subbasins can make it unwieldly to evaluate all of the offset projects needed to achieve a net ecological benefit for the WRIA.
- Stream distribution within each subbasin.
- Fishery resources within each subbasin.
- Streams with closures and minimum flows within each subbasin.

A more detailed description of the subbasin delineation is in the technical memo available in Appendix G.

3.3 Subbasin Map

The WRIA 14 subbasin delineations are shown on Figure 2 and summarized below in Table 4:

Table 4: WRIA 14 Subbasins

Subbasin Name	Primary Rivers and Tributaries	County
Case	Sherwood Creek, Shumocher Creek, Hoke Creek, Hiawata Creek, and Jones Creek	Mason
Goldsborough	Goldsborough Creek, North Fork Goldsborough Creek, South Fork Goldsborough Creek, Winter Creek, and Coffee Creek	Mason
Harstine	Jarrell Creek	Mason
Hood	Alderbrook Creek and multiple small drainages discharging directly to Hood Canal	Mason
Kennedy	Kennedy Creek, Perry Creek, Snodgrass Creek, Schneider Creek and other small drainages	Thurston and Mason
Mill	Mill Creek, Rock Creek, Gosnell Creek and small drainages discharging to the south shore of Hammersley Inlet	Mason
Oakland	Deer Creek, Cranberry Creek, Johns Creek, and other small drainages discharging to Oakland Bay	Mason
Skookum	Deer Creek, Lynch Creek, Elson	Mason

Subbasin Name	Primary Rivers and Tributaries	County
	Creek, Little Skookum Creek, Skookum Creek, and all drainages discharging to Little Skookum Inlet	

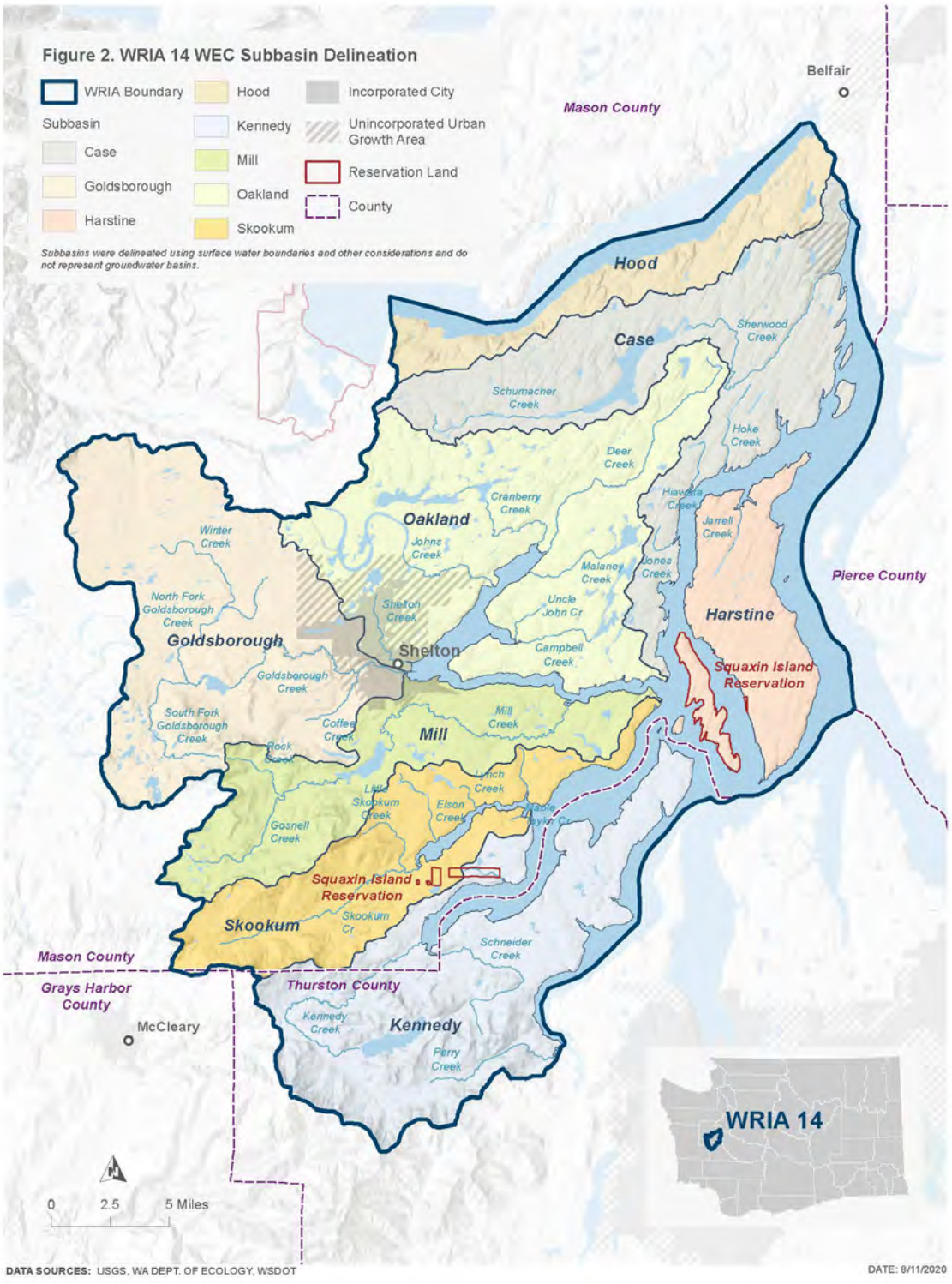

Figure 2: WRIA 14 WRE Subbasin Delineation

Chapter Four: New Consumptive Water Use Impacts

4.1 Introduction to Consumptive Use

The Final NEB Guidance states that, "Watershed plans must include a new consumptive water use estimate for each subbasin, and the technical basis for such estimate" (Ecology 2019b, page 7).[31] This chapter provides the WRIA 14 Committee's projections of new domestic permit-exempt well connections (referred to as PE wells throughout this plan) and their associated consumptive use (CU) for the 20-year planning horizon. This chapter summarizes information from the technical memos prepared for the Committee.

4.2 Projection of Permit-Exempt Well Connections (2018 - 2038)

This watershed plan addresses new consumptive water use from projected new homes connected to PE wells. Generally, new homes are associated with wells drilled during the planning horizon. However, new uses can occur where new homes are added to existing wells serving group systems under RCW 90.44.0050. The well use discussed in this plan refers to both of these types of new well use. PE wells may be used to supply houses, and in some cases, other Equivalent Residential Units (ERUs) such as small apartments. For the purposes of this document, the terms "house" and "home" refer to any permit-exempt domestic groundwater use, including other ERUs.

The WRIA 14 Committee projects 4,294 PE wells over the planning horizon. The largest number of these wells are likely to be installed in the Oakland Bay subbasin. Projections for Thurston County in this plan are based on Thurston County Comprehensive planning dates through 2040.

The WRIA 14 Committee reached consensus on a methodology to project the most likely number of new PE wells over the planning horizon in WRIA 14, in order to estimate new consumptive water use. The method is based on recommendations from Appendix A of Ecology's Final NEB Guidance. The following sections provide the 20-year projections of new PE wells for each subbasin within WRIA 14, the methods used to develop the projections, and the uncertainties associated with the projections.

[31] Though the statute requires the offset of "consumptive impacts to instream flows associated with permit-exempt domestic water use" (RCW 90.94.020(4)(b)) and 90.94.030(3)(b)), watershed plans should address the consumptive use of new permit exempt domestic withdrawals. Ecology recommends consumptive use as a surrogate for consumptive impact to eliminate the need for detailed hydrogeologic modeling, which is costly and unlikely feasible to complete within the limited planning timeframes provided in chapter 90.94 RCW. RCW 90.94.020 and 90.94.030 have various references to how watershed plans are to project, offset, or account for "water use." Ecology interprets these subsections of the law (RCW 90.94.020(4)(b), 90.94.020(4)(c), 90.94.030(3)(b), 90.94.030(3)(c), 90.94.030(3)(d), and 90.94.030(3)(e)) to relate to the consumptive water use of new permit-exempt domestic withdrawals that come online during the planning horizon. (Ecology, 2019a, page 7)

4.2.1 Permit-Exempt Well Connections Projection by Subbasin

This WRIA 14 watershed plan compiles the counties' growth projection data both at the WRIA scale and by subbasin. Note that two counties are present in WRIA 14: Mason County and Thurston County. The projection for new PE wells in WRIA 14 by subbasin is shown in Table 5 and Figure 3.

Table 5: Number of PE Wells Projected between 2018 and 2038 for the WRIA 14 Subbasins

Subbasin	Projected PE Wells
Case	512
Goldsborough	546
Harstine	143
Hood	117
Kennedy (Mason County)	59
Kennedy (Thurston County)	529
Mill	466
Oakland	1559
Skookum	363
Totals	**4,294**

Mason County projects approximately 3,765 new PE wells for the over the planning horizon. Thurston County projects approximately 529 PE wells within unincorporated areas of WRIA 14 over the planning horizon. The total projection for WRIA 14 is 4,294 new PE wells.

4.2.2 Methodology

The WRIA 14 Committee gave deference to each county for identifying the most appropriate method of projecting PE wells within their jurisdiction. Each county used a different method for calculating the PE well projections within their jurisdiction. Both the Mason County and Thurston County methods are based on Office of Financial Management (OFM) population forecasts, which is simple mortality and migration rate data collection. This method is summarized in the section below for each respective County. The technical consultant developed a WRIA 14 Permit-Exempt Growth and Consumptive Use Summary, provided in Appendix H, which offers a more detailed description of the methods used by the counties.

Mason County Growth Projection Methodology

Mason County developed growth projections based on the Mason County Comprehensive Plan, which is based on OFM medium population growth estimates.

Mason County used the following steps to project growth of permit-exempt connections over the planning horizon:

1. Develop 20-year growth projections based on OFM 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 build-out capacity by county urban growth areas (UGAs) and rural lands.
3. Apply growth projections to buildable lands.
4. Overlay subbasins to determine new permit-exempt connections in each subbasin.

These methods were used to develop an initial projection of 3,509 new PE wells. A revised projection was developed by assuming that some permit-exempt growth will occur in water system areas, which resulted in 3,765 new PE wells. It was assumed that growth in each respective water system will be proportional to buildable parcels without water system hookups relative to parcels with water system hookups. The following methods were applied on top of the initial methods:

1. Define total buildable parcels in GIS, using Department of Health (DOH) service area polygons and county parcel data.
2. Define total approved water system connections (built out + available) and active water system connections (built out) using the DOH Sentry database (DOH 2019).
3. Buildable parcels with water system hookup = total approved minus active water system connections.
4. Buildable parcels without water system hookup = total buildable parcels minus total approved water system connections.
5. Define proportion of permit-exempt growth within each water system by dividing number of buildable parcels without water system hookups by total number of buildable parcels.
6. Multiply proportion of permit-exempt growth within each respective water system by total growth projected to occur in that water system.
7. Sum additional permit-exempt growth by subbasin and add to initial permit-exempt growth projection.

Thurston County Growth Projection Methodology

The Thurston County growth projection methods and results were provided by the Thurston Regional Planning Council (TRPC) and Thurston County.[32]

TRPC used the following steps to project growth of permit-exempt connections over the planning horizon:

1. Develop 20-year growth projections based on OFM medium population growth estimates, and conversion to dwelling units based on assumed people per dwelling unit.

[32] Documentation for TRPC's housing projections is available at https://www.trpc.org/236

2. Develop residential capacity estimates.
3. Allocate growth to parcels based on recent residential development and permit trends, where capacity is available.
4. Once allocated, estimate the amount of development on permit-exempt connections based on the following criteria provided by Thurston County::
    a. Located outside incorporated cities; growth in incorporated cities is assumed to connect to a municipal water system.
    b. Water systems within UGAs; permit-exempt growth is assumed to occur on parcels with no sewer service.
    c. Rural water systems; assumed no permit-exempt growth.

These methods were used to develop an initial projection of 497 new PE wells. A revised projection was developed by assuming that some permit-exempt growth will occur in rural water system areas, which resulted in a projection of 529 new PE wells. It was assumed growth in each respective rural water system will be proportional to buildable parcels without water system hookups relative to parcels with water system hookups.

The Mason and Thurston County PE well growth projections were added together for the initial and revised scenarios, respectively. The WRIA 14 Committee agreed by consensus to use revised projections totaling 4,294 new PE wells in WRIA 14 as the final estimate for the purposes of estimating consumptive use.

4.2.3 Distribution of New PE Wells

The WRIA 14 Committee mapped potential locations of new PE wells in the watershed based on parcels available for residential development dependent on PE wells. These parcels are primarily in rural areas, but also within Urban Growth Areas that are not served by water systems, and in water systems where growth is expected to exceed available water system infrastructure. The resulting map (Figure 3) shows the most likely areas that new residential development dependent on PE wells will occur.

The WRIA 14 Committee projects that most new PE wells will occur in and around the Shelton urban growth area, in the Oakland and Goldsborough subbasins. (Table 5 and Figure 3).

4.2.4 Projected Growth Map

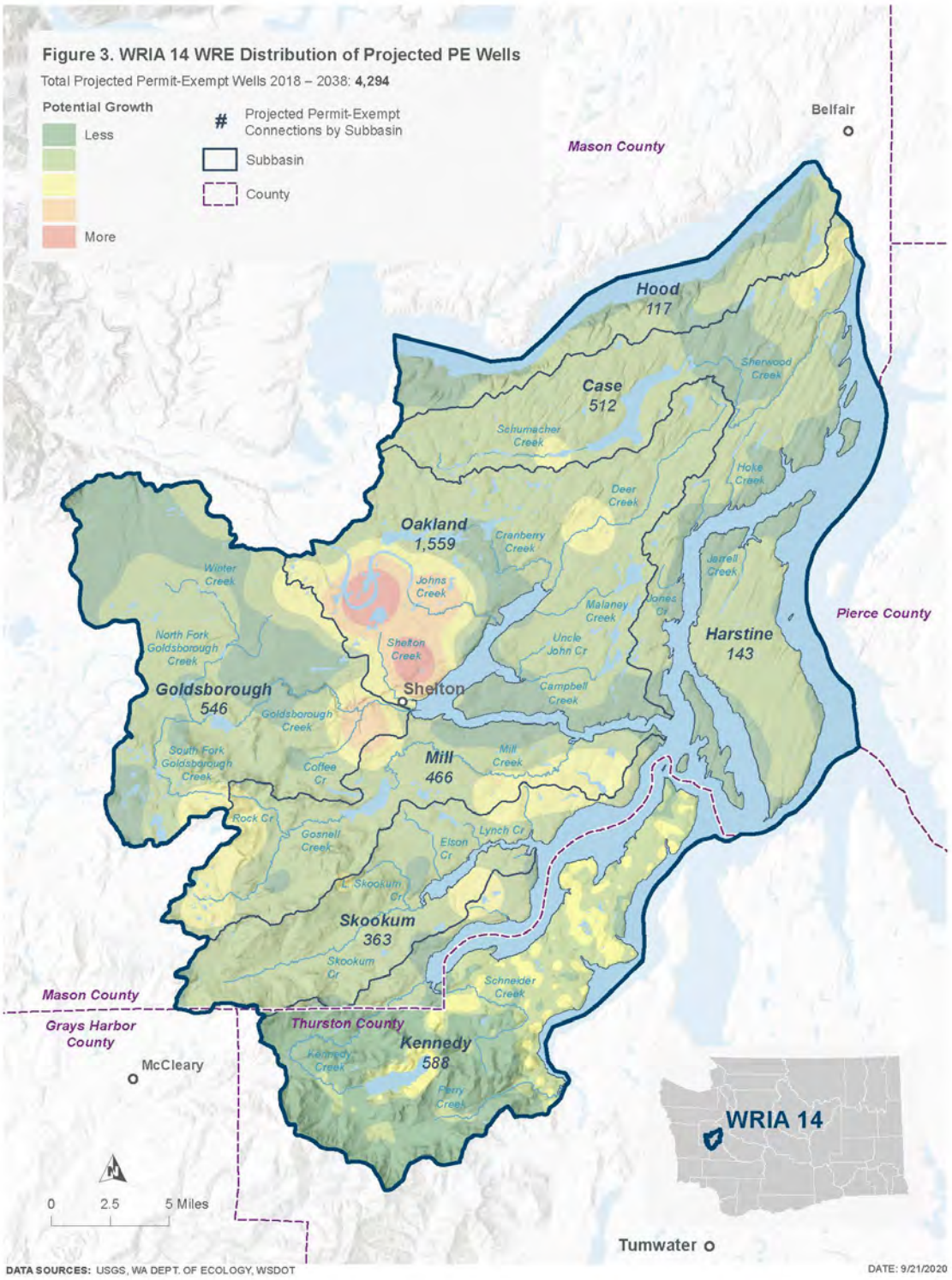

Figure 3: WRIA 14 WRE Distribution of Projected PE Wells for 2018-2038

4.2.5 Summary of Uncertainties and Scenarios

The methods described above for projected new PE wells include a number of uncertainties. These uncertainties were discussed with the WRIA 14 Committee and recognized as inherent to the planning process. The uncertainties are shared here to provide transparency in the planning process and deliberations of the Committee, and to evaluate the range of outcomes that could occur in the future.

One example of uncertainty is that Mason County's method omitted PE wells installed within water system areas. Although most cities require new homes to connect to water systems, they allow exceptions if a connection is not available (for instance, if a home is more than 200 feet from a water line). Additionally, cities and developments may increase the number of available connections through water system expansion, which may result in a lower number of new PE wells, especially in rural areas which have water systems.

Another example of uncertainty is the reliance on historical data. The methods assumed that historical growth trends would continue into the future. However, many factors play into homebuilding trends. Additionally, there is some uncertainty in the methodology that may lead to assumptions of where new PE wells are expected to occur.

An additional example of uncertainty are variations in growth scenarios for each county by OFM. The OFM medium growth scenario was used for this analysis, however OFM also provides a high growth scenario, which is not a formal alternative scenario and is based on the likelihood of the counties experiencing a historically high growth rate. The OFM 20-year high growth projection for 2040 is 18.4% higher than the medium growth projection in Thurston County, and 17.2% higher than the medium growth projection in Mason County.

Because of the uncertainty in the projections, the WRIA 14 Committee evaluated additional PE well scenarios using different assumptions, such as that some permit-exempt growth will occur in rural water system areas. This resulted in the final PE well estimate which the Committee agreed by consensus was the appropriate analysis for WRIA 14.

This methodology is described in detail in Appendix H.

4.3 Impacts of New Consumptive Water Use

The WRIA 14 Committee used a 20-year projection for WRIA 14 of new PE wells to estimate the consumptive water use that this watershed plan must address and offset. The WRIA 14 Committee estimates 759 acre-feet per year (AFY) (1.05 cfs) as the "most likely" new consumptive water use in WRIA 14. This watershed plan also includes a higher consumptive use goal of 1,035 AFY (1.43 cfs) to achieve through adaptive management. This section includes an overview of the method used by the WRIA 14 Committee to estimate new consumptive water use (consumptive use), an overview of the anticipated impacts of new consumptive use in WRIA 14 over the planning horizon, and other considerations by the WRIA 14 Committee, such as assumptions and uncertainties. The WRIA 14 Permit-Exempt Growth and Consumptive Use Summary provides a more detailed description of the analysis and alternative scenarios considered (Appendix H.)

Consistent with the Final NEB guidance (page 8, Appendix B), the Committee assumed impacts from consumptive use on surface water are steady-state, meaning that impacts on the stream from pumping do not change over time. This assumption is based on the wide distribution of future well locations and depths across varying hydrogeological conditions.

4.3.1 Methodology to estimate indoor and outdoor consumptive water use

Appendix A of the Final NEB Guidance describes a method (referred to as the Irrigated Area Method) that assumes average indoor use per person per day, and reviews aerial imagery to provide a basis to estimate irrigated area of outdoor lawn and garden areas. Use patterns for indoor uses versus outdoor uses are different. Indoor use is generally constant throughout the year, while outdoor use occurs primarily in the summer months. Also, the portion of water use that is consumptive varies for indoor and outdoor water use. The Irrigated Area Method accounts for indoor and outdoor consumptive use variances by using separate approaches to estimate indoor and outdoor consumptive use.

To develop the consumptive use estimate, the WRIA 14 Committee used the Irrigated Area Method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance (Ecology 2019). This chapter provides a summary of the technical memo available in Appendix H.

To develop consumptive use estimates, the WRIA 14 Committee looked at other methodologies for estimating consumptive use, such as the water system data method. The Committee determined that the water system data method would not provide an accurate depiction of water use in the watershed, but the results are provided in the technical memo in Appendix H, and additional water system data from Mason PUD is provided in Appendix L.

New indoor consumptive water use

Indoor water use refers to the water that households use (such as in kitchens, bathrooms, and laundry), and that leaves the house as wastewater, typically to a septic system.[33] The WRIA 14 Committee used the Irrigated Area Method and Ecology's recommended assumptions for indoor daily water use per person and local data to estimate the average number of people per household, and applied Ecology's recommended consumptive use factor to estimate new indoor consumptive water use[34]:

- 60 gallons per day (gpd) per person, as recommended by Ecology.
- 2.5 persons per household assumed for rural portions of WRIA 14[35]

[33] USGS 2012 https://pubs.usgs.gov/sir/2012/5163/sir12_5163.pdf
[34] NEB Guidance 2019 https://fortress.wa.gov/ecy/publications/documents/1911079.pdf
[35] OFM information for each county:
Mason County: https://www.ofm.wa.gov/washington-data-research/county-and-city-data/mason-county

- 10 percent of indoor use is consumptively used (or a consumptive use factor [CUF] of 0.10), based on the assumption that homes on PE wells are served by on-site sewage systems. On-site sewage systems return most wastewater back to the immediate water environment; a fraction of that water is lost to the atmosphere through evaporation in the drainfield.

The equation used to estimate household consumptive indoor water use is:

60 gpd per person x 2.5 people per house x 0.10 CUF

This results in an indoor consumptive water use of 15 gallons per day per well. This equates to 5,475 gallons per year (0.017 AFY[36]) (0.000023 cfs[37]).

New outdoor consumptive water uses

Most outdoor water is used to irrigate lawns, gardens, orchards and landscaping, and may include water for livestock. To a lesser extent, households use outdoor water for car and pet washing, exterior home maintenance, pools, and other water-based activities. Water from outdoor use does not enter onsite sewage systems, but instead infiltrates into the ground or is lost to the atmosphere through evapotranspiration.[38]

The WRIA 14 Committee used aerial imagery to measure the irrigated areas of 80 randomly selected parcels of a stratified sample served by PE wells to develop an average outdoor irrigated area. This analysis returned a large portion of parcels with no visible irrigation, which were given irrigated area values of zero. In order to address uncertainty in the analysis, the WRIA 14 Committee replaced the zero values with a value of 0.05 acres to account for potential outdoor water use other than irrigation. Taking that assumption into account, the average irrigated area for the 80 parcels was 0.10 acres. This analysis was determined to result in the most likely outdoor consumptive use estimate for WRIA 14, and will be used as the target offset to compare to offsets from projects. The WRIA 14 Committee then conducted a statistical confidence level analysis on the results. The 95 percent upper confidence limit yielded an irrigated area of 0.14 acres, representing a conservative estimate of the average irrigation area (i.e., there is a 95 percent probability that the true average irrigated area is less than 0.14 acres). This method is further summarized in Appendix H. A higher consumptive use estimate based on this value is included in the plan as a goal that represents successful achievement of NEB through adaptive management. The Committee considers this analysis as a way to account for other uncertainties such as future growth, and climate change.

Thurston County: https://www.ofm.wa.gov/washington-data-research/county-and-city-data/thurston-county

[36] Acre-foot is a unit of volume for water equal to a sheet of water 1 acre in area and 1 foot in depth. It is equal to 325,851 gallons of water; 1 acre-foot per year is equal to 893 gallons per day.

[37] Cubic feet per second (cfs) is a rate of the flow in streams and rivers. It is equal to a volume of water 1 foot high and 1 foot wide flowing a distance of 1 foot in 1 second; 1 cubic foot per second is equal to 646,317 gallons per day.

[38] NEB Guidance, Page 19, Ecology 2019 https://fortress.wa.gov/ecy/publications/documents/1911079.pdf

The WRIA 14 Committee used the following assumptions, recommended in Appendix A of the NEB Guidance, to estimate outdoor consumptive water use:

- Crop irrigation requirements (IR) for turf grass according to Washington Irrigation Guide (WAIG) (NRCS-USDA 1997): a weighted average of 18 inches of irrigation for the Grapeview (18.8 inches), Shelton (17.8 inches), and Olympia (16.5 inches) WAIG stations. This value was used to estimate the amount of water needed to maintain a lawn.
- An irrigation application efficiency (AE) to account for water that does not reach the turf: 75 percent. This increases the amount of water used to meet the crop's irrigation requirement by 25 percent.
- Consumptive use factor of 0.8, reflecting 80 percent consumption for outdoor use. This means 20 percent of outdoor water is returned to the immediate water environment.
- Outdoor irrigated area based on existing homes using PE wells: 0.10 acres (0.14 acres was used for the higher consumptive use estimate as a goal to achieve through adaptive management)

The equation used to estimate household consumptive outdoor water use is:

$$\frac{1.5\ feet\ per\ year * 0.10\ acres * 0.80\ CUF}{0.75\ AE}$$

First, water loss is accounted for by dividing the irrigation requirement by the application efficiency. Next, the total water volume used to maintain turf is multiplied by the area irrigated. Finally, the volume of water is multiplied by 80 percent to produce the outdoor consumptive water use.

This results in 0.16 AF per year (52,136.15 gallons per year) (0.000221 cfs) average outdoor consumptive water use per PE well for the WRIA based on 0.10 acres used for the most likely consumptive use estimate. Using 0.14 acres used in the higher adaptive management consumptive use estimate, this results in 0.22 AF per year (72,990 gallons per year) (0.00031 cfs). This is an average for the year, however the Committee expects that more water use will occur in the summer. The outdoor consumptive use varies by subbasin due to varying temperature and precipitation across the watershed.

4.3.2 Uncertainties and Limitations

The uncertainties and limitations are discussed here to provide transparency in the planning process and deliberations of the Committee, and to evaluate the range of outcomes that could occur in the future.

To reduce uncertainty, the WRIA 14 Committee relied on existing data to the extent possible, such as the average number of people per household, or information from other studies that estimate average indoor water use per person. However, it was recognized by the Committee that the method is based on historical and current water use, and future indoor water use may

vary based on a variety of factors. For example, water conservation may result in indoor water use becoming more efficient over time.

The outdoor consumptive use calculation contains more uncertainty than indoor consumptive use calculations, because it is based on four different factors and represents close to 90% of water usage. The average outdoor irrigated area analysis was limited to a sample size of 80 parcels distributed by location and property values. Also, the interpretation of irrigated areas from aerial photos is subject to error. Some Committee members voiced concern over these uncertainties in the outdoor irrigated area analysis. To help address the potentially limited sample size, the Committee estimated the error margin achieved with the 80 parcels, and determined that it was approximately 0.03 acres (i.e., the arithmetic average of 0.07 acres, which was the initial averaged irrigated area, has an error margin of 0.03 acres). Applying this error margin increased the irrigated area to 0.11 acres. Also, the Committee calculated the 95 percent upper confidence of the irrigated area average. The 95 percent upper confidence limit was 0.14 acres. The 95 percent upper confidence limit represents an upper estimate of the mean that has a 95 percent probability of being less than that upper limit (i.e. an over estimate of irrigated area that would likely result in a more conservative consumptive use estimate). The Committee generally agreed by consensus that future outdoor irrigation amounts for new permit-exempt connections will most likely fall below the estimate based on the 95 percent confidence limit (0.14 acres).

Potential bias in methodology was investigated in a comparability study with another consultant, GeoEngineers (Appendix H). Methods used by GeoEngineers in WRIAs 9 and 10 were compared to HDR's methods (as used in WRIA 14) for the same parcel images. HDR's method was found to be lower than GeoEngineers by 0.05 to 0.06 acres. The finding of the comparability study was that while the method is subject to error and the results varied between the two analyses, the variation of the results in the two analyses was inconclusive in terms of accuracy and the difference between analysists were not large enough to warrant any revisions to the estimates. However, since the HDR estimate were low, relative to the GeoEngineers estimates, the Committee used the 95% upper confidence limit of the results of this analysis (estimated by HDR) to develop the higher adaptive management CU goal account for uncertainty.

Uncertainty associated with method detection of irrigated areas in aerial photos was addressed by assigning a minimum value of 0.05 acres to the 80 parcels used to calculate the average irrigated area. When this minimum value was applied, the average irrigated area increased to 0.10 acres. This acreage was selected by the Committee for consumptive use calculations. More information on uncertainties on these methods can be found in Appendix H.

Other factors of uncertainty in the outdoor consumptive use calculation are the assumptions about irrigation amounts and irrigation efficiencies. The calculation assumes that homeowners water their lawns and gardens at the rate needed for commercial turf grass (i.e., watering at rates that meet crop irrigation requirements per the Washington Irrigation Guide). The irrigated area analysis demonstrated that many people irrigate their lawns enough to keep the grass alive through the dry summers, not at the levels that commercial turf grass requires. The

method also assumes that residential irrigation has an efficiency of 75 percent. This assumes that an additional 25 percent of the water needed to grow the lawn turf is used, because of watering inefficiency.

Another source of uncertainty is that climate change is expected to create longer, hotter, drier growing seasons, which may raise evapotranspiration and increase dry season water demands.[39] [40]

In order to help reduce uncertainty for the Committee when considering both the USGS Groundwater Model and the Irrigation Area Methods regarding consumptive use, the Skokomish Tribe and Aspect Consulting conducted an assessment of how, or if, precipitation variability across geography and time would affect outdoor irrigation consumptive use estimates in WRIA 14. The study used up to date climatological data from Ag Weather Net and PRISM to compare to values using the Irrigation Area Method. This was undertaken to address concerns that these methodologies may not be conservative enough and whether or not a "safety factor" needed to be factored in to the consumptive use analysis. This assessment can be found in the Plan Compendium. The assessment confirmed for the Skokomish Tribe that the Irrigation Area Method is a conservative estimate, eliminating the need for any safety factor for this method, however it does show that addressing climate change is critical when considering future growth.

The WRIA 14 Committee addressed the uncertainties, assumptions, and limitations in this method by using conservative assumptions, and by developing two estimates for consumptive use: "most likely" and "higher use". This Committee prefers this approach, because it gives assurance that if sufficient projects are implemented to offset these consumptive use estimates, those projects will offset actual water use.

4.3.3 Summary of Consumptive Use Estimates

Of the methodologies presented to address uncertainty in the calculations of consumptive use, the Committee agreed by consensus on two estimates for WRIA 14: a "most likely" estimate and a higher estimate as a goal to achieve through adaptive management. Both are based on the assumption to assign a minimum value of 0.05 aces to the 80 parcels used to calculate the average irrigated area. The most likely estimate is based on an irrigated area of 0.10 acres, while the higher use estimate is based on an irrigated area of 0.14 acres (the 95 percent upper confidence limit of the average irrigated acres). These were applied to the calculations to determine indoor, outdoor, and total consumptive use estimates by subbasin (Table 6). The total consumptive use estimates for WRIA 14 are 759 AF per year (1.05 cfs) for the most likely estimate, and 1,034 AF per year (1.43 cfs) for the higher adaptive management goal. The total

[39] See https://climatetoolbox.org/ for more information on climate data.

[40] A memo '*Analysis of water use under climate change'* developed by the Squaxin Island Tribe is provided in the Compendium.

consumptive use estimates for WRIA 14 are calculated as the number of PE wells projected (see Section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. Table 6 summarizes the estimated indoor and outdoor consumptive use by subbasin for WRIA 14. The highest consumptive use is expected to occur in the subbasin with the most anticipated new PE wells, as presented in Figure 3: PE well growth by subbasin.

Table 6: WRIA 14 Estimated PE Well Projects and Indoor and Outdoor "Most Likely" Consumptive Use Estimates by Subbasin, 2018-2038,[41] in acre-feet per year[42]

			Assumed Irrigated Acreage of 0.10 Acre (Most Likely Estimate)		**Assumed Irrigated Acreage of 0.14 Acre (Higher Adaptive Management Goal)**	
Subbasin	**Projected PE wells**	**Indoor CU (AF/year)**	**Outdoor CU (AF/year)**	**Total CU/year (AF/year) in 2038**	**Outdoor CU (AF/year)**	**Total CU/year (AF/year) in 2038**
Case	512	8.6	81.9	90.5	114.7	123.3
Goldsborough	546	9.2	87.4	96.5	122.3	131.5
Harstine	143	2.4	22.9	25.3	32.1	34.5
Hood	117	2.0	18.7	20.7	26.2	28.2
Kennedy	588	9.9	94.0	103.9	131.6	141.5
Mill	466	7.8	74.6	82.4	104.4	112.2
Oakland	1,559	26.2	249.4	275.6	349.2	375.4
Skookum	363	6.1	58.1	64.2	81.3	87.4
TOTAL	**4,294**	**72**	**687**	**759.2**	962	**1,034.0**

[41] The WRIA 14 Committee has determined that an area of 0.10 irrigated acres result in the most likely outdoor consumptive use estimate for WRIA 14, and will be used as the target offset to compare to projects. The analysis based on an area of 0.14 irrigated acres is included in the plan as a higher goal to achieve through adaptive management.

[42] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

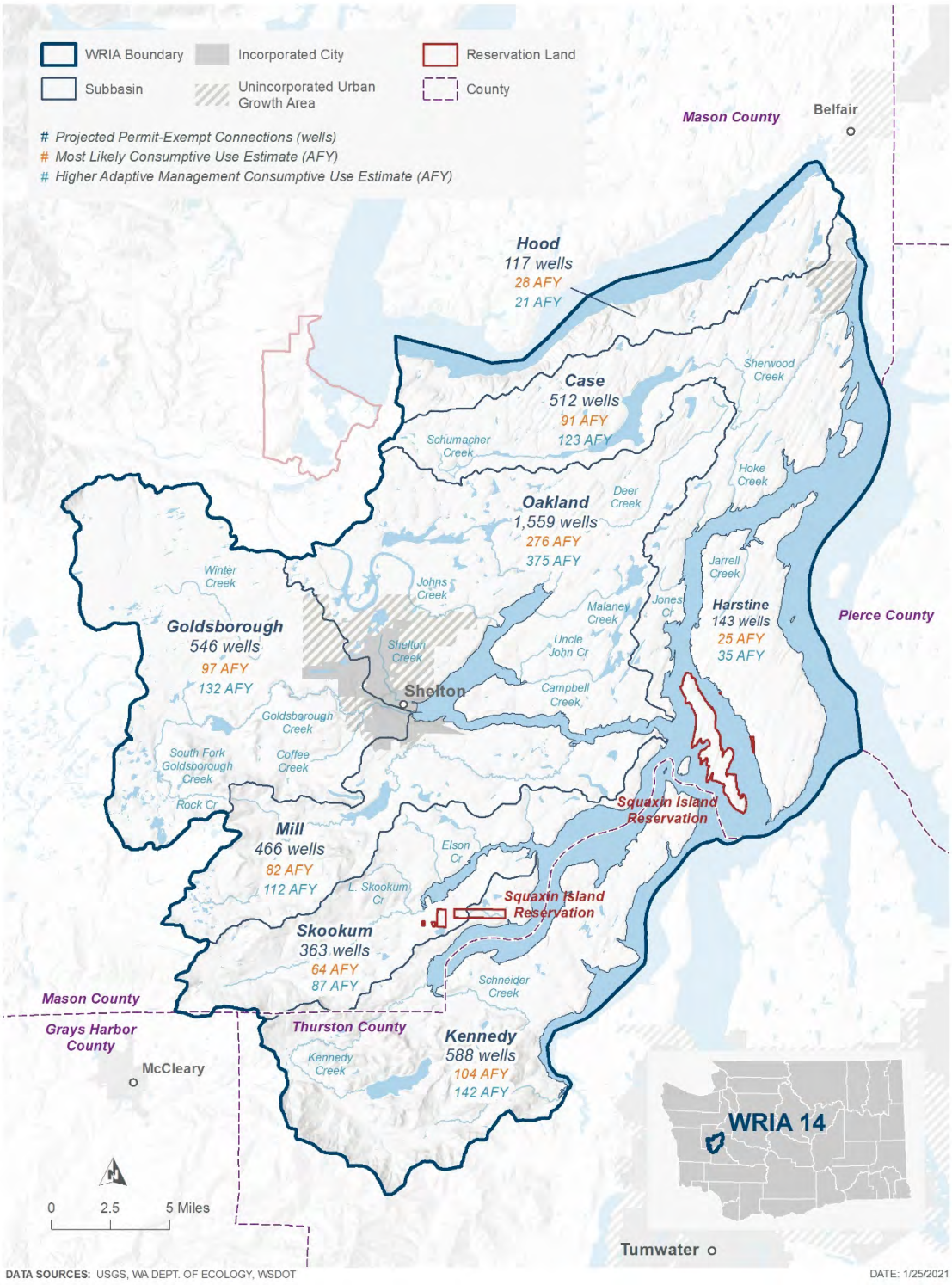

Figure 4: WRIA 14 Estimated Consumptive Use by Subbasin 2018-2038

Chapter Five: Projects and Actions

5.1 Description and Assessment

Watershed plans must identify projects that offset the potential impacts future PE wells will have on streamflows and provide a net ecological benefit (NEB) to the WRIA.[43] This chapter provides recommendations from the WRIA 14 Committee for projects to offset consumptive use and meet NEB[44] and describes water offset projects and habitat projects. Water offset projects have a quantified streamflow benefit and contribute to offsetting consumptive use. Habitat projects contribute toward achieving NEB by improving the ecosystem function and resilience of aquatic systems, supporting the recovery of threatened or endangered salmonids, and protecting instream resources including important native aquatic species. Habitat projects included in this plan were selected for their potential to result in an increase in streamflow, but the water offset benefits for these projects is difficult to quantify. Therefore, this watershed plan does not rely on habitat projects to contribute toward offsetting consumptive use.

To identify the projects summarized in this chapter, as well as the complete project inventory in Appendix J, Committee members and WRIA 14 partners brought project suggestions forward to the workgroup and Committee for discussion. Ecology and the technical consultants also identified projects with potential streamflow benefit from the Puget Sound Action Agenda near term actions, salmon recovery lead entity four-year work plans, streamflow restoration grant applications, and public works programs. The Committee used a project inventory to capture and track all project ideas, no matter their phase of development, throughout the planning process. To receive feedback on projects on alignment with other planning processes and identify any projects of concern for inclusion in the WRE Plan, the WRIA 14 Committee engaged the salmon recovery lead entity in WRIA 14. At any point in the process, Committee members or WRIA 14 partners could identify projects of concern for inclusion in the WRE Plan and recommend removal of the project from the project inventory. Where possible, project sponsors have been identified for projects and were engaged during project development.

[43] The NEB Guidance defines "projects and actions" as "General terms describing any activities in watershed plans to offset impacts from new consumptive water use and/or contribute to NEB." (Ecology, 2019b, page 5) This watershed plan uses the term "projects" for simplicity to encompass both projects and actions as defined by the NEB guidance.

[44] In 2015 the State Supreme Court issued a decision on Foster v. Ecology, City of Yelm, and Washington Pollution Control Hearings Board. The decision, frequently referred to as the "Foster decision," reaffirmed and reinforced that instream flows adopted in a rule must be protected from impairment. The Legislature established the Joint Legislative Task Force on Water Resource Mitigation (Task Force) in RCW 90.94.090 to understand impacts of the 2015 Foster decision. In that law, Ecology is authorized to issue permit decisions for up to five water mitigation pilot projects using a stepwise mitigation approach that can include out of kind mitigation. The City of Port Orchard is one of the entities undertaking a pilot project. As of January 2020, the pilot project work is still ongoing. More information about the Task Force, including their 2019 report to the legislature, can be accessed on their webpage: http://leg.wa.gov/JointCommittees/WRM/Pages/default.aspx. (Ecology, 2020b)

Based on initial information available on projects, the Committee identified a subset of projects that showed promise for quantitative streamflow benefits and prioritized these for further analysis. The technical consultants developed detailed analyses on the subset of projects and the Committee determined the offset value to attribute to each project. This chapter presents summaries of those projects.

Technical consultants provided support to identify water right acquisition opportunities for WRIA 14. In coordination with the Committee, technical consultants narrowed down the list of opportunities. The Committee provided input on the revised list of projects to develop a focused list of water rights for future opportunities such as full or partial acquisition or efficiency projects; however no specific water rights were identified for acquisition. The Committee acknowledged that only the consumptive use portion of the water right that is put to beneficial use could contribute to a water offset in the future. This work shows the annual quantity (Qa) of water rights from the focused list, and acknowledges that only a portion of that would equate to consumptive use. Before these rights are acquired and put into Trust, they will go through a full extent and validity analysis to determine the consumptive use offset component. As these analyses cannot happen until the owners of the rights have agreed to sell, the Committee is relying on the evaluations of the technical consultant to estimate the offset volumes described in section 5.2.

For projects that did not provide a quantifiable streamflow benefit, the WRIA 14 Committee chose not to invest the same level of technical consultant resources to further develop the projects during this planning period as they did for the water offset projects. Information presented on these projects is based on available information from WRIA 14 partners. The Committee focused the technical resources and expertise on finding projects that provide quantifiable offset benefits.

The projects identified in this plan are consistent with the project type examples listed in the Final NEB Guidance: (a) water right acquisition offset projects; (b) non-acquisition water offset projects; and (c) habitat and other related projects (Ecology 2019b). This watershed plan presents projects in the following three categories:

I. Likely to be implemented and provide quantitative streamflow benefits.

II. Likely to be implemented and provide habitat benefit and/or unquantifiable streamflow benefits.

III. Unable to be implemented at this time because the project is highly conceptual or has other constraints.

Projects in Category I and II are presented in this chapter. Prospective projects are also presented in this chapter and may be defined as category I or II projects, once further developed during plan implementation. All other projects are presented in the project inventory in Appendix J. The WRIA 14 Committee recommends implementation of projects in this chapter as well as in Appendix J in order to meet the offset need and NEB for WRIA 14.

As described in Chapter 6, the WRIA 14 Committee supports the development of an implementation group to further develop projects. Priorities of this group may include working

with project sponsors on project implementation, providing guidance for project monitoring, supporting development of feasibility studies, and supporting adaptive management.

5.2 Category I Projects with Quantifiable Streamflow Benefit

The WRIA 14 Committee set the goal of meeting the overall WRIA-scale consumptive use target. The WRIA 14 Committee set a secondary goal of offsetting consumptive use in each subbasin. The projects presented below have quantifiable streamflow benefit and the Committee identified these projects as having the greatest potential for implementation and achieving the required offset need. Detailed descriptions of each of the projects presented in this section are available in Appendix I. A summary of projects and offset benefits by subbasin are presented at the end of this section in Tables 7 - 8.

5.2.1 WRIA-wide Projects

5.2.1.1 Managed Aquifer Recharge Projects in WRIA 14

Managed aquifer recharge (MAR) projects divert, convey, and infiltrate peak seasonal river flows in engineered facilities that are in connection with the local alluvial aquifer that the donor stream or river is also in connection. To ensure that flows would be diverted in quantities that would not reduce habitat suitability for salmonids or reduce habitat forming processes, a couple different methods were used to estimates flow rates. If minimum flows have been designated, then the flow rate was estimated ~~as less~~ than two percent or less of minimum flows. However, on Kennedy Creek, where minimum flows have not been designated, a diversion of 1 cfs was used, which would be less than 2% of average wet season flows. Seepage back into the river would result in attenuation of these flows, increasing base flows across a broader time period, including the late summer and early fall, when flows are typically the lowest, and water demand for consumptive use is the highest. MAR projects are proposed for the following streams:

- Kennedy Creek
- Mill Creek
- Skookum Creek
- Goldsborough Creek
- Johns Creek
- Cranberry Creek
- Sherwood Creek

MAR projects in WRIA 14 have been identified through analysis by the technical consultants to identify potential suitable locations and are estimated to have a total potential water offset of 910 acre-feet per year (AFY). Due to uncertainties in the likelihood of projects being built and the benefits being realized (including the timing of streamflow benefits), the Committee chose to reduce the initial 910 AFY estimate of benefits from MAR projects. Consequently, the Committee determined that a reasonable offset estimate to claim for the purposes of this plan

is 273 AFY (i.e. thirty percent of the estimated 910 AFY total), accounting for uncertainties such as likelihood of implementation and timing of streamflow benefits (Table 7). The Committee supports future feasibility studies within WRIA 14 for MAR projects to further develop this information. Explanation and potential offset quantities for MAR projects in each stream are described in the following subbasin sections. A detailed project description is available in Appendix I.

The WRIA 14 Committee acknowledges that some diversion methods including in-channel structures may pose an impact to fish habitat, and strongly advocates for the use of diversion methods that do not include in-channel structures. For example, diverted water could be conveyed through a collector well adjacent to the river (e.g. Ranney Collector well). The WRIA 14 Committee suggests that projects should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Thurston County and Mason County have indicated that they would be the likely project sponsors of MAR projects within their respective county boundaries, in coordination with project partners and implementation groups, pending feasibility studies and land ownership.

5.2.1.2 Water Right Opportunities

The WRIA 14 Committee supports the full and partial acquisition of water rights to increase streamflows and offset the impacts of PE wells. Water rights should be permanently and legally held by Ecology in the Trust Water Rights Program to ensure that the benefits to instream resources are permanent. The WRIA 14 Committee acknowledges that all water right transactions rely on willing sellers and willing buyers. The WRIA 14 Committee recognizes the importance of water availability for producers and the limited available water supply.

The WRIA 14 Committee has identified a focused list of water rights for potential future investigation by WRIA 14 implementation partners, which can be found in Appendix I.

Water right opportunities are proposed for the following subbasins, and the amount of offset benefit by subbasin is shown based on the assumption of claiming 10% of the total Qa from the focused water rights list:

- Goldsborough: 34 AFY
- Hood: 31 AFY
- Mill: 30 AFY
- Oakland: 16 AFY

Based on the focused list of water rights, the Committee estimates that future feasibility studies or acquisition and efficiency opportunities may lead to a total estimated offset of 111 AFY (Table 7). The Committee supports future investigations of water rights for all water users, including commercial/industrial water right holders, to develop information on extent and validity of water rights for future project opportunities.

5.2.2 Case Subbasin

5.2.2.1 Managed Aquifer Recharge Project in Sherwood Creek

An MAR project (as described in the WRIA-wide Projects section above) is proposed for Sherwood Creek (Appendix I). Sherwood Creek flows from Mason Lake. Average monthly flows for Sherwood Creek at Sherwood Cr Rd. range between 79 - 144 cfs between November and April. Water could be diverted from the downstream end of Mason Lake and conveyed to an MAR site directly downstream of the lake outlet. An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) is proposed over this period. At least 72 days are likely to be above minimum instream flows during this period, while still accommodating a 1 cfs diversion, resulting a potential water offset of 143 AFY. The Committee has conservatively claimed thirty percent of this water offset, or 43 AFY (Table 8).

5.2.3 Goldsborough Subbasin

5.2.3.1 City of Shelton Reclaimed Water

The City of Shelton (City) proposes to increase the quantity and rate of reclaimed water infiltration into the North Fork Goldsborough subbasin by increasing production of Class A reclaimed water (RW) and infiltrating this to groundwater at the City RW spray field, near the Washington Corrections Center (WCC). This project will re-direct an annual average of 560 AFY of the City's wastewater in North Shelton from the City's Wastewater Treatment Plant (WWTP) to the City's Water Reclamation Plant (WRP). The additional flow will be treated to produce 560 AFY of RW for subsequent conveyance to the existing City spray field. The following infrastructure improvements will need to occur to facilitate this project:

- Conveyance of North Shelton wastewater to the WRP.
- A storage tank (0.750 million gallons per day) to store RW at the WRP.

The conveyance of North Shelton wastewater to the WRP is currently in its design phase, and is likely to include a sewage lift station, and 18-inch sewer main that would run from West Birch Street to reclaimed water satellite plant (approximately 9,000 linear feet). The RW storage tank will buffer variable production and use of RW. RW produced from City wastewater may be used for City uses, including a backup for firefighting, and it allows strategic timing of application of reclaimed water to the ground to benefit aquifers and streams and wetlands. Streamflow restoration funds are currently supporting design options for the lift station, sewer main, storage tank, and cost estimates. The additional RW will be conveyed to the City's existing spray field near the WCC with and infiltrated to local groundwater. Assuming an infiltration efficiency of 80%, this would result in about 448 AFY of water being infiltrated into the local aquifer.

The second component of this project is the use of RW at the WCC. The WCC proposes to use RW to irrigate their outdoor lawn, instead of water that they currently pump from their local well. Pumping from their local well has been shown to impact instream flows in the North Fork

Goldsborough Creek. Assuming an infiltration efficiency of 80%, this would result in about 38 AFY of additional RW being infiltrated to the local aquifer. Both project components sum to a potential water offset of 486 AFY (Tables 7 – 8).

5.2.3.2 Managed Aquifer Recharge Project in Goldsborough Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Goldsborough Creek (Appendix I). Soils and geology are favorable for MAR sites near Goldsborough Creek at multiple locations. Average monthly flows for Goldsborough Creek at S. 7th Street (USGS gage 12076800) range between 196 – 341 cfs between November and April. An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. At least 166 days are likely to be above minimum instream flows during this period, while still accommodating a 1 cfs diversion, resulting a potential water offset of 329 AFY. The Committee has conservatively claimed thirty percent of this water offset, or 99 AFY (Table 8).

5.2.4 Harstine Subbasin

No water offset projects are identified for the Harstine Subbasin.

5.2.5 Hood Subbasin

5.2.5.1 Managed Aquifer Recharge Project in the Hood Subbasin

MAR projects (as described in the WRIA-wide Projects section) may be proposed for streams in the Hood Subbasin during plan implementation. The Committee supports MAR projects in this subbasin, if there is a suitable stream and MAR infiltration basin that would benefit low seasonal flows.

5.2.6 Kennedy Subbasin

5.2.6.1 Managed Aquifer Recharge Project in Kennedy Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Kennedy Creek (Appendix I). Kennedy Creek could have an MAR site(s) at near the outlet of Summit Lake or at approximately River Mile (RM) 5. Both of these areas are forested and have suitable geology and soils for infiltration. Average monthly flows near the mouth of Kennedy Creek range between ~~92~~57 – 119 cfs between November and March. Since no minimum flows are set for Kennedy Creek, the average flows were used as a basis for setting diversion flow quantities. An MAR diversion of 1 cfs between November and March equates to less than 2% of average wet season flows. A conservative estimate of 40 days (a third of the time) is estimated to be above these average flows, while still accommodating a 1 cfs diversion. This would result in a 79 AFY water offset. The Committee has conservatively claimed thirty percent of this water offset, or 24 AFY (Table 8).

5.2.6.2 Schneider Creek Source Switch

The Schneider Creek Source Switch Project would replace an agricultural surface water diversion on Schneider Creek with a groundwater source. By shifting irrigation withdrawals to a groundwater source, the effect of those irrigation withdrawals on Schneider Creek would be

much less. However, by pumping groundwater as opposed to surface water, the pumping effect on Schneider Creek may affect surface flows year round. This lesser but more attenuated impact on stream flow is not currently consistent with Washington State water law. Chapter 173-514 WAC places a seasonal closure on Schneider Creek May 1 through October 31, but the existing water right specified that all the surface water withdrawals must stop on October 1. If future groundwater pumping was to stop on that date, the effects of groundwater pumping would continue into the month of October and affect streamflow during part of the closed period. Therefore, no water offset credit is currently being claimed for this project. However, if this aspect of Washington State Water law could be modified during plan implementation, the Committee would like to implement this project for water offset credits (Table 7).

5.2.6.4 Steamboat Middle

The Steamboat Middle project consists of expanded water storage in an existing forested/non-forested wetland. The project would expand water storage in a low-lying area between elevation of 114 and 118 ft. Some additional habitat may be created from this project as well as an expansion of wetlands as a result of additional water storage area. Conceptually, this project could provide infiltration of 14 to 61 AFY and would require quantification as part of a feasibility study. The WRIA 14 Committee is conservatively claiming 14 AFY of offset benefit (Table 8).

5.2.7 Mill Subbasin

5.2.7.1 Managed Aquifer Recharge Project in Mill Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Mill Creek (Appendix I). Soils and geology are favorable for MAR sites immediately downstream of Isabella Lake. This location would be useful, in terms of providing cool groundwater recharge downstream of the lake. Average monthly flows for Mill creek at Highway 3 range between 81 - 153 cfs between November and April. An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. There were between 86 - 128 days when flows were above minimum instream flows, while still accommodating a 1 cfs diversion, resulting a potential water offset of 171 – 254 AFY. At least 86 days are likely to be above minimum instream flows during this period, while still accommodating a 1 cfs diversion, resulting a potential water offset of 171 AFY. The Committee has conservatively claimed thirty percent of this water offset, or 51 AFY (Table 8).

5.2.8 Oakland Subbasin

5.2.8.1 Evergreen Mobile Home Estates Water Rights Acquisition

Evergreen Mobile Home Estates (Evergreen Estates) Group A water system (PWSID# 24154) has been issued a compliance order to install CT6 disinfection (i.e. chlorination) to address failing on-site wastewater systems in close proximity to its wells. As an alternative to CT6 treatment, Evergreen Estates is considering connection to the City of Shelton's (City's) water system and abandoning its existing wells. The City has been pursuing consolidating the Evergreen Estates

with the City drinking water system and conducted a feasibility study to identify infrastructure improvements necessary for this to occur. The water system consolidation would result in the water rights of the Evergreen Mobile Estates Group A system no longer being unused. A water offset benefit would occur if that water right was placed into permanent trust, per RCW 90.42. The City conducted a feasibility Study and estimated their likely annual water use to be 7.2 AFY. Therefore, if the City provided water to the Evergreen Estates, and the existing water right were to be placed into permanent trust, the water offset value would be 7.2 AFY (Tables 7 – 9).

The Evergreen Estates installed five new sewer septic systems and a chlorination system at the wells. The property owner has indicated that the State has accepted their plan for onsite septic and chlorination improvements and that no further action on their part is needed. However, water system consolidation could still occur, and may be incentivized if the Evergreen Estates consolidation costs were covered by others or with grant funding.

5.2.8.2 Managed Aquifer Recharge Project in Johns Creek and Cranberry Creek

MAR projects (as described in the WRIA-wide Projects section) are proposed for Johns Creek and Cranberry Creek (Appendix I). Average monthly flows for Johns Creek at Hwy 3 range between ~~81 – 153~~52-97 cfs between November and April. An MAR diversion of 0.5 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. At least 36 days are likely to be above minimum instream flows during this period, while still accommodating a 0.5 cfs diversion, resulting a potential water offset of 36 AFY. The Committee has conservatively claimed thirty percent of this water offset, or 11 AFY (Table 8).

Average monthly flows for Cranberry Creek at Highway 3 range between 48 - 99 cfs between November and April. An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. At least 35 days are likely to be above minimum instream flows during this period, while still accommodating a 1 cfs diversion, resulting a potential water offset of 69 AFY. The Committee has conservatively claimed thirty percent of this water offset, or 21 AFY (Table 8).

5.2.9 Skookum Subbasin

5.2.9.1 Managed Aquifer Recharge Project in Skookum Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Skookum Creek (Appendix I). Skookum Creek has unfavorable soils for MAR infiltration along much of its stream alignment. However, there are some small areas of suitable geology and soils in the headwaters and near the confluence with Kamilche Creek. Average monthly flows at Highway 101 range between 57 – 140 cfs between November and April. Assuming that flows are similar downstream of Kamilche Creek, an MAR diversion of 0.5 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 84 - 131 days were above minimum instream flows, while still accommodating a 0.5 cfs diversion, resulting a potential water offset of 83 – 130 AFY. At least 84 days are likely to be above minimum instream flows during this period, while still accommodating a 0.5 cfs diversion, resulting a potential water offset of 83 AFY. The Committee has conservatively claimed thirty percent of this water offset, or 25 AFY (Table 8).

Table 7: Category I and Prospective Projects with Quantifiable Streamflow Benefit.

Project Type	Project Name	Project Description	Subbasin	Estimated Water Offset (AFY)[45]	Offset Claimed by WRIA 14 Committee (AFY)	Timing of Benefits	Project Sponsor	Estimated Project Cost[46]	Readiness to Proceed
Category I	City of Shelton RW/ WCC Source Switch	Re-direct North Shelton wastewater to WRP and infiltrate Class A reclaimed water at existing spray field near the WCC	Goldsborough	486	486	Year-round	City of Shelton	$8.8M	High
Category I	Evergreen Mobile Estates	Water system consolidation and water right acquisition	Oakland Bay	7	7	Year-round	City of Shelton	$474,000	Low
Category I	MAR	Install managed aquifer recharge facilities	Multiple	910	273	Year-round	Mason County/Mason PUD 1/ Thurston County/WRIA 14 Implementation Partners[47]	$3.1 M	Low
Category I	Water Right Opportunities	A focused WRIA-wide analysis on potential WR efficiencies and acquisition for future studies and implementation	Goldsborough, Hood, Mill, Oakland	1,112	111	Year-round	WRIA 14 Implementation Partners	$285,000	Low
Category I	Steamboat Middle	Surface water retention and infiltration	Kennedy	14	14	Year-round	Thurston County	$1 M	Low

[45] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day
[46] Costs are based on offset claimed by the Committee and are based on order of magnitude estimates.
[47] The WRIA 14 Committee supports the development of an implementation group to further develop projects

Prospective	Schneider Creek Source Switch[48]	Source switch from surface water ground water	Kennedy	64	0	n/a	Thurston County	n/a	Low
Prospective	Summit Lake Water System	Future potential source switch for local domestic water supply	Kennedy	24-133	0	n/a	Thurston County	n/a	Low
Prospective	Mason Co Rooftop Runoff	New county requirement for new rural residential building to install LID BMPs that infiltrate over 95% of rooftop runoff.	All	249	0	Year-round	Mason County	$0[49]	High
	WRIA 14 Total Water Offset for WRIA 14 Projects			**2,866-2,975**	**891**				
	WRIA 14 Consumptive Use Estimate			**759**					
	WRIA 14 Higher Adaptive Management Consumptive Use Goal			**1,034**					

[48] The Schneider Creek Source Switch project currently conflicts with the Foster Supreme Court Decision, and would only be implemented pending legislative changes to allow for such projects to move forward; however, the Committee supports implementation of this project and has estimated the potential future offset quantity should this project be implemented.

[49] At this time, all estimated project costs are expected to be included in costs of construction for new homes, which would range from $3,780-$9.300 per home – a total of ~$17 million for proposed project.

Table 8: Water Offsets claimed by the WRIA 14 Committee, summed by subbasin. All values are in acre-feet per year.[50]

Subbasin	WRIA 14 Most Likely CU Estimate	WRIA 14 Higher Adaptive Mgmt CU Goal	Managed Aquifer Recharge	Water Rights	Shelton RW/WCC	Evergreen Mobile Estates	Steamboat Middle	Total
Case	90.5	123.3	43	0	0	0	0	43
Goldsborough	96.5	131.5	99	34	486	0	0	619
Harstine	25.3	34.5	0	0	0	0	0	0
Hood	20.7	28.2	0	31	0	0	0	31
Kennedy	103.9	141.5	24	0	0	0	14	38
Mill	82.4	112.2	51	30	0	0	0	81
Oakland Bay	275.6	375.4	32	16	0	7	0	55
Skookum	64.2	87.4	25	0	0	0	0	25
Total	**759.2**	**1,034.0**	**273**	**111**	**486**	**7**	**14**	**891**

[50] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

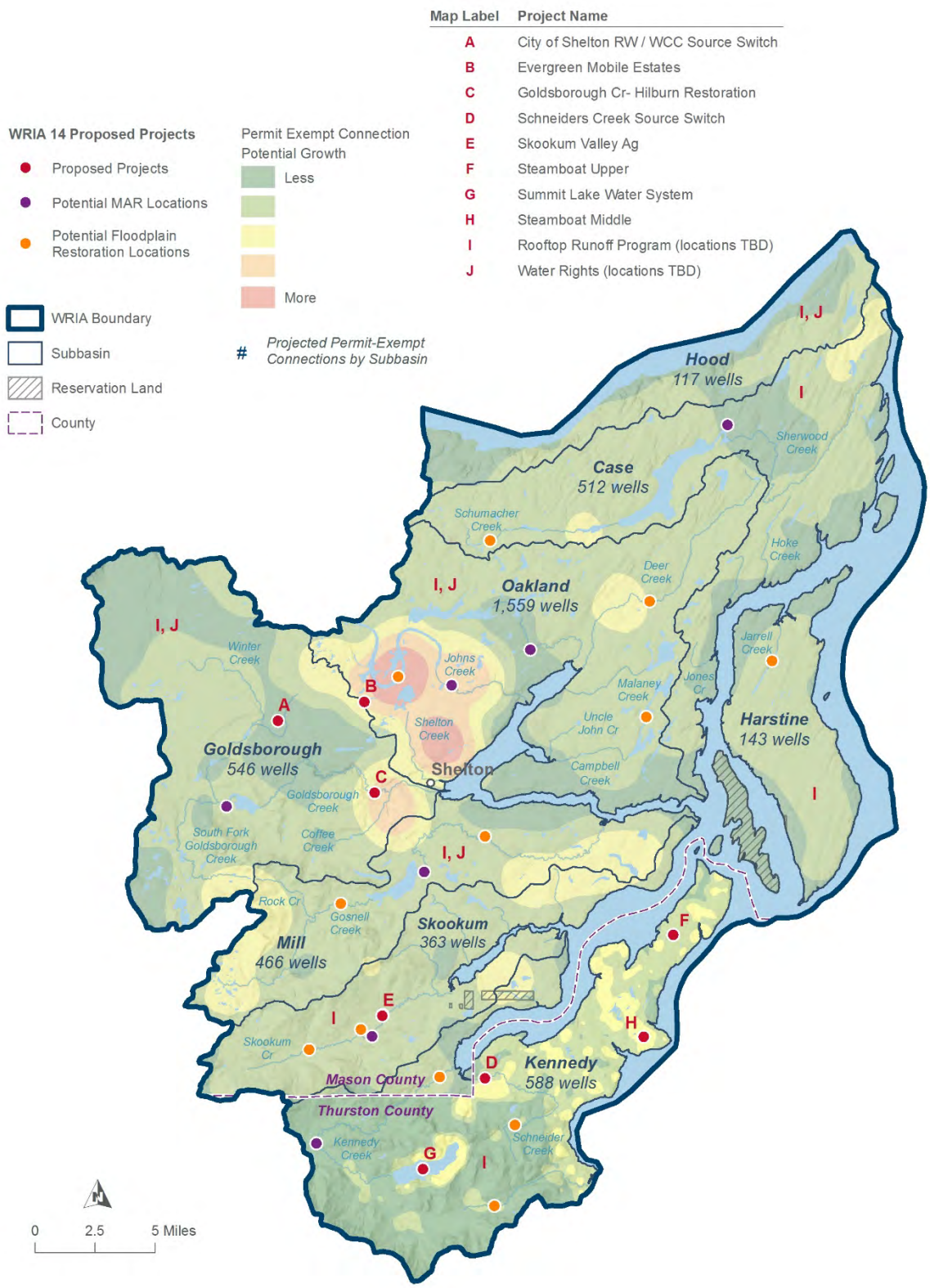

Figure 5: WRIA 14 Projects

5.3 Category II Projects that Primarily Provide Habitat Improvements

A number of habitat restoration projects, or projects with unquantifiable streamflow benefit were identified in WRIA 14. While several of these projects may produce a marginal offset benefit by increasing seasonal storage, the benefits were too small and too complex to estimate. In general, these projects increase stream complexity, reconnect floodplains, fish passage, and enhance natural processes that had been lost to the benefit of salmonids and other aquatic species. Projects are described in Table 9, and detailed project descriptions are included in Appendix I.

Table 9: Category II Projects in WRIA 14 that Primarily Provide Habitat Improvements

Project Name	Project Description	Subbasin	Anticipated Ecological Benefit	Sponsor	Estimated Cost[51]	Readiness to Proceed
Skookum Valley Ag	Channel re-alignment to increase channel length and sinuosity	Skookum	Increase floodplain connectivity; increase usable aquatic habitat area; increase fish cover; increase habitat complexity	Squaxin Island Tribe	<$1M	High
Skookum Valley Railroad Culvert Crossings	Restore fish passage at several existing barriers	Skookum	Fish passage	Squaxin Island Tribe	$1-5M	Medium
Goldsborough Cr-Hilburn Restoration	Remove bank protection and channel fill; Increase density of large woody debris	Goldsborough	Increase floodplain connectivity; increase usable aquatic habitat area; increase fish cover; increase habitat complexity	Squaxin Island Tribe	<$1M	High
Steamboat Upper	Increase ponded storage on north end of the Steamboat peninsula	Kennedy	Increase base flow in unnamed stream flowing from pond.	Thurston County	$1M	Low

[51] Costs are based on order of magnitude estimates

5.4 Categorical Projects and Prospective Projects

In addition to the projects described above, the plan identifies categorical actions that will increase water conservation throughout the WRIA, and in some cases may result in water offset benefits during plan implementation (Table 7). These categorical projects do not have specific locations yet, but would during plan implementation.

5.4.1 Water Right Opportunities

In addition to the projects described in this chapter, the WRIA 14 Committee supports projects and actions that achieve the following goals:

1. Opportunities to address irrigation efficiencies for water right holders. This may be accomplished through education, outreach, or incentive programs.
2. Acquisitions of water rights to increase streamflows and offset the impacts of PE wells. Water rights should be permanently and legally held by Ecology in the Trust Water Rights Program to ensure that the benefits to instream resources are permanent.
3. The WRIA 14 Committee acknowledges that all water rights transactions rely on willing sellers and willing buyers. The WRIA 14 Committee supports acquisition of all types of water rights, including municipal water rights. The WRIA 14 Committee recognizes the importance of water availability for farmers and the limited available water supply. The WRIA 14 Committee supports the acquisition of irrigation water rights if the properties underlying the water rights have access to an alternative water source that can be reliably supplied at rates no greater than that of current irrigation, or is otherwise agreeable to the property owner.
4. The WRIA 14 Committee recommends that opportunities for the above-mentioned projects and actions be addressed through future feasibility studies, water right investigations, etc.
5. Prioritize subbasins where the highest needs for projects exist.

The WRIA 14 Committee acknowledges the need for project sponsors, technical assistance to manage complex studies, and future funding to adequately implement projects.

A detailed summary of the water right analysis performed for the WRIA 14 Committee is included in in Appendix I.

5.4.2 Forest Stand Age

The Committee is interested in voluntary projects that involve forest conservation, forest land acquisition, carbon sequestration that can be demonstrated to have a streamflow benefit. If a project can demonstrate a streamflow benefit, it can be considered for providing an offset and NEB benefit under the plan. Due to uncertainties regarding forest management projects, the Committee chose not to count the potential offset from this project during the plan analysis. More information on this project proposal can be found in the plan Compendium.

5.4.3 Floodplain Restoration

The Committee is interested in restoring stream floodplain function, where appropriate. WRIA 14 floodplain restoration projects would address loss of groundwater storage, low flows and water quality conditions. The specific actions proposed for any given project would be specific to the restoration opportunity and habitat capacity of that location. The goal of any given project would be to rehabilitate natural hydrologic and geomorphic processes that are provided by floodplain connectivity. More detailed objectives pursuant to this goal would be specific to each respective project.

Projects will vary depending on the stream setting, habitat capacity, the impact that has occurred, and the corresponding opportunities for restoration. Potential floodplain restoration actions include the following:

- Channel re-alignment (i.e. re-meander),
- Removing bank protection,
- Installation of large wood to promote hyporheic and floodplain water storage
- Removal of fill or creation of inset floodplain (i.e. excavation of terraces),
- Side channel and off-channel feature reconnections, creation or enhancement.

Potential floodplain restoration locations were identified based on being unconfined, within a flood zone, and being vacant. Secondary considerations were given to locations that were on public land, and near tributary inflow (and therefore potentially prone to flooding).

Due to uncertainties regarding floodplain restoration, the Committee chose not to count the potential offset from this project during the plan analysis.

5.4.4 Summit Lake Water System

This project conceptually involves determining alternative solutions for safe water supply to the Summit Lake community. It involves a substantial portion of the lakefront residents of south shore drive along Summit Lake currently using surface water from the lake itself. An alternative water supply could supply water and reduce the use/demand for 235 homes on south Summit Lake Shore Drive South. Potential alternative sources include new source wells, and piping water from a public water system. A water offset benefit could occur by limiting irrigation for homes newly connected to water supply, and by retiring non-certificated permits and the retirement of certificated water rights into permanent trust. The first steps would be to conduct a feasibility study to determine the best option for a new Summit Lake community source and perform community outreach. Depending on the assumptions made, flow benefits in the Kennedy Creek subbasin may be on the order of 24-133 AFY. The potential offset benefit from this project is shown in table 7 above; however, due to all the uncertainties associated with this project and the need for feasibility and community outreach to occur, the Committee chose not to claim a water offset benefit.

5.4.5 Mason County Rooftop Runoff

Mason County has proposed a modification of the County building code to require low-impact development (LID) best management practices (BMPs) to capture of roof runoff from new rural residential (RR) development (Appendix I). Examples of LID BMPs would include dry wells, infiltration trenches, infiltration galleries, or rain gardens. The requirement would achieve 85% infiltration of runoff from a new rural residential parcel development roof for parcels on hydrologic type A and B soils (Appendix I). Parcels on hydrologic type C soils are anticipated to achieve an average of 69% infiltration of runoff from a new RR parcel development. The maximum infiltration trench size is assumed to be 620 square feet. The infiltrated runoff is assumed to be shallow groundwater recharge as an interflow contribution, with an assumed down-gradient surface water benefit to receiving waters base flow augmentation. Based on 2,766 wells apportioned to assumed full parcel buildout within the WRIA 14 Project area, this project could potentially yield a water recharge offset of 249 AFY or 0.34 cfs (Appendix I; Table 7). The technical approach used to develop these potential water offsets and associated results were reviewed and vetted with the WRIA 14 Committee.

For the purposes of the WRIA 14 watershed plan, 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. The Mason County rainfall runoff proposal is available for a quantitative offset because it is not otherwise required by law or regulation. RCW 90.94.030(4)(a)(vi)(C) states the following: “An applicant shall manage stormwater runoff on-site to the extent practicable by maximizing infiltration, including using low-impact development techniques, or pursuant to stormwater management requirements adopted by the local permitting authority, if locally adopted requirements are more stringent.” For Mason County, the “extent practicable” is defined as the extent feasible or capable of being done or carried out with reasonable effort, taking into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations. For this reason, the rooftop runoff proposal goes beyond the “extent practicable” and would not already be required on under RCW 90.94. In addition, current locally adopted requirements are not more stringent than this definition. Therefore, the project if implemented as proposed would more stringent than the “extent practicable” for Mason County and would be allowed.

In addition, Mason County is not currently covered by the MS4 Phase 2 NPDES Stormwater permit, which would require the kind of runoff infiltration proposed. Therefore, at this time the proposed project would not be required under the MS4 permit. Based on growth projections and the requirements of the law, Mason County would be required to meet the MS4 permit requirements no sooner than reaching population totals requiring regulation. According to the MS4 Stormwater Permitting Guide, an important distinction from Phase I MS4s is that not all Small MS4s are regulated. Some Small MS4s or portions of Small MS4s are not required to obtain NPDES permit coverage. A Small MS4 must obtain an NPDES permit only in two situations: if it (1) is within a Census-designated urbanized area or (2) has been designated by

the permit authority as requiring a permit. Therefore, this project would likely be in effect for the 20-year horizon required for planning, if implemented.

The Committee is not claiming any offset from this project for the purposes of the NEB evaluation because Mason County is unable to commit to implementation due to regulatory constraints. The project may be considered for implementation if these constraints are lifted, and has Committee support for future consideration. The Committee recommends that a future implementation group (described in Chapter 6) revisit this project during review of adaptive management if offset needs are not being met in WRIA 14. A detailed analysis of this project and calculation of potential offsets in provided in Appendix I for informational purposes should this project be implemented.

5.5 Project Implementation Summary

5.5.1 Summary of Projects and Benefits

As specified in Chapter 4, this plan aims to offset 759 AFY of consumptive use from new PE wells over the planning horizon based on the "most likely" consumptive use estimate. This watershed plan also provides a higher consumptive use estimate of 1,034 AFY as a goal to achieve through adaptive management. The project offset benefits claimed by the Committee and included in Table 7 provide an estimated offset of 891 AFY and exceeds the "most likely" consumptive use estimate at the WRIA scale. The project offset benefits claimed by the Committee and presented in Table 7 do not meet the higher adaptive management goal consumptive use estimate. At the subbasin scale, estimated offsets exceed both the "most likely" and higher adaptive management goal consumptive use estimates in the Goldsborough, and Hood, subbasins. Conversely, estimated offsets fall short of both the "most likely" and higher adaptive management goal consumptive use estimates in all other subbasins.

A total of four habitat projects have been identified by the Committee for their potential to provide streamflow benefits and are included in Table 9. Ecological benefits associated with these projects include floodplain restoration, wetland reconnection, availability of off-channel habitat for juvenile salmonids, increase in groundwater levels and baseflow, and increase in channel complexity. While many of these projects have potential streamflow benefits, this plan does not account for the water offset from habitat projects. The ecological and streamflow benefits from habitat projects are supplemental to the quantified water offsets. A total of five prospective projects have been identified by the Committee for their potential to provide streamflow and ecological benefits. These projects may be part of plan implementation, if they are demonstrated to be feasible.

5.5.2 Cost Estimate for offsetting new domestic water use over 20 Year Planning Horizon

Per RCW 90.94.030(3)(d), this watershed plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years. To satisfy this requirement, this plan includes planning-level cost estimates for each of the water offset

projects listed in Table 7. The plan also includes costs estimates for habitat projects in Table 9 when that information was readily available.

The estimated cost for implementing individual water offset projects range from $285,000 for Water Right Opportunities to $8.8 million for City of Shelton Reclaimed Water. The total estimated cost for implementing the water offset projects listed and described in this chapter is $13.7 million.

The estimated cost for implementing individual habitat projects range from $1-5 million, based on order of magnitude cost estimates. The total estimated cost for implementing the habitat projects listed and described in this chapter is $4-8 million.

5.5.3 Certainty of Implementation

This plan includes adaptive management and policy recommendations (see Chapter 6) to increase reasonable assurance that the projects and actions in the plan will be implemented.

The WRIA 14 Committee selected projects that have a likelihood of implementation and have support from project sponsors. As is further discussed in Chapter 6, the WRIA 14 Committee supports the continuation of an implementation group to further develop projects.

Chapter Six: Policy Recommendations, Adaptive Management, and Implementation

6.1 Policy and Regulatory Recommendations

The Streamflow Restoration law lists optional elements committees may consider including in the plan to manage water resources for the WRIA or a portion of the WRIA (RCW 90.94.030(3)(f)). The WRIA 14 Committee included "policy and regulatory recommendations" in the watershed plan to show support for programs, policies, and regulatory actions that would contribute to the goal of streamflow restoration. When similar concepts arose from multiple Watershed Restoration and Enhancement Committees, the WRIA 14 Committee coordinated with those other committees to put forward common language for inclusion in the watershed plans, when appropriate. Coordination also occurred for jurisdictions that cross multiple watersheds. All projects and actions the WRIA 14 Committee intended to count toward the required consumptive use offset or NEB are included in Chapter 5: Projects and Actions.[52]

As recommended by the NEB Guidance, the WRIA 14 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).

The WRIA 14 Committee initially identified a list of potential recommendations based on proposals brought forward by members of the Committee.[53] After iterative rounds of discussion and feedback during Committee meetings, in one on one conversations, and using a survey tool, the Committee narrowed the recommendations to those presented below. Unless otherwise specified, the proposed implementing entity is not obligated by this plan to implement the recommendation; however, the WRIA 14 Committee requests consideration of each recommendation by the identified implementing entity. Additional information on assurance of implementation has been provided by many entities in section 6.3.2. The identification and listing of these policy and regulatory recommendations is directly from the WRIA 14 Committee members and is not endorsed or opposed by Ecology.

[52] "New regulations or amendments to existing regulations adopted after January 19, 2018, enacted to contribute to the restoration or enhancement of streamflows may count towards the required consumptive use offset and/or providing NEB." Streamflow Restoration Policy and Interpretive Statement, POL-2094

[53] Initial policy proposals are included in the Plan Compendium.

The WRIA 14 Committee provides the following recommendations. Please note that these are not listed in order of priority:

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

Proposed implementing entity: Department of Ecology

Recommendation: Update Department of Ecology's well tracking system to better track the number and location of permit-exempt wells in use. This update would include the following:

- Collect latitude and longitude of wells on well report forms;
- Identify permit-exempt wells on well log form; and
- Provide electronic 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 permit-exempt wells will support the WRIA 14 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 the legislature provide additional funding.

Additional Resources: The full proposal for this recommendation is included in Appendix M

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 and implement a research and monitoring strategy for WRIA 14 that may include the following:

- Streamflow monitoring
- Groundwater monitoring
- Groundwater modeling
- Precipitation and drought conditions
- Land use changes
- Water consumption and water supply data

Purpose: The WRIA 14 Committee desires comprehensive monitoring data on the overall 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. Revolving Loan and Grant Fund for Community Water Systems

Proposed implementing entity: Thurston and Mason Counties

Recommendation: Investigate the feasibility of establishing and operating a revolving loan/grant fund to offset the costs of connecting to Group A public water systems. Funding would be available when the cost of connecting to a Group A system is higher than creating a new permit-exempt well, creating an economic barrier for applicants. Feasibility would be determined by criteria set for the provider and applicant (such as the availability of a sufficient water right; consistency with the relevant Water System Plan).

Purpose: This would reduce barriers to connecting to Group A systems, thereby reducing the number of projected new permit-exempt wells and reducing groundwater consumptive use.

Funding source: Funding would be needed to develop and manage the program and to provide seed money to the revolving fund. Potential funding sources have not been identified.

4. Mason County-Wide Conservation Outreach Program

Proposed implementing entity: Mason Conservation District and Mason County, with support from the Squaxin Island Tribe

Recommendation: Develop a program for all water users in Mason County to provide water conservation education incentives (mailers, websites, special events, tables at community events, free low flow indoor and outdoor fixtures, rain barrels, xeriscapes, etc.) Measurements of success could be included, such as a certification program, use of signage, the number of conservation items installed, or other methods.

Purpose: This benefits the watershed in creating awareness for water conservation and providing a cumulative reduction in groundwater use. An effective conservation program also supports drought response and climate change resilience. Overall, the program would support NEB and the Plan's goal of streamflow restoration.

Funding source: Funding would be needed to support the program. Potential sources include state or local appropriations, grants, pooling of resources by Committee members and other stakeholders, or other means.

5. Water Supply Data for Comprehensive Water Planning

Proposed implementing entity: Ecology with support from counties, Department of Health, local jurisdictions and potentially consultants.

Recommendation: By September of 2026, collect, estimate, and/or project the following data and include in a report to the WRIA 14 Committee members and the group established in section 6.2 to address Adaptive Management:

- Number of existing permit exempt domestic water wells and their water use.
- All projected water usage for the next 20 years (permit-exempt wells, inchoate rights, and new water rights).
- Number of municipal water supply connections expected in the next 20 years, by subbasin.
- Total number of existing permit-exempt wells by county.
- Total existing (2018 and earlier) connections in service using (1) unmitigated inchoate water rights; (2) mitigated inchoate water rights; or (3) permit-exempt wells.
- Total connections expected to be put into service in the next 20 years using (1) unmitigated inchoate water rights; (2) mitigated inchoate water rights; or (3) permit-exempt wells.
- 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 would provide a robust information base for comprehensive water planning and would provide context for the Plan and its goals. This also supports tribal desire for a comprehensive water use estimate.

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

6. Sports Field Irrigation Conservation

Proposed implementing entity: City of Shelton. Other sports field owners, such as Shelton School District, Mason County Parks and Rec, South Mason Youth Soccer Association, YMCA. Support from Squaxin Island Tribe.

Recommendation: Increase conservation at outdoor sports fields by assessing and improving current practices through the following steps:

- Review current irrigation practices of sports ball fields.
- Develop short conservation plans for each entity.
- Develop contingency plans for reclaimed water and use reclaimed water when it becomes available.
- Install water-saving infrastructure at sports fields.
- Use existing metering to demonstrate savings from new infrastructure.
- Consider rainwater capture potential from buildings at outdoor sports fields.

Purpose: This would reduce groundwater use, increase use of reclaimed water, and provides resilience to drought and climate change.

Funding source: Funding would be needed to prepare plans, install water saving infrastructure, and to evaluate program. Funding sources are undetermined.

7. Group A Water System Conservation through Infrastructure Improvements

Proposed implementing entity: City of Shelton and Mason Public Utility District 1

Recommendation: Replace leaking household water distribution pipes to greatly reduce unaccounted for water (distribution system leakage). Start by identifying systems with high distribution system leakage and prioritize them based on quantity of water that can be conserved with infrastructure improvements.

Purpose: Group A water systems are currently required by WA Department of Health to bring distribution system leakage below 10%; the objective of this recommendation is to bring distribution systems below this threshold. By reducing system leakage, group A water systems could expand service territory from the additional connections gained. Expanding service territory decreases the likelihood of nearby installation of permit exempt wells.

Funding source: Grant funding to Group A water system purveyors.

8. Funding for Plan Implementation

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

Recommendation: The WRIA 14 Committee recommends the Legislature provide 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.
- 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.).
- Ongoing monitoring within the basin (see recommendation 6.1.2).
- Plan implementation.

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.

9. Waterwise Landscaping

Proposed implementing entity: Mason County, Mason Conservation District, Squaxin Island Tribe, and/or Committee Members or other stakeholders.

Recommendation: The WRIA 14 Committee recommends the Legislature provide funding for a technical and financial support program for voluntarily participating landowners (~100) who are developing their property and installing permit-exempt domestic wells to do the following:

- Around a newly built home site, create waterwise landscaping which includes native plants or retains the existing native vegetation on the site.
- After the completion of home landscaping, monitor daily outdoor water consumption for landscaping purposes only for three years.
- Changes in landscaping water use per household resulting from this program will be summarized and reported by a participating implementing entity.

Purpose: This would generate a new model in waterwise and native landscaping that provides wildlife habitat, and decreases water use which could be quantified and used for planning of future incentive programs.

Funding source: Legislature or others.

6.2 Plan Implementation and Adaptive Management

6.2.1 Project, Policy, and Permit-Exempt Well Tracking

The WRIA 14 Committee recommends tracking the growth of permit-exempt (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. Recommended funding for plan implementation is described in detail in section 6.1.8.

A. The WRIA 14 Committee recommends tracking the following information on an ongoing basis:

   - New building permits issued that include permit-exempt wells, as well as the number of building permits requiring water connections.
   - 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.

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 the Washington Department of Ecology and RCO, will coordinate the implementation of project tracking through the Salmon Recovery Portal.
    - Project sponsors are expected to support project tracking efforts and data sharing.
    - Local salmon recovery Lead Entity Coordinators will not be expected to provide ongoing support for project entry, maintenance, or reporting. 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.
    - 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 14 Committee (or an implementation group, if created) are encouraged to assist as needed with coordination, data gathering and input, and tracking.

Table 10 summarizes the entities recommended as being responsible for implementing the tracking and monitoring recommendation and associated funding needs.

Table 10: Implementation of Tracking and Monitoring Recommendation

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 is 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 and proposed implementing entities listed in 6.1 Policy and Regulatory Recommendations*	Additional funding may be needed to gather status updates.

6.2.2 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. Recommended funding for plan implementation is described in detail in section 6.1.8.

A. The WRIA 14 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 14 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 and 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 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.
- 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
    - Other options
- Ecology will share the report with Committee members and other interested parties.

B. The WRIA 14 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 14 Committee recommends that the WRIA 14 Committee members continue to meet to allow continued collaboration on plan implementation.
    - Interested WRIA 14 Committee members, or a new implementation group if established, will meet regularly 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 14 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.
    - Updating data and assumptions.
    - Other items identified by Committee members.
- Additional meetings may be scheduled as needed.
- Mason County has offered to play the role of coordinating an implementation group for WRIA 14. Mason County will use existing capacity as well as seek funding opportunities to support their role. Mason County will convene interested member entities of the WRIA 14 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 14 Committee, which could include a new name, charter, and supporting interlocal agreement.
    - Identifying project development lead(s) and supporting project development.
    - Identifying triggers for adaptive management and develop responses to emerging challenges.
    - Coordinating monitoring and research.
    - Coordinating reporting.
    - Identifying funding mechanisms to provide capacity for the Committee members and facilitator.
    - Other tasks as needed.

Table 11 summarizes the entities responsible for carrying out the reporting and adaptation recommendation and associated funding needs.

Table 11: 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.	• Local jurisdictions are already required to provide building permit information to Ecology (no additional funding needed). • Ecology staff would compile reports using existing resources.

Action	Entity or Entities Responsible	Funding Considerations
	• 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.	• 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. • Mason County convenes interested members of the WRIA 14 Committee to review progress and recommend adaptations as needed.	• 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. • Mason County may need additional funding to support their role in convening the implementation group.

6.3 Other Issues

6.3.1 Summary of Legislative requests

Legislative funding is requested for recommendations 6.1.1, 6.1.2, 6.1.5, 6.1.8, and 6.1.9

6.3.2 Assurance of Plan implementation

The WRIA 14 Committee prepared the WRIA 14 watershed plan with the intent that the plan is fully implemented Members of the Committee provided the following statements of assurance of their commitment to plan implementation.

- **Department of Ecology**
    - Ecology follows NEB Guidance and RCW 90.94.030 provisions in reviewing the watershed plan and considering plan adoption.
    - Ecology administers the 90.94 Grant Program, giving priority evaluation points to projects included in WRIA plans, and updating grant guidance as needed to better support plan implementation.
    - Ecology considers watershed plan recommendations and investigates the feasibility of actions and recommendations where Ecology is identified as the lead.
    - Ecology reports to the legislature on the status of the watershed plan implementation in 2020 and 2027.
- **Squaxin Island Tribe**
    - The Squaxin Island Tribe supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seek project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement
- **Skokomish Indian Tribe**
    - The Skokomish Tribe supports and participates in implementation activities as staff capacity allows, including:
        - As directed by Skokomish management, participating in implementation group meetings.
        - As directed by Skokomish management, coordination between meetings:
            - Assist in research and identify project opportunities

        - Assist in the identification of funding opportunities to achieve implementation
        - Identify areas for improvement

- **Thurston County**

    - Thurston County will adopt this watershed plan by resolution, formalizing our support of the plan contents once the plan has been approved by Ecology.
    - This watershed plan will become one of the guiding documents for Thurston County community planning work, including implementation of the Comprehensive Plan and related plans.
    - Thurston County will evaluate the relationship of identified projects within the watershed plan with the Thurston County Capital Improvement Program, seeking potential for overlap in funding opportunities.
    - Thurston County supports and participates 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

- **Mason County**

    - Mason County adopts this watershed plan by resolution, formalizing our support of the plan contents once the plan has been approved by Ecology.
    - Mason County supports and participates 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

- **City of Shelton**

    - The City of Shelton supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seek project opportunities
            - Seeking and supporting funding opportunities to achieve implementation

        - Tracking implementation and identifying areas for improvement

- **Mason County PUD No. 1**

    - Mason County PUD 1 supports collaboration among WRIA 14 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 14 watershed basin.
    - Mason County PUD 1 evaluates and prioritizes capital projects included in this plan for placement into the Capital Improvement Program.
    - Mason County PUD 1 supports and participates in implementation activities as staff capacity allows, including:

        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seek project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement

- **Building Industry Association of Washington (BIAW)**

    - BIAW supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seek project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement

- **Washington State Chapter Sierra Club**

    - The Sierra Club will support and participate in implementation activities as Sierra Club volunteer representative capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seek project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement

- **Mason Kitsap Farm Bureau**

    - The Mason Kitsap Farm Bureau supports and participates in implementation activities as staff capacity allows, including:

i. Participating in implementation group meetings.
ii. Coordination between meetings, including:
    1. Supporting project development and seeking project opportunities
    2. Tracking implementation and identify areas for improvement
    3. Providing information and support from the perspective of agriculture

- **Mason Conservation District - Salmon Recovery Lead Entity (Ex-Officio Member)**
    - Mason Conservation District supports and participates in implementation activities as staff capacity and funding resources allow, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seek project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement
- **Washington State Department of Health (Ex-Officio Member)**
    - WA State Department of Health supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Prior to approving a Water System Plan for a municipal water supplier (or other planning document with a water right place of use expansion), the Office of Drinking Water will ensure that new water service provided under the water system plan is consistent with relevant provisions of adopted local plans and development regulations. The Office of Drinking Water will ensure consistency through local government review of water system plans against relevant provisions of adopted local plans and development regulations.
        - Office of Drinking Water commits to coordinate with Department of Ecology through the agencies' Joint Memorandum of Understanding. This MOU states that the Department of Ecology will make a determination that the water system's service area and the submitted Water System Plan is not-inconsistent with any county-approved watershed plans.
- **Green Diamond (Ex-Officio Member)**
    - Green Diamond supports and participates in implementation activities as appropriate, including:
        - Partnership in implementations activities with nexus to Green Diamond forest lands, including:
            i. Supporting project development where consistent with Green Diamond's operations

ii. Supporting funding and in-kind opportunities to achieve implementation
iii. Tracking implementation and identifying areas for improvement

Chapter Seven: Net Ecological Benefit

The projects identified in this plan are consistent with the project type examples listed in the Final NEB Guidance: (a) water right acquisition offset projects; (b) non-acquisition water offset projects; and (c) habitat and other related projects (Ecology 2019b). Offset projects in WRIA 14 focus on infiltration of reclaimed water, water right acquisition, water system consolidation and source water replacement, and Managed Aquifer Recharge (MAR). Habitat restoration projects focus on increasing stream complexity, floodplain reconnection, fish passage, and enhancement of natural processes to benefit aquatic species. Water offset projects may also provide additional habitat benefits in the watershed as described below and in project descriptions in Appendix I. Similarly, some habitat restoration projects may produce a marginal offset benefit by increasing seasonal storage.

7.1 Consumptive Use and Water Offsets

This plan uses medium population growth forecasts for Mason and Thurston Counties to project a total of 4,294 new PE wells installed within WRIA 14 during the 2018 through 2038 planning horizon. To address uncertainty in the consumptive use estimate, conservative assumptions were made with regards consumptive use from outdoor irrigation. When estimating outdoor irrigated areas (with existing rural parcels with PE wells), all parcels were assumed to irrigate at least 0.05 acres, even when the parcels had no visible irrigated areas. In addition, when calculating outdoor consumptive use, irrigation was assumed to be at rates required for growing commercial turf grass. Applying these assumptions, and accounting for both indoor and outdoor water use, 759 acre-feet per year (AFY) (1.05 cfs) of new consumptive water use is projected to be the "most likely" estimate for new PE wells in WRIA 14 through 2038.

The Committee also defined a higher adaptive management goal of 1,034 AFY, a conservative target of consumptive water use resulting from an assumed average irrigated area of 0.14 acres per well. This larger average irrigated area is based on the 95 percent upper confidence limit of the average irrigated area. This additional factor of safety provides greater certainty that offsets and NEB are met. The Committee recommends that adaptive management measures, as described in Chapter 6, are used to achieve the higher goal.

The Committee's approach to offsetting these consumptive water use estimates was to develop a list of potential offset projects that exceed the anticipated impacts by a margin large enough to give reasonable assurance that this plan will be successful over the planning timeline. This watershed plan demonstrates that the water offset project portfolio (Table 12), if implemented,

can succeed in offsetting consumptive use impacts at the WRIA scale from the "most likely" consumptive use estimate. This plan estimates a total potential water offset of 891 AFY claimed by the WRIA 14 Committee from five water offset projects (Table 12), that produce a WRIA-wide surplus offset of 132 AFY above the "most likely" consumptive use offset target. The total water offset claimed by the Committee results in a WRIA-wide deficit of 143 AFY compared to the "higher adaptive management" goal set by the Committee.

RCW 90.94 allows for an uneven distribution of the offset project amounts relative to anticipated consumptive water use, provided the plan will lead to a NEB at the WRIA-scale. Although the "most likely" consumptive use offset goal is achieved at the WRIA-scale, the distribution among subbasins is uneven (Table 13). In the Goldsborough and Hood subbasins, the surplus offsets exceed the offset target by 523 and 10 AFY, respectively. All other subbasins have water offset deficits, ranging from 1 – 221 AFY.

Water offset benefits from projects fall short of the higher adaptive management consumptive use offset goal at the WRIA-scale. In the Goldsborough and Hood subbasins, the surplus offsets exceed the offset target by 488 and 3 AFY, respectively (Table 13). All other subbasins have water offset deficits, ranging from 31 – 320 AFY.

The Committee recommends using adaptive management measures as described in Chapter 6 to develop sufficient projects to meet the goal of exceeding the "higher adaptive management" consumptive use water offset estimates in all subbasins. The adaptive management and implementation measures include a robust project tracking protocol to ensure that projects are dispersed throughout the watershed to address offset needs across numerous small streams. For example, the five prospective projects not included in the water offset accounting (Section 5.4) have the potential to provide offsets in excess of the higher adaptive management offset goal and distribute offset benefits throughout all subbasins. Water rights acquisitions and efficiencies will be sought in all subbasins. The Mason County Rooftop Runoff Project, if implemented, would provide offset benefits in all subbasins. The Forest Stand Age and Floodplain restoration projects may be implemented in all subbasins and could result in a quantifiable water offset. Finally, the Summit Lake Water System Project could provide a substantial water offset benefit to the Kennedy subbasin.

The water offset projects provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA. For the project types planned in WRIA 14, additional benefits could include the following:

- Water right acquisition projects: Aquatic habitat improvements during key seasonal periods; reduction in groundwater withdrawals and associated benefit to aquifer

resources; and/or beneficial use of reclaimed water. Water right acquisition opportunities in WRIA 14 can be associated with land acquisitions which provide additional conservation-related habitat benefits.

- MAR and Infiltration of reclaimed water projects: Aquatic habitat improvements during key seasonal periods; increased hydration of wetlands and headwaters; increased groundwater recharge; reduction in summer/fall stream temperature; increased groundwater availability to riparian and near-shore plants; and/or contribution to flood control. Improvements to water quality may also occur as a result of infiltration.

In summary, while this watershed plan demonstrates the water offset portfolio will offset the "most likely" consumptive use impacts at a WRIA scale, it would have to rely on successful adaptive management if it is to meet the goal to achieve offset benefits by subbasin or the higher adaptive management consumptive use estimate.

Table 12: Summary of WRIA 14 Water Offset Projects Included in NEB Evaluation

Project Name	Subbasin(s)	Project Short Description	Estimated Offset Benefits (AFY)[54]	Estimated Offset Benefits Claimed by WRIA 14 Committee (AFY)	Readiness to Proceed
City of Shelton RW/ WCC Source Switch	**Goldsborough**	Re-direct North Shelton wastewater to WRP and infiltrate Class A reclaimed water at existing spray field near the WCC	486	486	High
Evergreen Mobile Estates	**Oakland Bay**	Water system consolidation and water right acquisition	7	7	Medium
Steamboat Middle	**Kennedy**	Expanded water storage in an existing forested/non-forested wetland.	14	14	Low
MAR	**Multiple**	Install managed aquifer recharge facilities: Kennedy, Mill, Skookum, Goldsborough, Johns, Cranberry, Sherwood Creeks	910	273	Low
Water Right Analysis	**All**	WRIA-wide analysis on potential WR acquisition for future studies and implementation.	1,112	111	Low
WRIA 14 Total Water Offset			**2,529**	**891**	
WRIA 14 Consumptive Use Estimate			**759**		
Higher Adaptive Management Consumptive Use Goal			**1,034**		

[54] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

Table 13: Subbasin Water Offset Totals Compared to Permit-Exempt Well Consumptive Use Estimate

Subbasin	Offset Project Totals (AFY)	Permit-Exempt Well Most Likely Consumptive Use Estimate (AFY)	Surplus/Deficit[55] from Most Likely Consumptive Use Estimate (AFY)	Higher Adaptive Management Consumptive Use Estimate (AFY)[56]	Surplus/Deficit from Higher Adaptive Management Consumptive Use Estimate (AFY)
Case	43	91	-48	123	-80
Goldsborough	619	97	523	132	488
Harstine	0	25	-25	35	-35
Hood	31	21	10	28	3
Kennedy	38	104	-66	142	-104
Mill	81	82	-1	112	-31
Oakland Bay	55	276	-221	375	-320
Skookum	25	64	-39	87	-62
WRIA 14 Total	**891**	**759**	**132**	**1,034**	**-143**

7.2 Habitat Benefits

The WRIA 14 plan includes an inventory of additional projects to meet the offset needs and NEB for the watershed. Additional projects can be broken down into the following:

- Projects that provide habitat and streamflow benefits, but streamflow benefits are difficult to quantify.

[55] Surplus water offset is associated with a positive value and a deficit in water offset is associated with a negative value. This column represents the difference between the project offset total and the offset target (estimated consumptive use in the subbasin).

[56] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

- Projects that primarily benefit habitat and address limiting factors for salmonids.

Many habitat restoration projects were identified in WRIA 14. Table 14 summarizes the benefits of five habitat improvement projects as shown in Figure 5, Chapter 5 and described in further detail in Chapter 5 and Appendix I. While several of these projects may produce a marginal offset benefit by increasing seasonal storage, the benefits were too small and too complex to estimate without further evaluation. In general, these projects increase stream complexity, reconnect floodplains, improve fish passage, and enhance natural processes that had been lost to the benefit of salmonids and other aquatic species. Additional habitat projects that are less developed are listed in the Project Inventory in Appendix J.

The Kennedy-Goldsborough Watershed is an important and productive system for salmonids. The habitat projects in Table 14 address many of the salmonid limiting factors described in Chapter 2.1.3, including:

- Fish Passage
- Riparian Canopy Closure
- Streambank Condition
- Floodplain Connectivity
- Substrate Embeddedness
- Large Woody Debris
- Pool Frequency and Quality
- Off-channel Habitat
- Temperature
- Dissolved Oxygen
- Water Quantity/ Dewatering
- Change in Flow Regime
- Biological Processes

Specifically, water quantity and general dewatering of creeks was identified as a limiting factor in Skookum Creek, Mill Creek, Goldsborough Creek, Shelton Creek, Johns Creek and Cranberry Creek.

Implementation of habitat improvement projects, in coordination with other restoration programs, will contribute to a cumulative net ecological benefit. Providing fish passage improves fish access to existing habitat, and therefore provides immediate benefits. Improvements to riparian condition will increase shade, bank stability, large woody debris loading, and fish cover. Increasing shade will maintain or lower water temperature on a

cumulative basis. Lower water temperatures have a greater saturation potential for dissolved oxygen, which is beneficial for salmonids, in general. Improving bank stability will reduce bank erosion and substrate embeddedness, which increases suitability for salmonid spawning habitat and macroinvertebrate communities (salmonid prey items). Increased bank stability, increased large woody debris loading, and reduced fine sediment inputs will all contribute to increased pool frequency and quality. Increased floodplain connectivity will attenuate flood flows and store water in the floodplain soils for slow release back to the stream over the course of days to months. This local storage will contribute to improving the flow regime and flow quantity.

The watershed plan also includes a number of policy recommendations, described in Chapter 6. Some of these recommendations are expected to result in additional benefits to habitat, fish and wildlife. Benefits include reduced water consumptive, increased water conservation, improved water quality, habitat protection and restoration, and direct streamflow benefits.

Table 14: Summary of WRIA 14 Habitat Improvement Projects included in NEB Evaluation

Project Name	Project Type and Brief Description	Subbasin	Anticipated Ecological Benefit(s)	Readiness to Proceed
Skookum Valley Ag	Channel re-alignment to increase channel length and sinuosity	Skookum	Increase floodplain connectivity; increase usable aquatic habitat area; increase fish cover; increase habitat complexity	High
Goldsborough Cr- Hilburn Restoration	Remove bank protection and channel fill; Increase density of large woody debris	Goldsborough	Increase floodplain connectivity; increase usable aquatic habitat area; increase fish cover; increase habitat complexity	High
Skookum Valley Railroad Culvert Crossings	Restore fish passage at several existing barriers	Skookum	Fish passage	Medium
Floodplain Restoration	Floodplain restoration with variable objectives	Kennedy, Skookum, Mill, Oakland, Harstene, Case	Increased floodplain function and local aquifer storage	Medium
Steamboat Upper	Increase ponded storage on north end of the Steamboat peninsula	Kennedy	Increase base flow in unnamed stream flowing from pond.	Low

7.3 Uncertainty and Adaptive Management

The WRIA 14 Committee identified a number of challenges related to plan implementation, described in Chapter 6. These challenges include uncertainty in growth projections, uncertainty in consumptive use estimates, uncertainty in offset quantities associated with specific project types, uncertainties associated with project implementation, future effects of climate change, and other factors. The Committee has recommended adaptive management measures in Chapter 6 of the plan for the purpose of addressing uncertainty in plan implementation. Adaptive management measures include PE well tracking, offset and habitat project implementation tracking, and periodic watershed plan implementation reporting, with recommended adjustments to the plan.

These measures, in addition to the project portfolio and associated benefits described in Chapter 5, increase the resiliency of the plan and increase the certainty that sufficient additional water from projects is available to achieve NEB. The Committee supports focusing implementation efforts on projects identified in this plan, as well as in subbasins where there is the most need for offsets.

Conservative estimates of PE well growth and consumptive use have been applied at multiple levels in this plan as a precaution, and to add certainty that the project portfolio is adequate to meet offset targets and address factors limiting salmonid survival in the watershed. Furthermore, the Committee has discounted the estimates of calculated offset benefits for projects in the project portfolio. The highly conservative estimates of both consumptive use and estimated project offsets also help ensure that streams will see flow benefits despite uncertainties associated with project implementation.

7.4 NEB Evaluation Findings

The WRIA 14 watershed plan provides projects that, if implemented, can offset an estimated 759 AFY as the “most likely” new consumptive water use in WRIA 14.This watershed plan sets goals of achieving offsets through a total of five water offset projects with an estimated cumulative offset projection of 891 AFY claimed by the WRIA 14 Committee. The projected total water offset yields a surplus offset of 132 AFY above the consumptive use estimate of 759 AFY, but results in a deficit of 143 AFY below the higher adaptive management estimate in WRIA 14. Three additional water offset projects that are not listed in Table 12 (the Schneider Creek Source Exchange, the Summit Lake Water Source, and the Mason County Rooftop Runoff project) would provide additional benefit, but were not included due to uncertainty associated with implementation or other restrictions. The surplus offsets, additional habitat restoration projects, adaptive management measures, and the conservative approach to estimating both

project offsets and consumptive use offset targets increase the certainty that sufficient additional water from projects is available to achieve NEB by protecting, restoring and enhancing streamflows in WRIA 14.

Although the project portfolio will meet offset targets from the "most likely" consumptive use estimate on a WRIA-scale, much of the water offset in WRIA 14 is concentrated in the Goldsborough subbasin. The remainder of the subbasins are near neutral or in deficit as compared to the higher adaptive management consumptive use estimate. The Oakland Bay subbasin has the largest deficit, and any opportunities to increase offset benefits in this subbasin should be prioritized.

Within this plan, water offset projects are complimented by a total of five habitat improvement projects, which provide streamflow habitat benefits. While many of these habitat improvement projects have potential streamflow benefits, the Committee excluded any associated water offset from the plan's water offset accounting.

Additional prospective projects and programmatic actions (described in Chapters 5 and 6) include exploration of water right opportunities, development of a Mason County Rooftop Runoff Program, development of floodplain restoration projects, incentives to increase the average age of forest stands, organization of a Summit Lake community water system, a Water Conservation Education and Incentives Program, a recommendation to update the Ecology Well Log Database, and the potential establishment of a revolving loan and grant fund to offset costs of connecting to Group A public water systems. These prospective projects and programmatic actions could result in water offsets, if they were developed during plan implementation. Improvement of the Ecology Well Log Database may improve the technical capacity for future technical evaluation.

The Committee has additionally recommended adaptive management measures, as described above and in Chapter 6, to provide reasonable assurance that the plan will adequately address new consumptive use impacts anticipated during the planning horizon, despite inevitable challenges that will arise during project implementation, operation, and maintenance.

This WRIA 14 watershed plan describes projects, which if implemented as intended, can offset the anticipated new consumptive use over the planning horizon and achieve NEB. The WRIA 14 Committee developed this Plan to meet NEB, given the limitations of the timeline and resources. As this chapter describes, this watershed plan provides multiple ecological benefits. The WRIA 14 Committee is leaving the final NEB determination to Ecology.

Appendices

WRIA 14 Kennedy - Goldsborough Watershed

Final Draft Plan

~~February~~April 2021

Appendix A – References

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Appendix B – Glossary

Acronym	Definition
AE	Application Efficiency
AFY	Acre-Feet per Year
CFS	Cubic Feet per Second
CU	Consumptive Use
CUF	Consumptive Use Factor
GPD	Gallons per Day
GIS	Geographic Information System
IR	Irrigation Requirements
LID	Low Impact Development
LIO	Local Integrating Organization
MAR	Managed Aquifer Recharge
NEB	Net Ecological Benefit
PE	Permit-Exempt
RCW	Revised Code of Washington
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Areas

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

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

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

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

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

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

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

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

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

Foster Pilots and Foster Task Force: To address the impacts of the 2015 Foster decision, Chapter 90.94 RCW established a Task Force on Water Resource Mitigation and authorized the Department

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

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

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

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

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

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

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

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

Impact: For the purpose of streamflow restoration planning, impact is the same as new consumptive water use (see definition below). As provided in Ecology WR POL 2094 "Though the statute requires the offset of 'consumptive impacts to instream flows associated with permit-

exempt domestic water use' (RCW 90.94.020(4)(b)) and 90.94.030(3)(b)), watershed plans should address the consumptive use of new permit-exempt domestic well withdrawals. Ecology recommends consumptive use as a surrogate for consumptive impact to eliminate the need for detailed hydrogeologic modeling, which is costly and unlikely feasible to complete within the limited planning timeframes provided in chapter 90.94 RCW. " (NEB)

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

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

~~**Instream Flows and Instream Flow Rule (IFR)**: Instream flows are a specific flow level measured at a specific location in a given stream. Seasonal changes cause natural stream flows to vary throughout the year, so instream flows usually vary from month to month rather that one flow rate year-round. State law requires that enough water in streams to protect and preserve instream resources and uses. The Department of Ecology sets flow levels in administrative rules. Once instream flow levels are established in a rule, they serve as a water right for the stream and the resources that depend on it. Instream flow rules do not affect pre-existing, or senior, water rights; rather, they protect the river from future withdrawals. Once an instream flow rule is established, the Department of Ecology may not issue water rights that would impair the instream flow level. (ECY)~~

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

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

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

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

Listed Species: Before a species can receive the protection provided by the Endangered Species Act (ESA), it must first be added to the federal lists of endangered and threatened wildlife and plants.

The List of Endangered and Threatened Wildlife (50 CFR 17.11) and the List of Endangered and Threatened Plants (50 CFR 17.12) contain the names of all species that have been determined by the U.S. Fish and Wildlife Service (Service) or the National Marine Fisheries Service (for most marine life) to be in the greatest need of federal protection. A species is added to the list when it is determined to be endangered or threatened because of any of the following factors: the present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or other natural or manmade factors affecting its survival. (USFWS)

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

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

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

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

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

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

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

New Consumptive Water Use: The consumptive water use from the permit-exempt domestic groundwater withdrawals estimated to be initiated within the planning horizon. For the purpose of

RCW 90.94, consumptive water use is considered water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment due to the use of new permit-exempt domestic wells. (NEB)

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

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

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

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

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

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

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

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

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

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

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

RCW 90.44 **(Groundwater Regulations)**: RCW 90.44 details regulations and policies concerning groundwater use in Washington state, and declares that public groundwaters belong to the public and are subject to appropriation for beneficial use under the terms of the chapter. The rights to appropriate surface waters of the state are not affected by the provisions of this chapter.

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

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

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

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

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

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

Salmon Recovery Funding Board (SRFB): Pronounced "surf board", this state and federal board provides grants to protect and restore salmon habitat. Administered by a 10-member State Board

that includes five governor-appointed citizens and five natural resource agency directors, the board brings together the experiences and viewpoints of citizens and the major state natural resource agencies. For watersheds planning under Section 203, the Department of Ecology will submit final draft WRE Plans not adopted by the prescribed deadline to SRFB for a technical review (RCO and Policy and Interpretive Statement).

Section 202 or Section 020: Refers to Section 202 of ESSB 6091 or Section 020 of RCW 90.94 respectively. The code provides policies and requirements for new domestic groundwater withdrawals exempt from permitting with a potential impact on a closed water body and potential impairment to an instream flow. This section includes WRIAs 1, 11, 22, 23, 49, 59 and 55, are required to update watershed plans completed under RCW 90.82 and to limit new permit-exempt withdrawals to 3000 gpd annual average.

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

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

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

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

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

Urban Growth Area (UGA): UGAs are unincorporated areas outside of city limits where urban growth is encouraged. Each city that is located in a GMA fully-planning county includes an urban growth area where the city can grow into through annexation. An urban growth area may include more than a single city. An urban growth area may include territory that is located outside of a city

in some cases. Urban growth areas are under county jurisdiction until they are annexed or incorporated as a city. Zoning in UGAs generally reflect the city zoning, and public utilities and roads are generally built to city standards with the expectation that when annexed, the UGA will transition seamlessly into the urban fabric. Areas outside of the UGA are generally considered rural. UGA boundaries are reviewed and sometimes adjusted during periodic comprehensive plan updates. UGAs are further defined in RCW 36.70.

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

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

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

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

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

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

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

Watershed Plan: A general term that refers to either: a watershed plan update prepared by a WRIA's initiating governments, in collaboration with the WRIA's planning unit, per RCW 90.94.020;

or a watershed restoration and enhancement plan prepared by a watershed restoration and enhancement committee, per RCW 90.94.030. This term does not refer to RCW 90.82.020(6). (NEB)

Watershed Restoration and Enhancement Plan (WRE Plan): The Watershed Restoration and Enhancement Plan is directed by Section 203 of ESSB 6091 and requires that by June 30, 2021, the Department of Ecology will prepare and adopt a watershed restoration and enhancement plan for WRIAs 7, 8, 9, 10, 12, 13, 14 and 15, in collaboration with the watershed restoration and enhancement committee. The plan should, at a minimum, offset the consumptive impact of new permit-exempt domestic water use, but may also include recommendations for projects and actions that will measure, protect, and enhance instream resources that support the recovery of threatened and endangered salmonids. Prior to adoption of an updated plan, Department of Ecology must determine that the actions in the plan will result in a "net ecological benefit" to instream resources in the WRIA. The planning group may recommend out-of-kind projects to help achieve this standard.

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

Appendix C – Committee Roster

Entity Representing	Primary Representative Name	Alternate Representative Name
Mason County	Commissioner Kevin Shutty	Commissioner Randy Neatherlin, David Windom
Thurston County	Joshua Cummings	Kaitlynn Nelson, Brad Murphy
City of Shelton	Ken Gill	Mark Ziegler, Jason Dose
Skokomish Indian Tribe	Alex Gouley	Seth Book , Dana Sarff
Squaxin Island Tribe	Jeff Dickison	Paul Pickett
Department of Ecology	Angela Johnson	Mike Noone, Rebecca Brown
Department of Fish and Wildlife	Allison Cook	Darrin Masters, Tristan Weiss, Megan Kernan
Mason County PUD #1	Commissioner Ron Gold	James Reyes, Brandy Milroy, Kristin Masteller
Washington State Chapter Sierra Club	Elaine Packard	Lois Ward
Building Industry Association of Washington	Josie Cummings	
Mason-Kitsap Farm Bureau	Larry Boltz	Paul Miller
Department of Health (ex officio)	Fern Schultz	
Mason Conservation District (ex officio)	John Bolender	Barbara Adkins
Green Diamond (ex officio)	Patti Case	

Appendix D – Operating Principles

Operating Principles and Charter

Watershed Restoration Enhancement
Committee Water Resource Inventory
Area (WRIA) 14

Approved March 14, 2019
Revised and Approved September 10, 2020

SECTION 1: PURPOSE

The purpose of the operating principles and charter is to establish the watershed restoration and enhancement committee, as authorized under RCW 90.94.030, for the purpose of developing a watershed restoration and enhancement plan. The document sets forward a process for meeting, participation expectations, procedures for decision-making, structure of the Committee, communication, and other topics to support the Committee in reaching agreement on a final plan.

SECTION 2. AGREEMENT AND AMENDMENTS TO THE OPERATING PRINCIPLES

The operating principles are established when, all members of the watershed restoration and enhancement committee (Committee) approve them. Participants will work in good faith to participate productively in the development of the operating principles. By approving the operating principles, members of the Committee agree to uphold the principles as outlined in this document. Each entity participating on the Committee will be asked to document their approval of the operating principles in writing by signing a final document.

The Committee may review the operating principles periodically. Any member of the Committee may bring forward a recommendation for an amendment to the operating principles. Amendments will be brought for discussion when a quorum is present and take effect only there is consensus by the full Committee for.

The chair may revise the Appendices without requiring a decision by the Committee. The chair will notify the Committee of any changes to the Appendices. Nothing contained herein or in any amendment developed under the Agreement shall prejudice the legal claims of any party

hereto, nor shall participation in this planning process abrogate any party's authority or the reserved or other rights of tribal governments, except where the obligation has been accepted in writing.

SECTION 3. PARTCIPATION EXPECTATIONS AND GROUND RULES

PARTICIPATION EXPECTATIONS

Each entity invited by Ecology to participate on the Committee, and which has responded indicating their commitment to participate, shall identify a representative and up to two alternates to participate on the Committee. All members of the Committee are expected to work together to make decisions and recommendations to support the preparation of a watershed restoration and enhancement plan that all Committee members support by Ecology's adoption deadline of June 30, 2021. Committee members will, in good faith and using their best professional judgement:

- Actively participate in Committee meetings throughout the process;
- Review materials in preparation for the meetings;
- Review materials following the meetings;
- Engage in workgroups (if applicable);
- Come prepared for discussions and to make decisions (when applicable); and
- Commit to implementing the Committee ground rules (see below).

The chair will consult with the Committee to ensure that adequate time is given for review of materials. Meeting materials will be provided at least 7 days before meetings, with a minimum 14-day review period for documents intended for decision-making or that require feedback. The chair also understands that members may need to discuss decisions with their organizations prior to approval and will work with committee members to establish reasonable review time for materials prior to approval. When possible, Committee members will provide the chair reasonable notice if additional review time is needed prior to a decision.

Committee meetings will take place on a monthly basis for an initial period, with the interval of meetings being modified as needed to meet the deadlines (either more or less frequently). The chair will hold meetings at a convenient location in the watershed. Meetings are expected to last for approximately 4 hours, with the length modified as needed to meet deadlines.

The chair or facilitator will attempt to contact Committee members that did not send a representative or alternate to the meeting. If a Committee member does not participate for 3 consecutive meetings (through sending the representative or alternate), the chair or

facilitator will contact the Committee member to ask if they will continue to participate or forfeit their seat. Committee members will be asked to provide written acknowledgement when forfeiting their seat.

REMOTE PARTICIPATION

It is the expectation that Committee representatives shall attend all meetings in person. In person participation is essential to efficiency, clarity, and honest communication. Although it should not be routine, remote participation can be accommodated when necessary to facilitate Committee member participation. If there are difficulties with technology, the priority will be to continue the meeting with the in-person participants and not delay the meeting to address technology challenges. Representatives participating remotely may take place in decision-making. Representatives are strongly encouraged to attend in-person.

The Committee chair will allow for remote participation (e.g. via phone, web, video conference, etc.) if:

- Notice is provided to the chair or facilitator at least 1 week in advance of the meeting, AND
- Representative and alternates are not available to attend in person, AND
- Meeting room accommodates remote participation.

If extraordinary events, such as a pandemic or natural disaster, require the committee to meet remotely, all meetings will be held remotely and the operating procedures will remain in force, except portions that assume in-person versus remote participation.

GROUND RULES

Water management is inherently complicated and the Committee must work together effectively to develop the watershed restoration and enhancement plan. Therefore, given the range of members' diverse perspectives, the Committee has established the following ground rules to ensure good faith and productive participation amongst its members.

1. Be Respectful
    - Listen when others are speaking. Do not interrupt and do not participate in side conversations. One person speaks at a time.
    - Recognize the legitimacy of the concerns and interests of others, whether or not you agree with them.

- Cooperate with the facilitator to ensure that everyone is given equitable time to state their views. Present your views succinctly and try not to repeat or rephrase what others have already said.
- Silence cell phones and refrain for using laptops during the meeting, except to take notes.
- Respect other communication styles and needs.

2. Be Constructive
    - Participate in the spirit of giving the same priority to solving the problems of others as you do to solving your own problems.
    - Share comments that are solution focused. Avoid repeating past discussions.
    - Do not engage in personal attacks or make slanderous statements. Do not give ultimatums.
    - Ask for clarification if you are uncertain of what another person is saying. Ask questions rather than make assumptions.
    - Work towards consensus. Identify areas of common ground and be willing to compromise.
    - Minimize the use of jargon and acronyms. Attempt to use language observers and laypersons will understand.
    - It is okay to disagree, but strive to reach common ground.
3. Be Productive
    - Adhere to the agenda. Respect time constraints and focus on the topic being discussed.
4. Bring a Sense of Humor and Have Fun.

CONFLICT RESOLUTION

In the event a conflict arises amongst members or established workgroups of the Committee, the following steps should be taken by individuals:

1. Communicate directly with the person or persons whose actions are the cause of the conflict.
2. If the circumstance is such that the person with a conflict is unable or unwilling to communicate directly with the person or persons whose actions are the cause of the conflict, the person shall speak with the Committee chair and facilitator.
3. The conflict should first be brought up verbally. If this does not lead to satisfactory resolution, the conflict should be described in writing to the chair.
4. If such matters are brought to the chair and facilitator, the chair in consultation with the facilitator, will address the conflict as appropriate and

may seek outside or independent assistance as needed.

SECTION 4. MEMBERSHIP

ALTERNATES AND NEW MEMBERSHIP

Committee members shall provide to the chair, in writing, names and contact information for a primary representative and up to two designated alternates from their organization or government. Committee members shall inform the chair in writing of any changes to the primary representative or alternates. If the primary representative cannot attend a meeting, they should, if possible, send a designated alternate and notify the Committee chair and the facilitator as early as possible. It is the responsibility of the primary representative to brief the alternate on previous meetings and key topics arising for discussion in order for the alternate to participate productively. Alternates may participate in decision- making in lieu of the primary representative.

Representatives may call on alternates that attend the meeting at any time to speak. Only one representative from each government or entity shall sit at the table and participate in decision-making at any given meeting.

If the primary representative and alternates are no longer able to attend (staffing change, ongoing scheduling conflicts, etc.), the government or organization shall work with the chair to quickly identify alternative representation from the same government or organization. If no alternative representative is available from the same government or organization, an alternate entity that can represent the same interest is allowed and shall be brought forward to the chair for approval. Replacement members are subject to the following provisions:

- The entity cannot veto, request a new decision, or revisit items previously decided on by the Committee;
- The entity signs an intent to participate and provides primary and alternate Committee members;
- The entity agrees to and abides by the operating principles; and
- The entity joins the Committee and participates in meetings starting no later than September 10, 2020.

REMOVAL FROM THE COMMITTEE

Entities must participate in the committee process after September 10, 2020 to retain membership on the committee. If an entity does not attend at least one committee or workgroup meeting over any three-month period it will be assumed they have withdrawn from

the committee and will be removed as members, unless the member provides a written explanation and requests to remain on the committee. The Chair, via electronic communication and a courtesy phone call, will inform any committee member who has not been participating for two months with this information to provide a minimum of one-month notice before removal.

RESIGNATION FROM THE COMMITTEE

If an entity no longer wishes to participate in the committee process or the final plan approval, they should send written notice (electronic or mailed notice) to the chair as early as possible prior to their resignation. Advance notice will support the chair and facilitator in managing consensus building and voting procedures.

EX-OFFICIO AND AD-HOC MEMBERS

The Committee may decide to invite an additional entity to join the Committee as an ex officio non- voting member. Ex Officio members are invited to sit at the Committee table and participate actively in discussions and review of documents, but shall not participate in Committee decision-making.[57] Ex- officio members shall adhere to the operating procedures.

The Committee may decide to invite an individual or organization to participate in select meetings or agenda items where additional expertise or perspective is desired. Ad hoc members will be invited by the chair to sit at the Committee table, participate actively in discussions, and review of documents for the specified agenda items. They shall not participate in committee decision-making.

WORKGROUPS AND ADVISORY GROUPS

The Committee may establish workgroups or subcommittees as it sees fit. Workgroups may be temporary, established to achieve a specific purpose within a finite time frame, or a standing workgroup addressing the goals of the Committee. The decision to form a workgroup is a procedural decision, as it is not required by the legislature, and may be developed at the discretion of the Committee or the chair in order to support Committee decision-making. All Committee workgroups are workgroups of the whole, meaning their role is to support the efforts of the Committee and all Committee members are welcome to

participate in any workgroup formed by the Committee. The chair or Committee may also engage established workgroups in the watershed or invite non-Committee members to participate on the workgroups if they bring capacity or expertise not available on the Committee. No binding decisions will be made by the workgroups; all issues discussed by workgroups shall be communicated to the Committee as either recommendations or findings as appropriate. The Committee may, or may not, act on these workgroup outcomes as it deems appropriate.

SECTION 5. ROLE OF THE CHAIR AND COMMITTEE SUPPORT

RCW 90.94.030 (2b) states that "The department shall chair the watershed restoration and enhancement committee…" Ecology's streamflow restoration implementation lead chairs the Committee on behalf of the agency. The chair shall participate in Committee decision making.[58] The role of the chair is to help the Committee complete the plan with the goal to attain full agreement from the Committee members. If full agreement cannot be obtained, the chair shall ensure all opinions inform future decision-making for the final plan. In the event that the chair is unable to attend a scheduled meeting due to illness or other unanticipated absence, Ecology will designate an interim chair to avoid cancelling the meeting. The interim chair may participate in decision-making.

The chair, with assistance from Ecology technical staff, contractors, members of the Committee, and/or workgroups, shall prepare the watershed restoration and enhancement plan for the Committee's review, comment, and approval.

Ecology may provide the Committee a facilitator. The role of the facilitator is to focus on process and support the Committee in productive discussions and decision-making. Ecology will provide administrative support for the Committee as well as technical assistance through Ecology staff and consultants. Ecology will seek input from the Committee on consultant selection prior to entering into contract.

[58] Ecology leadership has determined that only entities specified in the legislation will participate in Committee decision-making. However, the Committee may decide to include non-decision-making members if they choose.

SECTION 6. DECISION MAKING

QUORUM

A quorum is constituted when two-thirds of the entities represented on the Committee are present (either in person or on the phone). A quorum of current membership must be present for decision- making to occur. Even if both a primary representative and alternates are present, each entity of the Committee counts only once for purposes of determining a quorum.

CONSENSUS

This planning process, by statutory design, brings a diversity of perspectives to the table. It is therefore important the Committee identifies a clear process for how it will make decisions. The Committee has elected to make decisions by consensus. The Committee made this choice in part because the authorizing legislation requires that the final plan must be approved by all members of the Committee prior to Ecology's review (RCW 90.94.030[3] "…all members of a watershed restoration and enhancement committee must approve the plan prior to adoption"). Therefore it follows that consensus during the foundational decisions upon which the plan is constructed will serve as the best indicators of the Committee's progress toward an approved plan.

Ideally, consensus represents whole-hearted agreement and support by all Committee members; however, it can be achieved with less than this level of enthusiasm. For example, some members might disagree with all or part of a decision, but based on listening to everyone else's input might agree to let the decision go forward because it is the best decision the entire group can achieve at the current time. For purposes of this effort, consensus is defined as an outcome all Committee members can at least "live with" and agree not to block or oppose during implementation, even if it is not their preferred choice.

The Committee recognizes four levels of consensus:

- I can say an unqualified "yes"!
- I can accept the decision.
- I can live with the decision.
- I do not fully agree with the decision; however, I will not block or oppose it now or during implementation.

Consensus will be assessed by polling committee members either in person at meetings or electronically by email. Ecology staff and the facilitator will record when consensus is achieved and will document any relevant background or context for the decision, including

when a Committee member is consenting to something even though it is not their preferred choice. Abstentions and the reasons for them also will b e described. During in person polling the following protocol will be used:

- Thumbs up – consent
- Thumbs sideways – consent with reservation but can live with it and will move forward with the process
- Thumbs down – do not consent
- Five fingers – abstain

In recognition that consensus can take time to achieve and in some cases decisions will need to be made quickly to stay on track to meet the plan deadline, the Committee may continue moving forward with deliberations even if it has not reached consensus on all interim decisions leading up to the final plan (e.g. growth scenarios, inclusion of individual projects, etc.). This is intended to keep the process moving, and is put forth with the recognition that these differences will need to be resolved before the end of the process to have a plan all Committee members can approve. Ecology staff and the facilitator will clearly document where there is consensus and where there is not consensus on all interim decisions. Where there is not consensus, care will be taken to describe the different perspectives and reasons for them. Differing parties with Ecology staff, the facilitator, and other Committee members will make a plan to try to resolve differences and reach consensus in time for the final plan approval. A "parking lot" may be used to capture ideas that the group cannot agree on or would like to return to at a later date for further discussion; however, this will not jeopardize meeting deadlines by postponing issues which must be resolved so deliberations can move forward. Committee members will work together to establish schedules and deadlines to ensure that final plans can be completed on time.

ELECTRONIC DECISION MAKING

In the case a decision is needed prior to the next Committee meeting, the chair can request an electronic decision via email or survey. This approach will only be used for time-critical items or when a quorum was not present at the Committee meeting where the issue was to be decided. The Department of Ecology will allow a minimum of 3 working days for responses to requests for an electronic decision. A non-response is considered an "abstention."

The result of an electronic decision will be reported at the next Committee meeting and the chair or facilitator may request confirmation to reaffirm the electronic decision.

INFORMAL STRAW POLLING

From time to time, the chair or the facilitator may take a straw poll to gather information on Committee needs and perspectives. Straw polling will be used solely for information-gathering and will not result in a decision.

LETTERS OF SUPPORT FOR PROJECTS

The Committee may choose to submit a letter of support for streamflow restoration projects applying for funding through Ecology Streamflow Restoration Funding program or other sources. The decision to submit a letter of support shall follow the voting process as described above. If the Committee does not approve a letter of support for a project, individual Committee representatives are not prohibited from submitting a letter of support from their entity or government.

FINAL PLAN APPROVAL

RCW 90.94 (3) states that "… all members of a watershed restoration and enhancement committee must approve the plan prior to adoption." Approval will be achieved if all Committee members consent to the final plan. To ensure no confusion on this issue, each entity participating on the Committee will be asked to document their consent to the final plan in writing (e.g., by responding to an email or signing a final document).

The facilitator will poll for and document consensus. Written and verbal votes will be shared with all Committee members. If consensus is not reached on the plan, the facilitator/note-taker will document which plan elements (if any) there is consensus on and which there is not consensus on and will describe the full range of different perspectives where there is not consensus. To ensure their perspectives are also available in their own words, each entity will have the opportunity to submit a letter describing their views.

The final plan approval may also be given verbally in a Committee meeting, or in writing when in-person participation is not possible:

- Approve
- Disapprove

SECTION 7. PUBLIC COMMENTS AND PUBLIC MEETING NOTICE

The agenda will provide time for public comment at each meeting. In general, members of the public will only be called on to speak during public comment, although the chair and facilitator may make exceptions on a case-by-case basis. The chair and facilitator will determine the time and extent of the public comment period based on the agenda for each

meeting, with input from the Committee. While the Committee is not explicitly required to follow the requirements of the Open Public Meetings Act, reasonable efforts will be made to post information and materials on the pertinent website in a timely manner to keep the public informed.

SECTION 8. COMMITTEE AND MEDIA COMMUNICATION

To support clear communication with the Committee, Ecology will:

1. Operate a list serve for Committee members and interested parties
2. Develop and manage a website for members of the Committee to access documents such as agendas, meeting summaries, technical reports, calendar, and other items as requested by the Committee

The facilitator and Ecology shall prepare a written meeting summary for each Committee meeting within 10 business days of the last Committee meeting. The chair will distribute the meeting summary to the Committee via an email and the facilitator or Ecology will post the summary on the Committee webpage. The summary, at a minimum, will include a list of attendees, decisions, discussion points, assignments, and action items. If comments are cited in such summaries, each speaker will be identified. Meeting summaries will capture areas of agreement and disagreement within the group. The Committee will review and accept (or revise) meeting summaries at the following meeting.

COMMUNICATION WITH THE MEDIA

When speaking to the media or other venues, the Committee members will clearly identify any opinions expressed as their personal opinions and not necessarily those of the other Committee members or the Committee as a whole. The Committee members will not attempt to speak for other members of the group or to characterize the positions of other members to the media or other venues. Comments to the media will be respectful of other Committee members.

Following significant accomplishments, the Committee may request Ecology to issue formal news releases or other media briefing materials. All releases and information given to the media will accurately represent the work of the Committee. Ecology will make every effort to provide the Committee with materials in advance for input, recognizing that media timelines may not allow for adequate review by the Committee.

Appendix E – Regional Aquifer Units within WRIA 14

Aquifer	Description	Typical Thickness
AA – Alluvial Aquifer	Composed of recent alluvium (Qa), this aquifer consists of clay, silt, sand, and gravel deposits. This aquifer is laterally discontinuous and limited to stream valleys.	A few feet up to about 50 feet thick, where present. Where saturated, the unit is often in direct continuity with surface-water bodies.
UA – Upper Aquifer	This aquifer is mainly composed of deposits from the Vashon recessional outwash (Qgo). The deposits are usually poorly- to moderately-sorted sand or sand and gravel, sometimes with lenses of silt or clay. The unit is generally unconfined.	The thickness varies from 5 feet up to about 250 feet.
UC – Upper Confining Unit	This confining unit is composed primarily of Vashon till (Qgt) and consists of unsorted and compacted clay, silt, sand, and gravel. This unit separates the Upper Aquifer and Middle Aquifer.	The thickness ranges from 5 feet up to about 360 feet.
MA – Middle Aquifer	This aquifer is mainly composed of deposits from the Vashon advance outwash (Qga). The deposits are usually moderately- to well-sorted sand, gravel, and silt with occasional lenses of silt or clay. Although laterally extensive, this aquifer is discontinuous where surface water drainages have incised through the overlying till and into the outwash. This aquifer is generally confined, but locally unconfined conditions may occur where the aquifer is not fully saturated, or where it is exposed at land surface.	The thickness ranges from a few feet to about 150 feet.
LC – Lower Confining Unit	This confining unit is primarily composed of pre-Vashon glaciolacustrine and interglacial sediments and consists of clay and silt, with some till and occasional deposits of peat and wood. This unit is laterally extensive and separates the Middle Aquifer and Lower Aquifer.	The thickness ranges from several tens of feet to about 350 feet.

Aquifer	Description	Typical Thickness
LA – Lower Aquifer	Sometimes also called the "sea-level aquifer" due its coincident elevation, this unit is primarily composed of pre-Vashon outwash deposits consisting of sand and gravel, with some lower-permeability deposits of silt, clay, or till. This aquifer is confined by the overlying Middle Confining Unit. This aquifer is present throughout most of the WRIA, except the southeast portion where bedrock is at or near ground surface.	The thickness ranges from 5 feet to about 200 feet.

Appendix F – WRIA 14 Surface Water Quality Assessment Category 4 and 5 Listings in WRIA 14

WATERBODY	CURRENT CATEGORY	PARAMETER NAME	TMDL NAME	MEDIUM NAME
BIG BEND CREEK	5	Bacteria		Water
BURNS CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
	5	pH		Water
	5	Temperature		Water
	5	Bacteria		Water
CAMPBELL CREEK	5	Temperature		Water
CASE INLET AND DANA PASSAGE	5	Bacteria		Water
	5	Dissolved Oxygen		Water
	5	Dissolved Oxygen		Water
CLARY CREEK	4A	Temperature	Totten, Eld, and Skookum Inlets Tributaries Temperature TMDL	Water
CRANBERRY CREEK	5	Temperature	Cranberry, Johns, and Mill Creeks Temperature TMDL	Water
	5	Temperature		Water
DEER CREEK	5	Dissolved Oxygen		Water
	5	Temperature		Water
DEVEREAUX CREEK	5	Bacteria		Water
GOLDSBOROUGH CREEK	4A	Bacteria	Oakland Bay, Hammersley Inlet Tribs Bacteria TMDL	Water
	5	Temperature		Water
	4C	Instream Flow		Water
GREAT BEND/LYNCH COVE	5	Dissolved Oxygen		Water

WATERBODY	CURRENT CATEGORY	PARAMETER NAME	TMDL NAME	MEDIUM NAME
HAMMERSLEY INLET	4A	Bacteria	Oakland Bay, Hammersley Inlet Tribs Bacteria TMDL	Water
HAPPY HOLLOW CREEK	5	Bacteria		Water
HOLYOKE CREEK	5	Bacteria		Water
ISLAND LAKE	4C	Invasive Exotic Species		Habitat
JOHNS CREEK	5	Temperature	Cranberry, Johns, and Mill Creeks Temperature TMDL	Water
JOHNS CREEK	4C	Instream Flow		Water
	5	Temperature		Water
KENNEDY CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
		Temperature	Totten, Eld, and Skookum Inlets Tributaries Temperature TMDL	Water
	5	Dissolved Oxygen		Water
LIMERICK LAKE	4C	Invasive Exotic Species		Habitat
LITTLE SKOOKUM INLET	5	Dissolved Oxygen		Water
MALANEY CREEK	5	Temperature		Water
MASON LAKE	4C	Invasive Exotic Species		Habitat
MILL CREEK	5	Temperature	Cranberry, Johns, and Mill Creeks Temperature TMDL	Water
	5	Temperature		Water
	4C	Instream Flow		Water
	5	Dissolved Oxygen		Water
MULBERG CREEK	5	Bacteria		Water

WATERBODY	CURRENT CATEGORY	PARAMETER NAME	TMDL NAME	MEDIUM NAME
OAKLAND BAY	4A	Bacteria	Oakland Bay, Hammersley Inlet Tribs Bacteria TMDL	Water
PERRY CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
	5	Dissolved Oxygen		Water
PIERRE CREEK	5	pH		Water
	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
	5	Dissolved Oxygen		Water
PRICKETT LAKE	4C	Invasive Exotic Species		Habitat
SCHNEIDER CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
	5	Dissolved Oxygen		Water
SHELTON HARBOR (INNER)	4A	Bacteria	Oakland Bay, Hammersley Inlet Tribs Bacteria TMDL	Water
SKOOKUM CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
		Temperature	Totten, Eld, and Skookum Inlets Tributaries Temperature TMDL	Water
	5	Temperature	Totten, Eld, and Skookum Inlets Tributaries Temperature TMDL	Water

WATERBODY	CURRENT CATEGORY	PARAMETER NAME	TMDL NAME	MEDIUM NAME
	4C	Instream Flow		Water
	5	Dissolved Oxygen		Water
SPENCER LAKE	4C	Invasive Exotic Species		Habitat
TWANOH CREEK	5	Bacteria		Water
UNCLE JOHN CREEK	4A	Bacteria	Oakland Bay, Hammersley Inlet Tribs Bacteria TMDL	Water
	4A	Bacteria	Oakland Bay, Hammersley Inlet Tribs Bacteria TMDL	Water
	5	Temperature		Water
				Water
UNNAMED CREEK (TRIB TO HOOD CANAL)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO SKOOKUM CREEK)	4A	Temperature	Totten, Eld, and Skookum Inlets Tributaries Temperature TMDL	Water
	5	Temperature		Water
UNNAMED DITCH (TRIB TO TOTTEN INLET)	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water

Appendix G – Subbasin Delineation Memo

To:	Angela Johnson, Washington State Department of Ecology
From:	Chad Wiseman, HDR
Copy:	
Date:	June 26, 2019
Subject:	WRIA 14 Draft Subbasin Delineation (Work Assignment WA-01, Task 2)

1.0 Introduction

HDR is providing technical support to the Washington State Department of Ecology and the Watershed Restoration and Enhancement (WRE) committee for Water Resource Inventory Area (WRIA) 14. 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 14 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 14 (Kennedy-Goldsborough).

2.0 Subbasin Delineation

This section explains the initial and draft delineations for WRIA 14.

2.1 Initial Delineation

The WRIA 14 workgroup (a subcommittee of the WRE committee) was tasked to delineate subbasin boundaries for discussion at WRE committee meetings. The WRIA 14 workgroup started with the subbasins used in the draft WRIA 14 watershed management plan that was pursuant to Chapter 90.82 RCW (Plateau 2006). These subbasins were organized based on the receiving saltwater body. During this watershed planning process, the subbasin discharging to Hood Canal was co-opted by the WRIA 16 watershed plan. This subbasin is part of WRIA 14 and was included for the purposes of this Chapter 90.94 RCW planning process.
The following subbasins were defined in the initial delineation:

- Hood: includes multiple small drainages discharging directly to the Hood Canal
- Case: includes Sherwood Creek and multiple small drainages that discharge to Case Inlet, including Harstine Island and Squaxin Island
- Goldsborough: includes all drainages discharging to Oakland Bay, including Deer Creek, Cranberry Creek, Johns Creek, Goldsborough Creek, Mill Creek, and other small drainages
- Skookum: includes all drainages discharging to Little Skookum Inlet, including Skookum and other small drainages

• Kennedy: includes all drainages discharging to Totten and Eld inlets, including Kennedy Creek, Perry Creek, and other small drainages

The workgroup requested that an alternative delineation be developed that had smaller drainage granularity. Twelfth-field hydrologic unit codes (HUCs) (USGS 2013) were applied to WRIA 14 as an alternative. The comparison of the 12th-field HUCs delineation with 12th-field hydrologic units resulted in 16 subbasins and, in some cases, subbasins were viewed as too small (e.g., Snodgrass Creek, discharging to Totten Inlet).

2.2 Draft Delineation

During the May 9, 2019, WRIA 14 WRE committee meeting, HDR presented a comparison between the initial subbasin delineation (based on the draft Watershed Management Plan and the south shore of Hood Canal) with the 12th-field HUCs. The comparison included stream distribution, fisheries resources, and stream management units (i.e., streams with closures and minimum flows) associated with the WRIA 14 instream flow rule (Washington Administrative Code [WAC] Chapter 173-514).

During the June 7, 2019, WRIA 14 workgroup meeting, HDR presented the same comparison as during the May 9, 2019, WRE committee meeting. The Squaxin Island Tribe made recommendations for a draft delineation premised with the understanding that there would be an opportunity for revision after the growth projections and consumptive-use estimates were completed and compared to the draft delineation. The recommendations included separating Harstine, Squaxin, and Hope islands from the rest of the initial "Case" subbasin. The recommendations also included breaking up the initial "Goldsborough" subbasin into three separate subbasins (Oakland, Goldsborough, and Mill). The Goldsborough Creek and Mill Creek watersheds would be their own respective subbasins.

The remainder of the initial "Goldsborough" subbasin (including Deer Creek, Cranberry Creek, and Johns Creek) would compose the Oakland subbasin. The draft subbasin delineation is depicted in Figure 1. The following subbasins were defined in the draft delineation:

• Hood: includes multiple small drainages discharging directly to Hood Canal
• Case: includes Sherwood Creek and multiple small drainages that discharge to Case Inlet
• Harstine: includes Harstine, Squaxin, and Hope islands
• Oakland: includes Deer Creek, Cranberry Creek, Johns Creek, and other small drainages discharging to Oakland Bay
• Goldsborough: includes the Goldsborough Creek watershed
• Mill: includes the Mill Creek watershed and small drainages discharging to the south shore of Hammersley Inlet
• Skookum: includes all drainages discharging to Little Skookum Inlet, including Skookum and other small drainages
• Kennedy: includes all drainages discharging to Totten and Eld inlets, including Kennedy Creek, Perry Creek, and other small drainages

The WRIA 14 workgroup recommended that this draft subbasin delineation be approved by the WRIA 14 WRE committee on June 13 2019.

3.0 Conclusion

The WRIA 14 workgroup draft subbasin delineation will be used as an organizational framework for growth projection and consumptive-use scenarios, pending approval by the WRIA 14 WRE committee. The current draft subbasin delineation is currently only a recommendation by the WRIA 14 workgroup. Furthermore, the draft subbasin delineation is subject to change after evaluation with the growth projection and consumptive-use scenarios. The final subbasin delineation will be used as a framework for consumptive-use impacts and offset benefit accounting and for the NEB evaluation.

4.0 References

Plateau Technical Communication Services (Plateau). 2006. WRIA 14 Watershed Management Plan: Kennedy–Goldsborough Watershed, Final Draft.

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/.

Appendix H – Permit-Exempt Growth and Consumptive Use Summary Technical Memo

To:	Angela Johnson, Washington State Department of Ecology
From:	Chad Wiseman, HDR, Malia Bassett, HDR
Copy:	
Date:	July 6, 2020
Subject:	WRIA 14 Permit-Exempt 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 Area 14. This memorandum provides a summary of the analytical methods used for Work Assignment 2 Task 2: Consumptive Use (CU) Estimates, and the final estimates of consumptive use per WRIA.

Under Revised Code of Washington (RCW) 90.94, consumptive water use by permit-exempt connections occurring over the 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 permit-exempt connections and related consumptive use of groundwater that is projected to impact WRIA 14 over the planning horizon.

This memorandum includes:

- A summary of WRIA 14 initial permit-exempt growth and an alternative scenario of permit-exempt growth.
- A summary of WRIA 14 initial and alternative scenario consumptive use using two different methods.

WRIA 14 Permit-Exempt Growth Projection Methods

Permit-exempt growth over the planning horizon was projected using methods at the county scale and then combined at the WRIA scale. HDR worked directly with Mason County to develop and implement growth projection methods. Thurston County (working with the Thurston Regional Planning Council) provided methods and results for Thurston County.

HDR worked with the WRIA 14 workgroup and Committee to define one alternative growth scenario that allowed for some permit-exempt growth in water system boundaries based on the proportion of parcels not currently served by their respective water systems.

Mason County

The Mason County initial permit-exempt growth projections were developed using the following methods:

1. Develop growth projections based on the Mason County Comprehensive Plan (the comprehensive plan is based on Office of Financial Management (OFM) 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 build-out capacity by county Urban Growth Areas (UGAs) and rural lands.
3. Apply growth projections to buildable lands.
4. Overlay subbasins to determine new permit-exempt connections in each subbasin.

Initial growth projections for Mason County have increased, based on updating parcel data for the application of growth projections to buildable lands (i.e., parcels that were streets or waterbodies). The results were organized by subbasin. The distribution of projected permit-exempt growth within subbasins was reported with a heat map.

An alternative permit-exempt growth projection scenario was developed by assuming that some permit-exempt growth will occur in water system areas. It was assumed that growth in each respective water system will be proportional to buildable parcels without water system hookups relative to parcels with water system hookups. The following methods were applied on top of the initial methods:

1. Define total buildable parcels in GIS, using Department of Health (DOH) service area polygons and county parcel data.
2. Define total approved water system connections (built out + available) and active water system connections (built out) using the DOH Sentry database (DOH 2019).
3. Buildable parcels with water system hookup = total approved minus active water system connections.
4. Buildable parcels without water system hookup = total buildable parcels minus total approved water system connections.
5. Define proportion of permit-exempt growth within each water system by dividing number of buildable parcels without water system hookups by total number of buildable parcels.
6. Multiply proportion of permit-exempt growth within each respective water system by total growth projected to occur in that water system.
7. Sum additional permit-exempt growth by subbasin and add to initial permit-exempt growth projection.

Thurston County Methods

The Thurston County initial permit-exempt growth projections were developed using the following methods:

1. Develop 20-year growth projections based on OFM medium population growth estimates, and conversion to dwelling units based on assumed people per dwelling unit
2. Develop residential capacity estimates.
3. Allocate growth to parcels based on recent residential development and permit trends, where capacity is available.
4. Estimate the amount of development on permit-exempt connections based on the following criteria provided by Thurston County:
    a) Located outside incorporated cities; growth in incorporated cities is assumed to connect to a municipal water system.
    b) Water systems within UGAs; permit-exempt growth is assumed to occur on parcels with no sewer service.
    c) Rural water systems; assumed no permit-exempt growth.

These Thurston County growth projection methods and results have not changed since the original estimate was provided to Ecology and the WRIA 14 WRE Committee (HDR 2019; Appendix B). The results were calculated for the Thurston County portion of the Kennedy subbasin. The distribution of projected permit-exempt growth within subbasins was further defined using a buildable lands analysis and was reported with a heat map (Appendix B).

An alternative permit-exempt growth projection scenario was developed by assuming that some permit-exempt growth will occur in the rural water system areas. It was assumed growth in each respective water system will be proportional to buildable parcels without water system hookups relative to parcels with water system hookups. The methods defined for the Mason County alternative growth scenario (see Mason County above) were used to define permit-exempt growth in these rural water systems.

WRIA 14 Consumptive Use Methods

Under RCW 90.94, consumptive water use (consumptive use) by permit-exempt connections that are forecast to be installed over the planning horizon to service rural growth must be estimated to establish the water offsets required under the Streamflow Restoration law. The following definitions from the *Final Guidance for Determining Net Ecological Benefit - ESSB 6091 - Recommendations for Water Use Estimates* (Ecology's Final NEB Guidance) are used in this memorandum as a guide to estimate consumptive water use by permit-exempt connections (Ecology 2019).

- Consumptive Use: water that evaporates, transpires, is consumed by humans, or is otherwise removed from an immediate water environment.

- Domestic Use: includes both indoor and outdoor household uses, and watering of a lawn and noncommercial garden.
- New Consumptive Water Use: The consumptive water use from the permit-exempt domestic groundwater withdrawals estimated to be initiated within the 20-year planning horizon (2020–2040; planning horizon). The required water offset is equal to new consumptive water use.
- Net Ecological Benefit: The outcome that is anticipated to occur through implementation of projects and actions in a plan to yield offsets that exceed impacts within (a) the planning horizon and (b) the relevant WRIA boundary.
- Water Offsets: Projects that put water back into aquifers or streams that offset new consumptive water use.

Ecology has provided guidance for estimating indoor and outdoor consumptive water use in Ecology's Final NEB Guidance (Ecology 2019).

Consumptive use estimates are divided into two components: the indoor and outdoor portions of use. The use patterns and consumptive portions of indoor versus outdoor use associated with permit-exempt connections are different; therefore, separate approaches within each method that account for these differences are used to estimate consumptive use.

Ecology's indoor consumptive water use guidance includes literature-based assumptions on per-capita indoor water use and the consumptive proportion. Outdoor consumptive water use guidance includes methods for the estimation of irrigated area, assumed irrigation requirements, irrigation efficiency, and the consumptive proportion. Ecology's guidance also recommends local corroboration using water system meter data for both indoor and outdoor estimates (Ecology 2018, 2019). For purposes of this technical memorandum, Ecology's method for estimating consumptive use is called the Irrigated Area method, and estimation of consumptive use using local water system meter data is called the Water System Data method.

Consistent with the Final NEB guidance, the Committee assumed that impacts from consumptive use on surface water are steady-state, meaning that impacts to the stream from pumping do not change over time. This assumption is based on the wide distribution of future well locations and depths across varying hydrogeological conditions.

Irrigated Area Method

Based on Ecology's Final NEB Guidance (Ecology 2019), estimating indoor and outdoor consumptive water use included literature-based assumptions for both the per capita indoor water use and indoor and outdoor use proportions.

Indoor Consumptive Use – Irrigated Area Method

The following assumptions were used to estimate indoor consumptive water use by occupants of a dwelling unit (Ecology 2018, 2019):

- 60 gallons per day (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 permit-exempt connection use septic systems for wastewater (Ecology 2019). This method assumes that 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.

Assuming that there is one permit-exempt connection per dwelling unit, a "per permit-exempt 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:

$$HCIWU\ (gpd) = 60\ gpd\ x\ 2.5\ people\ per\ household\ x\ 10\%\ CUF$$

or

$$HCIWU\ (afy) = 60 gpd * 2.5\ people\ per\ house * 365\ days * 0.00000307\ AF/gallon * 10\%\ CUF$$

Where:

HCIWU = Household Consumptive Indoor Water Use (gpd)

afy = acre-feet per year

CUF = Consumptive use factor

This estimate of indoor consumptive water use per household is 15 gpd and can be annualized and converted to acre-feet per year (AFY) or cubic feet per second (cfs).

Outdoor Consumptive Use – Irrigated Area Method

Ecology (2018, 2019) recommends estimating future outdoor water use based on an evaluation of the average outdoor irrigated area for existing dwelling units served by permit-exempt connections. To calculate the consumptive portion of total outdoor water required per connection, Ecology recommends:

- Estimating the average irrigated lawn area (pasture/turf grass) per parcel;
- 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. This method assumes that 80 percent of outdoor domestic water use is consumed by evaporation and transpiration.

Future outdoor water use may be based, in part, on an estimate of the average outdoor irrigated area for existing homes served by permit-exempt domestic wells (Ecology 2018, 2019). HDR estimated the average irrigated lawn area for WRIA 14 by delineating the apparent

irrigated area in 80 parcels identified as containing a dwelling unit served by a permit-exempt well in WRIA 14, and averaging them (Attachment A). The irrigated areas were delineated using one technician and a standard method. The average irrigated area per permit-exempt connection in WRIA 14 was estimated to be 0.07 acre. The majority of the parcels evaluated did not have an apparent irrigated area (i.e., most parcels had no irrigated area).

Bias in the irrigated area delineation methods was evaluated by doing a side-by-side comparison study with another consulting form that was providing similar technical support for the WRIA 7, 8, and 9 WRE plans. This comparability study concluded that there was no inherent bias in the methods. Overall method bias was also evaluated by comparing the CU calculated with the Irrigated Area method to specific parcels with meter records (Attachment B). The Irrigated Area method overestimated overall water use, relative to the actual metered use.

Because of the high proportion of zero irrigated acreage measurements contributing to the 0.07-acre irrigated acreage average, and because of the large variability in the results (i.e., large standard deviation), HDR proposed a range of alternatives to mitigate that uncertainty:

- To account for the uncertainty of detecting small areas of irrigation, the Committee could impute the zero values with a "minimum detection" irrigated area of 0.05 acre, which would result in a 0.10-acre average irrigated area size.
- HDR completed an irrigated area comparability study for the irrigated area parcel analysis, and determined that an additional way to account for uncertainty in "human error" could be done using a "correction factor," which would result in a 0.11-acre average irrigated area size.
- HDR has completed a statistical analysis of their data, and has determined that using the 95 percent Upper Confidence Limit of the data (based on initial analysis with 0 values) could be an additional way to account for uncertainty, which would result in a 0.14-acre average irrigated area size.

Initially, the WRIA 14 Committee decided to move forward with a "primary working number" and a "working number for comparison." The primary working number is an average irrigated acreage of 0.10 acre (average value with imputed minimum detection values of 0.05 acre). The working number for comparison is 0.14 acre, which is the non-parametric 95th Upper Confidence Limit of the mean. Consumptive use based on both acreages were evaluated and compared to the consumptive use calculated from the Water System Data Method. The Committee later agreed by consensus to include the consumptive use estimate based on the 0.10 acre average irrigated area as the "most likely" estimate in the plan, and the consumptive use estimate based on the 0.14 acre average irrigated area as a higher goal to achieve through adaptive management.

Crop irrigation requirements, irrigation efficiency and outdoor use assumptions were also made to estimate outdoor consumptive use. An average crop irrigation requirement of 18 inches per year was estimated for pasture/turf grass from nearby stations as provided in the Washington

Irrigation Guide (NRCS-USDA 1997). Irrigation application efficiency (i.e., the percent of water used that actually reaches the turf) was assumed to be 75 percent, consistent with Ecology (2018, 2019) recommendations. Finally, the consumptive portion of total amount of water used for outdoor use was assumed to be 80 percent. The WRIA 14 Committee chose not to modify the irrigation efficiency or indoor and outdoor consumptive factors used in the Irrigation Area method.

This method is summarized in the following equation:

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

Where:

HCOWU = Household Consumptive Outdoor Water Use (gpd)

afy = acre-feet per year

A = Irrigated Area (acres)

IR = Irrigation Requirement over one irrigation season (feet)

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

CUF = Consumptive Use Factor; assumed to be 80 percent (factor expressed as 0.80)

This estimate of outdoor consumptive water use per household per day can be annualized and converted to gallons per day or cubic feet per second.

Conversion Factors:

gpd = afy * 0.001120

cfs = afy * 723.97

This estimate of outdoor consumptive use per household per day is 143 gpd (assuming average irrigated area of 0.10 acre) and 200 gpd (assuming average irrigated area of 0.14 acre) and can be annualized and converted to acre-feet per year of cubic feet per second.

Seasonal consumptive use was estimated on a monthly basis by allocating total outdoor consumptive use proportional to the monthly irrigation requirement. The monthly irrigation requirement was defined by the Washington Irrigation Guidance.

Water System Data Method

Consumptive use by permit-exempt connections may also be estimated using metered connections from water systems. Water systems required to plan per Washington Administrative Code 246–290 must install meters on all customer connections. Smaller water systems that do not have state planning requirements may choose to meter their customer connections if the system billing is based on a tiered rate structure (i.e., increasing costs per unit of water consumed coincident with higher total use in the billing period).

Some systems bill customers a flat rate (i.e., same bill every month regardless of consumption). The lack of a tiered rate structure reduces the financial incentive to conserve water, which may result in consumption patterns more similar to those observed on a permit-exempt connection. These systems may or may not choose to meter their customers if meters are not required by law.

No water use meter data were available for systems that uses a flat rate structure. The Cherry Park, Union, and Harstene Island water systems operate under a tiered rate structure in WRIA 14 and were utilized for this analysis.

In most instances pumping impacts associated with new permit-exempt domestic withdrawals will be quite small, well dispersed, and nearly steady-state with respect to streams, as stated in Ecology's final NEB Guidance Appendix B (Ecology, 2019).

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 permit-exempt connections (assuming all connections are residential) to determine average daily indoor use per permit-exempt connection. Similar to that used in the Ecology Irrigated Area method, 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.

Annual 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 then subtracted from total annual use by a water system to estimate total annual outdoor use. Similar to the calculation used in the Ecology Irrigated Area Method, 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 14; therefore, seasonal outdoor water use was assumed to occur over a period of 6 months (April through September). 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.

Results

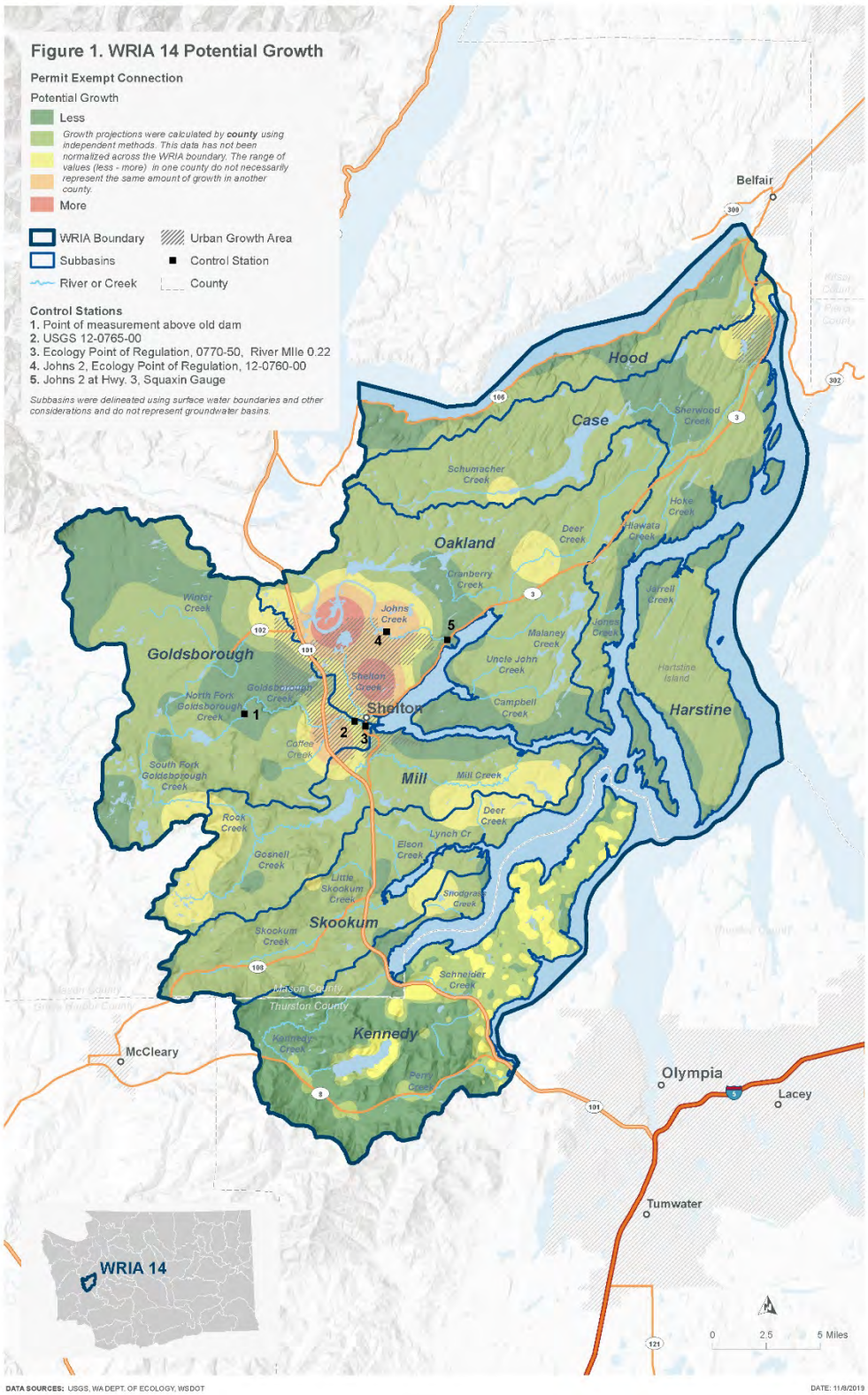
Permit-Exempt Connection Growth

Initial permit-exempt connection growth is projected to be 4,006 connections (Table 1). The alternative revised permit-exempt connection growth scenario is projected to have 288 additional connections, for a total of 4,294 permit-exempt connections. The WRIA 14 Committee has not selected one projection over the other for consumptive use estimation. Permit-exempt connection growth is expected to be greatest in the Oakland Bay subbasin.

Table 1: WRIA 14 Alternative Growth Projection Scenarios

Number of Permit-Exempt Wells Added between 2018 and 2038		
Subbasin	**Initial**	**Revised**
Case	418	512
Goldsborough	509	546
Harstine	143	143
Hood	74	117
Kennedy	556	588
Mill	462	466
Oakland	1,481	1559
Skookum	363	363
Totals	**4,006**	**4,294**

Figure 1. WRIA 14 Projected Permit-Exempt Connection Growth



Consumptive Use

The WRIA-wide consumptive use estimates used the Irrigated Area method range from 0.98 cfs (initial, average irrigated area of 0.10 acre) to 1.05 cfs (revised growth, average irrigated area of 0.10 acre) (Table 2 and Table 3). When an average irrigated area of 0.14 acre (95 percent Upper Confidence Limit [UCL] average irrigated area) was assumed, the consumptive use estimates ranged from 1.33 cfs (initial) to 1.43 cfs (revised growth).

The water system data analysis in WRIA 14 was conducted using averages of three systems managed by the Mason Public Utility District: Cherry Park, Union, and Harstene Retreat. The WRIA-wide consumptive use estimate calculated using the Water System Data method ranged from 0.48 cfs (initial) to 0.51 cfs (revised growth) (Table 2 and Table 3).

The WRIA 14 Committee selected the Irrigated Area method, using an average irrigated area of 0.10 acre as the "working" consumptive use estimate. The consumptive use estimates using a 95 percent UCL of the average irrigated area (0.14 acre) and the water system data method are for comparative purposes only.

Estimates of consumptive use using the Irrigated Area method are approximately two times greater than the Water System Data estimates.

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 4 and Table 5). The month of July has the highest irrigation requirement, resulting in the highest monthly consumptive use impact. This information may be used during evaluation of projects designed to offset subbasin- and season-specific impacts.

Sources

Ecology. 2018. *Recommendations for Water Use Estimates*. Washington State Department of Ecology, Publication 18-11-007.

Ecology. 2019. Final Guidance for Determining Net Ecological Benefit. Washington State Department of Ecology, Publication 19-11-079.

Natural Resource Conservation Service. 1997. Washington Irrigation Guide (WAIG). U.S. Department of Agriculture.

Table 2: Annualized Average Consumptive Use Estimates for WRIA 14 (2020–2040) – Initial Growth

Subbasin	Projected No. Permit-Exempt Wells	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (0.10 acre average irrigated area)			Annual Consumptive Use: Irrigated Area Estimate (0.14 acre average irrigated area)		
		AFY	GPM	AFY	AFY	GPM	CFS	AFY	GPM	CFS
Case	418	36.2	22.4	0.05	73.9	45.8	0.10	100.7	62.4	0.14
Goldsborough	509	44.0	27.3	0.06	90.0	55.8	0.12	122.6	76.0	0.17
Harstine	143	12.4	7.7	0.02	25.3	15.7	0.03	34.4	21.3	0.05
Hood	74	6.4	4.0	0.01	13.1	8.1	0.02	17.8	11.0	0.02
Kennedy	556	48.1	29.8	0.07	98.3	60.9	0.14	133.9	83.0	0.19
Mill	462	40.0	24.8	0.06	81.7	50.6	0.11	111.3	69.0	0.15
Oakland	1,481	128.2	79.4	0.18	261.8	162.3	0.36	356.6	221.1	0.49
Skookum	363	31.4	19.5	0.04	64.2	39.8	0.09	87.4	54.2	0.12
Totals	**4,006**	**346.7**	**214.9**	**0.48**	708.3	439.1	0.98	964.7	598.0	1.33

Table 3: Annualized Average Consumptive Use Estimates for WRIA 14 (2020–2040) – Revised Permit-exempt Connection Growth

Subbasin	Projected No. Permit-Exempt Wells	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (0.10 acre average irrigated area)			Annual Consumptive Use: Irrigated Area Estimate (0.14 acre average irrigated area)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
Case	512	44.3	27.5	0.06	90.5	56.1	0.13	123.3	76.4	0.17
Goldsborough	546	47.2	29.3	0.07	96.5	59.8	0.13	131.5	81.5	0.18
Harstine	143	12.4	7.7	0.02	25.3	15.7	0.04	34.5	21.4	0.05
Hood	117	10.1	6.3	0.01	20.7	12.8	0.03	28.2	17.5	0.04
Kennedy	588	50.9	31.5	0.07	103.9	64.4	0.14	141.5	87.7	0.20
Mill	466	40.3	25.0	0.06	82.4	51.1	0.11	112.2	69.6	0.16
Oakland	1559	134.9	83.6	0.19	275.6	170.9	0.38	375.4	232.7	0.52
Skookum	363	31.4	19.5	0.04	64.2	39.8	0.09	87.4	54.2	0.12
Totals	**4,294**	**371.6**	**230.4**	**0.51**	759.2	470.6	1.05	1,034.0	641.0	1.43

Table 4: WRIA 14 Monthly Consumptive Water Use (Irrigated Area method; assumed irrigated area of 0.10 acres)

Subbasin	Projected No. Permit-exempt Connections	Consumptive Use by Month (cfs)											
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Initial													
Case	418	0.00	0.00	0.00	0.02	0.18	0.24	0.33	0.25	0.10	0.00	0.00	0.00
Goldsborough	509	0.00	0.00	0.00	0.03	0.21	0.29	0.40	0.31	0.12	0.00	0.00	0.00
Harstine	143	0.00	0.00	0.00	0.01	0.06	0.08	0.11	0.09	0.03	0.00	0.00	0.00
Hood	74	0.00	0.00	0.00	0.00	0.03	0.04	0.06	0.04	0.02	0.00	0.00	0.00
Kennedy	556	0.01	0.01	0.01	0.03	0.23	0.32	0.44	0.34	0.14	0.01	0.01	0.01
Mill	462	0.00	0.00	0.00	0.03	0.19	0.27	0.36	0.28	0.11	0.00	0.00	0.00
Oakland	1,481	0.01	0.01	0.01	0.08	0.62	0.85	1.17	0.90	0.36	0.01	0.01	0.01
Skookum	363	0.00	0.00	0.00	0.02	0.15	0.21	0.29	0.22	0.09	0.00	0.00	0.00
Totals	**4,006**	0.04	0.04	0.04	0.22	1.69	2.31	3.15	2.43	0.97	0.04	0.04	0.04
Higher Permit-Exempt Connection Growth													
Case	512	0.00	0.00	0.00	0.03	0.22	0.29	0.40	0.31	0.12	0.00	0.00	0.00
Goldsborough	546	0.01	0.01	0.01	0.03	0.23	0.31	0.43	0.33	0.13	0.01	0.01	0.01
Harstine	143	0.00	0.00	0.00	0.01	0.06	0.08	0.11	0.09	0.03	0.00	0.00	0.00
Hood	117	0.00	0.00	0.00	0.01	0.05	0.07	0.09	0.07	0.03	0.00	0.00	0.00
Kennedy	588	0.01	0.01	0.01	0.03	0.25	0.34	0.46	0.36	0.14	0.01	0.01	0.01
Mill	466	0.00	0.00	0.00	0.03	0.20	0.27	0.37	0.28	0.11	0.00	0.00	0.00
Oakland	1,559	0.01	0.01	0.01	0.09	0.66	0.90	1.23	0.95	0.38	0.01	0.01	0.01
Skookum	363	0.00	0.00	0.00	0.02	0.15	0.21	0.29	0.22	0.09	0.00	0.00	0.00
Totals	**4,294**	0.04	0.04	0.04	0.24	1.81	2.47	3.38	2.61	1.04	0.04	0.04	0.04

Note: WRIA 14 did not consider a low-growth scenario.

Table 5: WRIA 14 Monthly Consumptive Water Use (Irrigated Area method; assumed irrigated area of 0.14 acres)

Subbasin	Projected No. Permit-exempt Connections	Consumptive Use by Month (cfs)											
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Initial													
Case	418	0.00	0.00	0.00	0.03	0.25	0.34	0.46	0.35	0.14	0.00	0.00	0.00
Goldsborough	509	0.00	0.00	0.00	0.04	0.30	0.41	0.56	0.43	0.17	0.00	0.00	0.00
Harstine	143	0.00	0.00	0.00	0.01	0.08	0.11	0.16	0.12	0.05	0.00	0.00	0.00

Hood	74	0.00	0.00	0.00	0.01	0.04	0.06	0.08	0.06	0.02	0.00	0.00	0.00
Kennedy	556	0.01	0.01	0.01	0.04	0.33	0.45	0.61	0.47	0.19	0.01	0.01	0.01
Mill	462	0.00	0.00	0.00	0.03	0.27	0.37	0.51	0.39	0.16	0.00	0.00	0.00
Oakland	1,481	0.01	0.01	0.01	0.11	0.87	1.19	1.63	1.25	0.50	0.01	0.01	0.01
Skookum	363	0.00	0.00	0.00	0.03	0.21	0.29	0.40	0.31	0.12	0.00	0.00	0.00
Totals	**4,006**	0.04	0.04	0.04	0.30	2.35	3.21	4.40	3.39	1.35	0.04	0.04	0.04
Higher Permit-Exempt Connection Growth													
Case	512	0.00	0.00	0.00	0.04	0.30	0.41	0.56	0.43	0.17	0.00	0.00	0.00
Goldsborough	546	0.01	0.01	0.01	0.04	0.32	0.44	0.60	0.46	0.18	0.01	0.01	0.01
Harstine	143	0.00	0.00	0.00	0.01	0.08	0.11	0.16	0.12	0.05	0.00	0.00	0.00
Hood	117	0.00	0.00	0.00	0.01	0.07	0.09	0.13	0.10	0.04	0.00	0.00	0.00
Kennedy	588	0.01	0.01	0.01	0.04	0.34	0.47	0.65	0.50	0.20	0.01	0.01	0.01
Mill	466	0.00	0.00	0.00	0.03	0.27	0.37	0.51	0.39	0.16	0.00	0.00	0.00
Oakland	1,559	0.01	0.01	0.01	0.12	0.91	1.25	1.71	1.32	0.53	0.01	0.01	0.01
Skookum	363	0.00	0.00	0.00	0.03	0.21	0.29	0.40	0.31	0.12	0.00	0.00	0.00
Totals	**4,294**	0.04	0.04	0.04	0.32	2.52	3.44	4.71	3.63	1.45	0.04	0.04	0.04

Note: WRIA 14 did not consider a low-growth scenario.

Attachment A

Estimation of Average Irrigated Area

Methods

1. 80 parcels representing an existing dwelling served by a permit-exempt well or connection was defined.
    a. A pool of parcels with an existing dwelling served by a permit-exempt well or connection was defined.
    b. The selection pool was classified by property value. The classes were (1) Under $350,000, (2) $350,000–$600,000, and (3) more than $600,000.
    c. 80 parcels were randomly drawn from the selection pool, weighted by the proportion of property value class membership.
    d. Additional parcels were randomly selected as alternates, in case any of the primary (80) samples were able to be interpreted to irrigated area.
    e. All parcels were provided in a GoogleEarth .kmz file.
2. The irrigated area in each parcel was delineated according to the following procedure:
    a. Used a single technician to minimize operator variability.
    b. Irrigated area delineations were made using GoogleEarth aerial imagery taken during drier summer months (i.e., July and August). Unirrigated lawns (pasture/turf) go dormant in the dry summer months and turn brown. As such, areas that remain green in the summer imagery were considered irrigated.
    c. Aerial imagery from winter months was reviewed alongside summer imagery to reveal which lawn areas change from green to brown. Those areas that do not change color, or moderately change color but remain green, were considered irrigated.
    d. If available, multiple years of aerial imagery were used to corroborate the irrigated area delineation.
    e. Landscaped shrub/flower bed areas within a larger irrigated footprint were included. Shrub and flower bed areas outside of the irrigated footprint were excluded.
    f. If the irrigated area extended beyond the parcel boundary, those areas were included.
    g. Parcels with no visible signs of irrigation were assumed to have zero irrigated acres.
    h. Areas that appeared to be native forest or unmaintained grass were not included in the irrigated footprint.

i. Parcels with homes or accessory dwelling units (ADUs) under construction in the most recent GoogleEarth imagery were excluded from the analysis, and an alternate parcel was evaluated.

- Figures B-1 through B-4 illustrate some example delineations.

•

Figure B-1. No irrigated areas visible in most recent GoogleEarth aerial imagery.

Figure B-2. Area in white includes maintained grass. Residence constructed between June 2017 and July 2018. Therefore, historical irrigation of property is unavailable in GoogleEarth imagery.

Figure B-3. Irrigated area includes landscaped area in driveway, maintained yard around residence, garden area, and maintained grass near garden area.

Figure B-4. No irrigated area. Assumption that green vegeation on southern portion of parcel is due to proximity to Spurgeon Creek since clear delineation of irrigated area is not present on aerial. Green area near residence appears to be tree and shrubs, not maintained landscaping and is excluded.

Results

Eighty parcels were evaluated for irrigated acreage (Figure B-5). The average irrigated acreage was 0.07 acre (Table B-1). In all WRIAs evaluated, most parcels had zero irrigated acres (Figure B-6). The distribution of irrigated acreages for all WRIAs were skewed because of the large percentage of parcels that had zero irrigated acres. Some parcels had an irrigated area nearly an order of magnitude larger than the mean, resulting in a large standard deviation. The 95 percent upper confidence limit of the mean could be fit only with a non-parametric distribution and was about twice the quantity of the calculated arithmetic mean. When a minimum irrigated acreage of 0.05 acre was imputed for the parcels with zero irrigated acres observed, the average acreage increased to 0.10 acre.

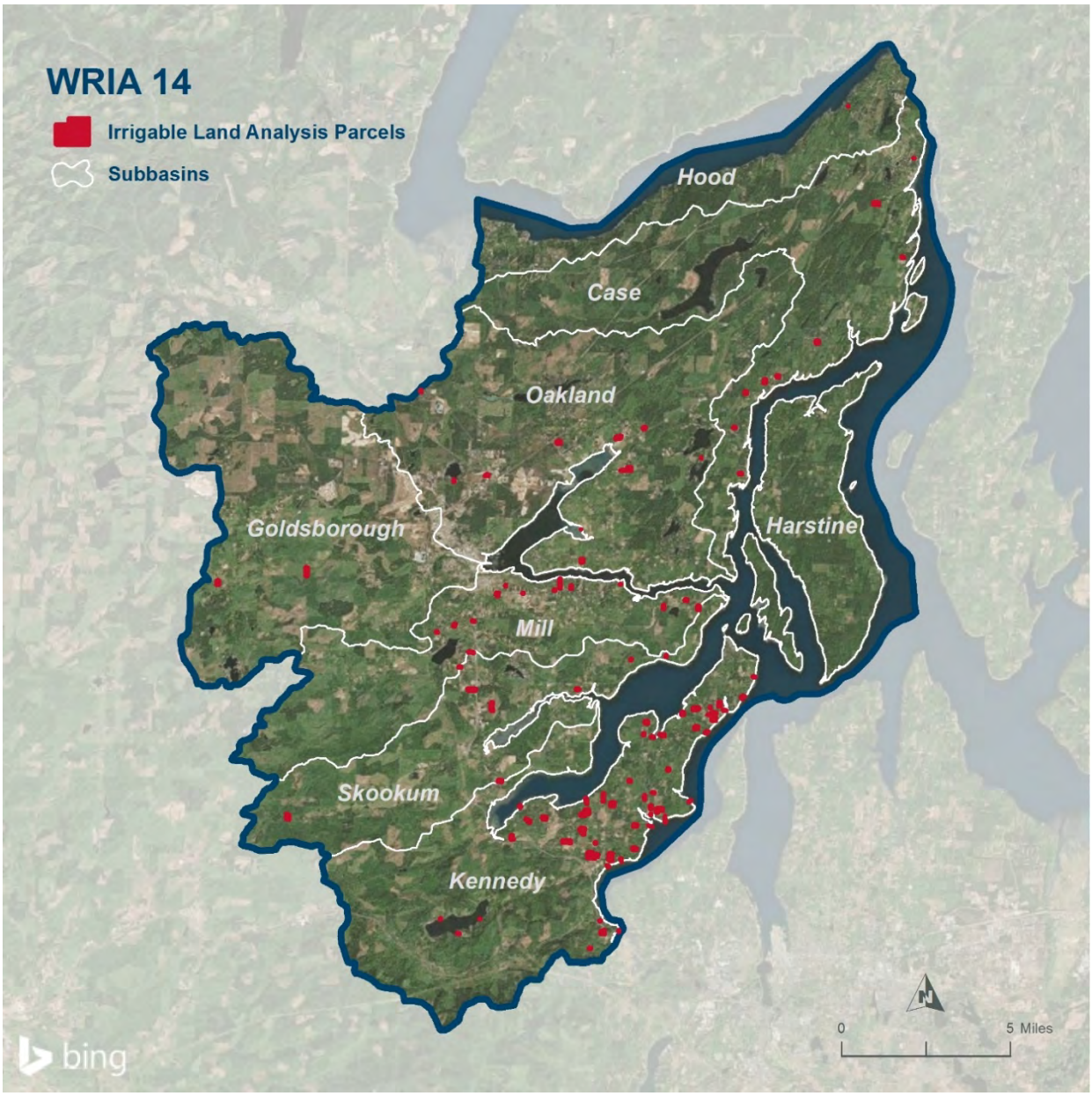


Figure B-5. Parcels selected in WRIA 14 with existing permit-exempt connections that were delineated for apparent irrigated areas.

Table B-1. Irrigated acreage delineation results

Statistic	WRIA 14
Permit-exempt Parcel Sample Pool	5,091
Sample Size	80
Mean (acres)	0.07
Mean, with 0.05-acre minimum (acres)	0.10

Standard Deviation (acres)	0.15
95% UCL (acres)	0.14

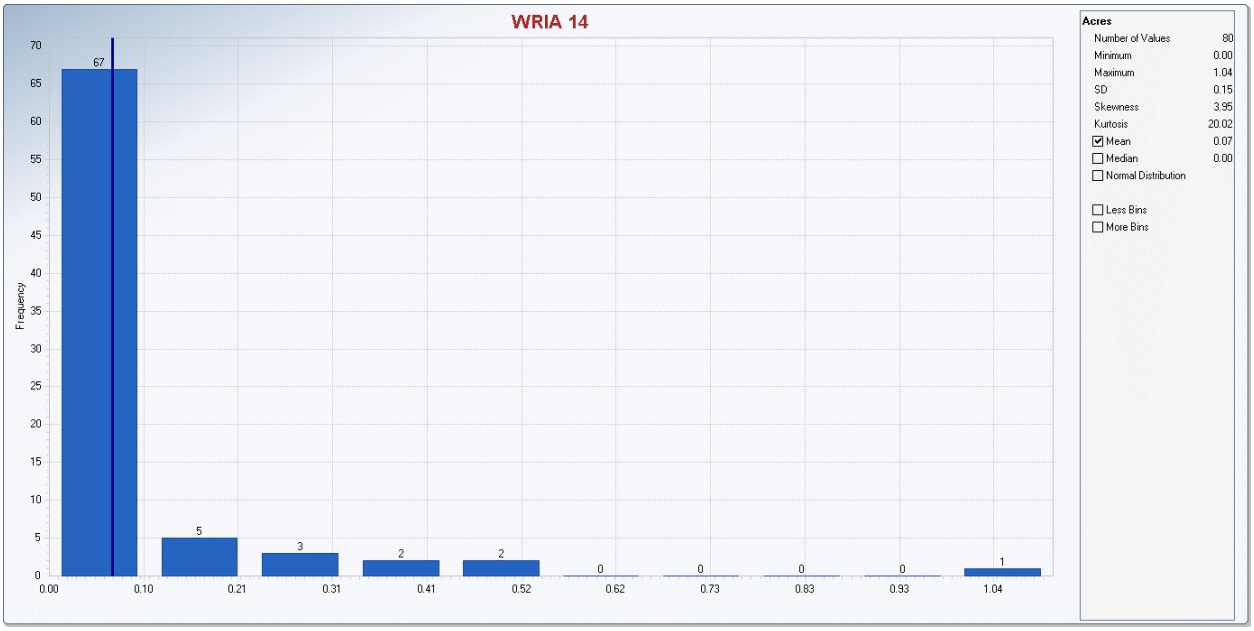


Figure B-6. Histogram of WRIA 14 irrigated acreage delineation results.

Because of the large proportion of parcels with zero acres observed, and the large variability in the results (i.e., large standard deviation), HDR proposed a range of alternatives to mitigate that uncertainty:

- To account for uncertainty of detecting small areas of irrigation, the Committee could impute the zero values with a "minimum detection" irrigated area of 0.05 acre, which would result in a 0.10-acre average irrigated area size.
- HDR completed an irrigated area comparability study for the irrigated area parcel analysis, and determined that an additional way to account for uncertainty in "human error" could be done using a "correction factor," which would result in a 0.11-acre average irrigated area size.
- HDR has completed a statistical analysis of their data, and has determined that using the 95 percent Upper Confidence Limit of the data (based on initial analysis with 0 values) could be an additional way to account for uncertainty, which would result in a 0.14-acre average irrigated area size.

The WRIA 14 Committee decided to move forward with a "primary working number" and a "working number for comparison." The primary working number is an average irrigated acreage

of 0.10 acre (average value with imputed minimum detection values of 0.05 acre). The working number for comparison is 0.14 acre, which is the non-parametric 95th Upper Confidence Limit of the mean. Consumptive use based on both acreages will be evaluated and compared to the consumptive use calculated from the Water System Data method.

Attachment B

Consumptive Use Corroboration Analysis

Thurston, Mason, and Kitsap PUDs provided water consumption data for several systems with a small number of connections. These systems were analyzed using both consumptive use estimation methods. All parcels in each system were analyzed for irrigated area, providing a direct comparison between the water estimated using the Irrigated Area method and the actual measured consumption by the water system. Table 1 contains the results of the corroboration analysis.

Table 1: Annual and Seasonal Consumptive Use Corroboration Analysis

WRIA – Water System	Annual Consumptive Use (gpd per household)			Seasonal Consumptive Use (gpd per household)					
				Summer			Winter		
	Water System Data	Irrigated Area Method	Percent Difference[1]	Water System Data	Irrigated Area Method	Percent Difference[1]	Water System Data	Irrigated Area Method	Percent Difference[1]
WRIA 12 – Whiskey Hollow	53.6	181.1	238	85.8	346.3	304	11.2	15.0	34
WRIA 13 – Rich Road	52.6	113.2	115	86.8	210.8	143	7.3	15.0	107
WRIA 14 – Canyonwood Beach	29.3	86.4	195	51.2	157.4	207	7.2	15.0	107
WRIA 15 – Echo Valley	76.7	75.5	-2	137.9	135.7	-2	15.2	15.0	-1

[1]Change in consumptive use from the Water System Data method to the Irrigated Area method.

The Irrigated Area method estimated consumptive use values at least double those estimated from the Water System Data method in WRIAs 12, 13, and 14. This is true for both indoor and outdoor use. The exception is winter consumptive use in the Whiskey Hollow system, which suggests that customers purchasing water from Whiskey Hollow use indoor water at a rate similar to that assumed in the Irrigated Area method (i.e., 60 gpd per person). The Echo Valley system in WRIA 15 has a slight decrease in estimated consumptive use in the Irrigated Area method compared to the Water System Data method. Customers in this system may heavily irrigate their lawns, or the estimate of total irrigated area in the system may be biased low. No small water system data were provided in WRIA 10.

Appendix I – Detailed Project Descriptions

I. City of Shelton Reclaimed Water

II. Evergreen Mobile Home Estates

III. General Floodplain Restoration

IV. Goldsborough Hilburn Restoration Project

V. Managed Aquifer Recharge Projects in WRIA 14

VI. Mason County Rooftop Runoff

VII. North Steamboat

VIII. Skookum Valley Railroad Culvert Blockages

IX. Skookum Valley Agricultural Project

X. Water Right Screening Methodology

XI. Steamboat Middle Storage Enhancement and Habitat Improvements

XII. Schneider Creek Source Substitution

XIII. Summit Lake Alternative Water Supply and Use

City of Shelton Reclaimed water

PROJECT DESCRIPTION

Description

The City of Shelton (City) proposes to increase the quantity and rate of reclaimed water infiltration into the North Fork Goldsborough subbasin by increasing production of Class A reclaimed water (RW) and infiltrating to groundwater at the City RW spray field, near the Washington Corrections Center (WCC). This project will re-direct an annual average of 0.5 mgd of the City's wastewater in North Shelton from the WWTP to the Water Reclamation Plant (WRP). The additional flow will be treated to produce 0.5 mgd of RW for subsequent conveyance to the existing City spray field. The following infrastructure improvements must occur to facilitate this project:

- Conveyance of North Shelton wastewater to the WRP.
- A storage tank (0.750 mg) to store RW at the WRP.

The conveyance of North Shelton wastewater to the WRP is currently in its design phase is likely to include a sewage lift station, and 18 inch sewer main and would run from West Birch Street to reclaimed water satellite plant (approximately 9,000 linear feet). The RW storage tank serves to buffer variable production and use of RW. Reclaimed water produced from City wastewater may be used for City uses, including a backup for firefighting, and it allows strategic timing of application of reclaimed water to the ground to benefit aquifers and streams and wetlands. Streamflow restoration funds are currently supporting design options for the lift station, sewer main, storage tank, and cost estimates. The additional reclaimed water will be conveyed to the City's existing spray field near the WCC with and infiltrated to local groundwater.

The second component of this project is RW use at the WCC. The WCC proposes to use reclaimed water to irrigate their outdoor lawn, instead of water that they currently pump from their local well. Pumping from their local well has been shown to impact instream flows in the North Fork Goldsborough Creek.

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

Wastewater in the Shelton area is currently treated by the City at the Fairmont wastewater treatment plant (WWTP) and the Water Reclamation Plant (WRP). Approximately 1.3 million gallons per day (1,490 acre-feet/year) of treated effluent from the WWTP is discharged directly to Oakland Bay. Approximately 0.213 million gallons per day (239 acre-feet/year) of RW is currently produced at the WRP and is conveyed to a wooded area near the WCC and overland sprayed. This overland spraying area is adjacent to the North Fork Goldsborough Creek, and it is likely that water infiltrating to the local aquifer is in connection with North Fork Goldsborough Creek flows.

The water offset benefit from the North Shelton wastewater re-direct to the WRP, would be the result of infiltrating the reclaimed water produced from that waste stream. The North Shelton wastewater is currently treated at the WWTP and discharged to Oakland Bay. All 560 acre-feet/ year of reclaimed water produced from the North Shelton waste stream would be infiltrated into the proposed infiltration facility. Assuming an infiltration efficiency of 80%, this would result in between 448 afy infiltrated to the local aquifer (Table 1).

The use of RW for irrigation by the WCC will result in a water offset, because of reduced consumptive use of their locally pumped water. The WCC is currently pumping 67 acre-feet/yr of local groundwater for irrigation. Eighty percent of the water used for irrigation will be lost to evapotranspiration (Table 2). However, if RW was used for outdoor irrigation, it's assumed that as the WCC population grows, the same quantity of water will be used for indoor use. However, very little of that water will be consumptively used, because the wastewater will be conveyed to the WRP, treated to Class A RW, pumped to the City spray field and land applied at rates that result in 80% infiltration efficiency. The resulting quantity of locally pumped water that would be infiltrated because of the change to indoor use would be 38 acre-feet/yr (Table 2). The immediate benefit would be larger, because the growth of indoor use would be gradual, and immediately after the switch to RW for irrigation, the WCC would pump 67 acre-feet/yr less from their local well. Future WCC expansion include new buildings (i.e. health care building and Program building) where grey water piping will be incorporated. These and other potential expansions may increase RW use to approximately 134 acre-feet/year. If outdoor water use (i.e. irrigation) used the entire 134 acre-feet/year in the future, then that would result in a net savings of 75 acre-feet/yr (Table 3).

Table 1. Estimated quantity of infiltrated reclaimed water from North Shelton, Basin 7.

New North Shelton Reclaimed Water	Water Quantity (af/yr)
RW Quantity	560
RW Infiltration (80%)	448

Table 2. WCC consumptive use savings from using RW for immediate irrigation needs.

Outdoor Use	**Water Quantity (af/yr)**
Irrigation Quantity	67
Irrigation CU	53.6
Indoor Use	
Future Indoor Use	60
Future Indoor CU	6
CU Savings	
CU Savings	47.6
RW Infiltration (80% Efficiency)	38

Table 3. WCC consumptive use savings from using RW for future potential irrigation needs.

Outdoor Use	**Water Quantity (af/yr)**
Irrigation Quantity	134
Irrigation CU	107
Indoor Use	
Future Indoor Use	134
Future Indoor CU	13
CU Savings	
CU Savings	94
RW Infiltration (80% Efficiency)	75

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

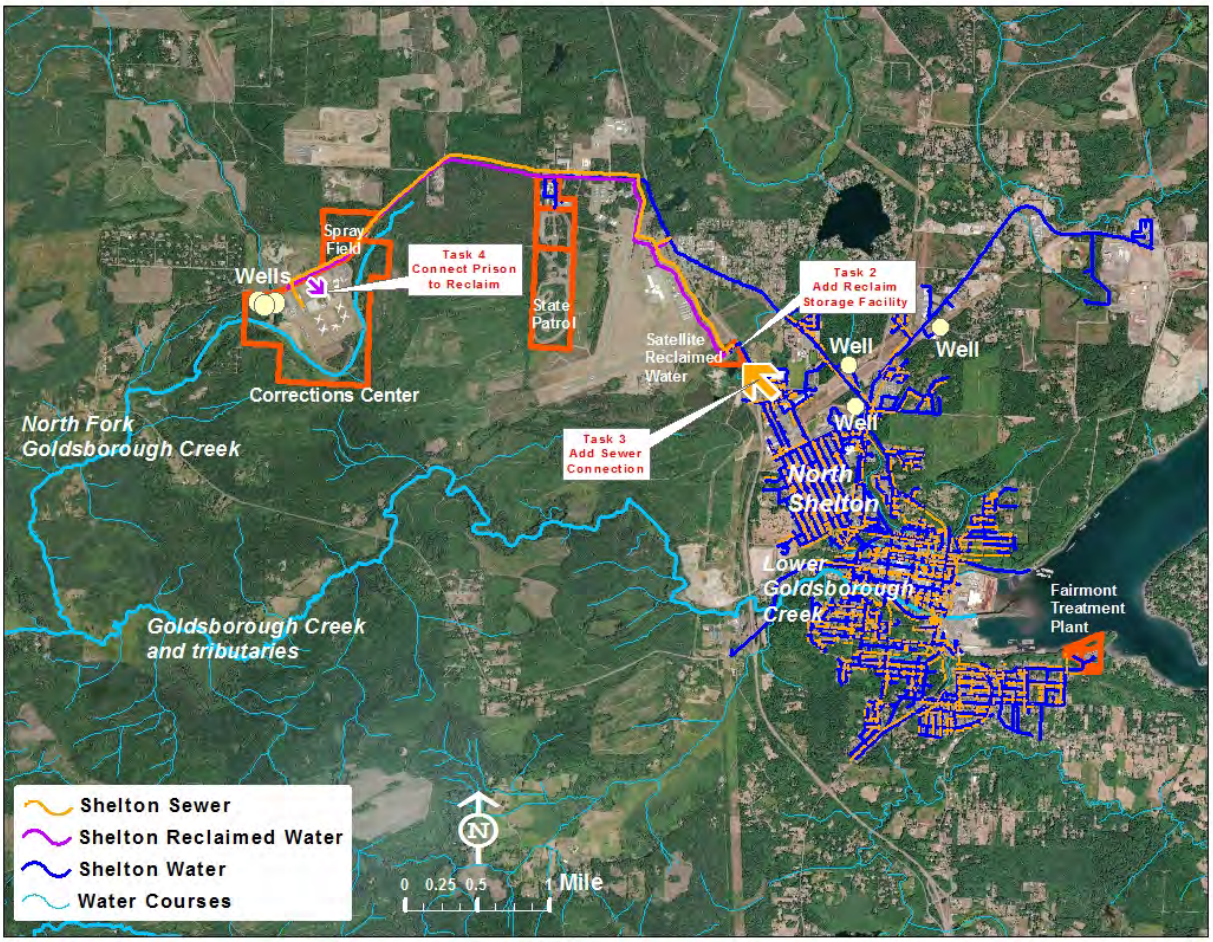


Figure 1. City of Shelton wastewaster collection network, wastewater treatment plants, and reclaimed water use at the WCC.

Description of the anticipated spatial distribution of likely benefits

RW infiltration will likely benefit stream flows in the North Fork Goldsborough Creek. The spray field is underlain by Vashon Recessional Outwash, as indicated by monitoring wells associated with reclaimed water permit ST6216 fact sheet. The spray field is up-gradient from the North Fork Goldsborough Creek to the west and south. On-site observations indicated significant swelling of the North Fork of Goldsborough Creek during rainfalls, suggesting that much of the water infiltrating in the immediate area discharges to the North Fork of Goldsborough Creek (Permit ST6216 fact sheet).

Performance goals and measures.

The following performance goals and measures will determine the success of this project:

- Annual average wastewater flow from the North Shelton neighborhood is 0.5 mgd (560 acre-feet/yr)

- Annual average RW production and conveyance to the infiltration facility is equal to the North Shelton and WCC input sources. Alternative uses of the reclaimed water originating from the WCC wastewater may be deducted from the total (i.e. separate accounting).

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

Goldsborough Creek is designated habitat for ESA-listed winter steelhead. It is also home to populations of chum and coho salmon and anadromous cutthroat trout (WDFW 2020). This project will benefit North Fork Goldsborough Creek and Goldsborough Creek. Increased flow will increase usable aquatic habitat, and would have the greatest benefit during summer low flows.

Identification of anticipated support and barriers to completion.

This project is supported by the City, the WCC, and the Squaxin Island Tribe. No barriers to completion are currently foreseen.

Potential budget and O&M costs.

The City and the Squaxin Island Tribe are currently undergoing a feasibility study that includes capital and O&M costs. The current cost estimate is $1,673,000, based on similar work from an existing project grant from the Squaxin Island Tribe.

Anticipated durability and resiliency.

This project is expected to be durable, because the upgrades and RW quantities will be reflected by NPDES wastewater permit requirements that are designed to avoid and minimize treatment failure. Treatment upsets are generally avoided with design redundancy and safeguards, as defined in the reclaimed water permit ST6216.

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

The project sponsor is the City of Shelton with the Squaxin Island Tribe as supporter. The WCC is a project stakeholder. All parties are currently proceeding with a feasibility study and are ready to implement the project, according to the results of the feasibility study.

References

Ecology (Washington State Department of Ecology). 2009. Fact Sheet for Reclaimed Water Permit Number ST 6216.

Ecology (Washington State Department of Ecology). 2016. Reclaimed Water Permit Number ST 6216.

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

Evergreen Mobile Home Estates Water Rights Acquisition

PROJECT DESCRIPTION

Description

Evergreen Mobile Home Estates (Evergreen Estates) Group A water system (PWSID# 24154) has been issued a compliance order to install CT6 disinfection (i.e. chlorination) to address failing on-site wastewater systems in close proximity to its wells. As an alternative to CT6 treatment, Evergreen Estates is considering connection to the City of Shelton's (City's) water system and abandoning its existing wells. The City has been pursuing consolidating the Evergreen Estates with the City drinking water system, and conducted a feasibility study to identify necessary infrastructure improvements to connect Evergreen Mobile Estates to its water system.

The Evergreen Estates installed five new sewer septic systems and a chlorination system at the wells. The property owner has indicated that the State has accepted their plan for onsite septic and chlorination improvements and that no further action on their part is needed (Carollo 2020). However, the Evergreen Estates owner did indicate that they would be amenable to water system consolidation if their costs were covered by others or with grant funding (HDR 2020).

The water system consolidation would result in the water rights of the Evergreen Mobile Estates Group A system to be unused. A water offset benefit would occur if that water right were to be put into permanent trust, per RCW 90.42.

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

The City of Shelton recently completed a consolidation feasibility study for the Evergreen Estates (Carollo 2020). The study identified the infrastructure that would need to be built by the City and by Evergreen Estates, respectively. The City would provide water service to the Evergreen Estates by providing an 8-inch water main for domestic supply and fire flows. Evergreen Estates would need to install a pressure reducing valve, a backflow prevention device, and potentially private fire hydrants.

The Evergreen Estates' available Water Use Efficiency reports indicated annual water production at the total authorized annual consumption of 26.9 acre-feet per year. However, the feasibility study estimated their likely annual water use to be 7.2 acre-feet per year. Therefore, if the City provided water to the Evergreen Estates, and the existing water right were to be put into permanent trust, the water offset value would be 7.2 acre-feet per year.

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

The Evergreen Estates and water offset benefits would occur in the North Shelton area, in the Oakland subbasin (Figure 1).

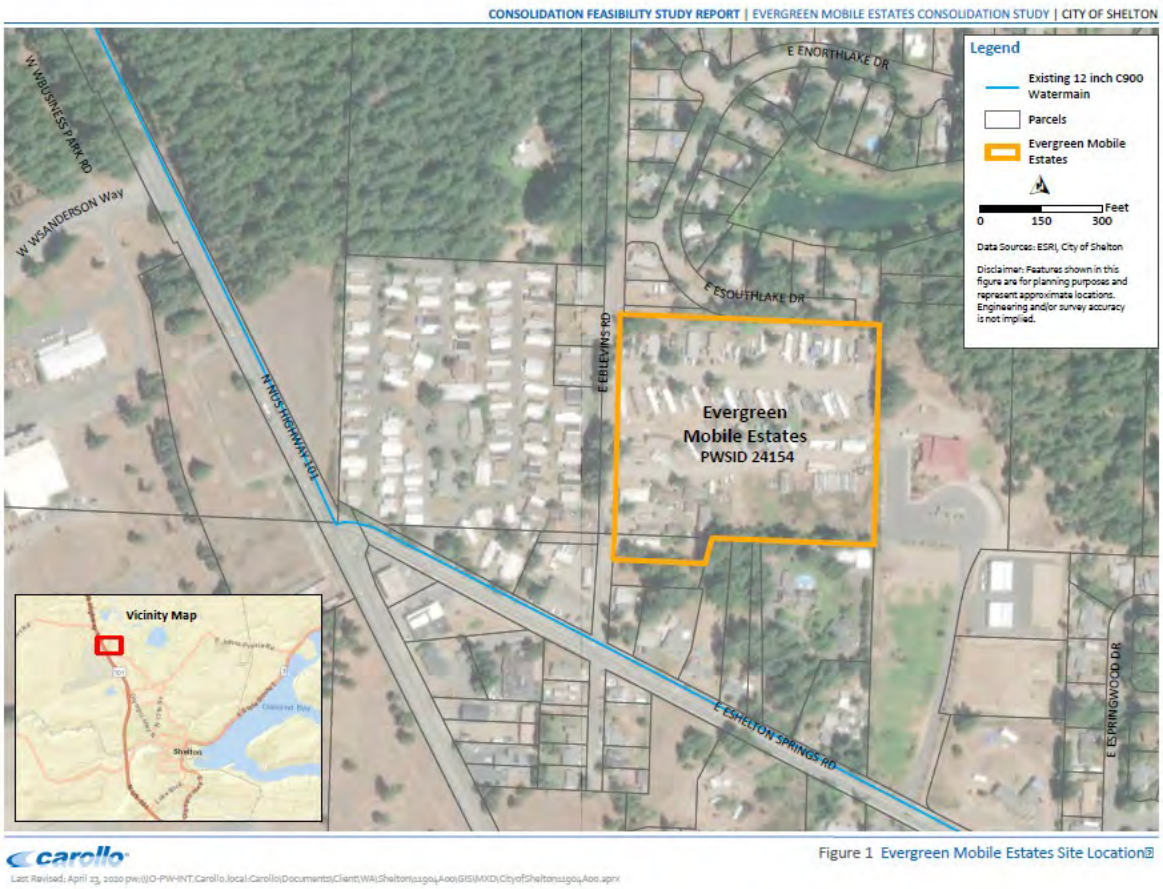


Figure 1 Evergreen Mobile Estates Site Location

Figure 1. Evergreen Estates Site Location (from Carollo 2020).

Description of the anticipated spatial distribution of likely benefits

Elimination of pumping and consumptive use at the Evergreen Estates may benefit flow in John's Creek, in the Oakland subbasin. John's Creek is less than half a mile away from Evergreen Estates.

Performance goals and measures.

The performance goals would include completion of the legal mechanism of putting the Evergreen Estates water right into permanent trust, and permanent well closure.

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

John's Creek supports coho, summer chum, fall chum, and winter steelhead (WDFW 2020). Increased summer low flows would support juvenile coho and winter steelhead juveniles. Chum species would

benefit from continued groundwater connectivity during spawning and early rearing during the winter and early spring.

Identification of anticipated support and barriers to completion.

The primary barrier to this project is funding. Evergreen Estates has already invested in new septic systems and chlorination at their well. Consolidation may need to be fully funded by a grant(s).

Potential budget and O&M costs.

Costs are estimated at $474,000. Specific improvements and costs are currently being developed in a feasibility study that is being funded through a grant between the Department of Health (DOH) and the City (DOH Contract Number GVL24700).

Anticipated durability and resiliency.

The water rights acquisition would be a durable benefit, because it would be put into permanent trust. Although the City would need to pump more groundwater to provide water to the evergreen Estates, the City would still have the same maximum allowable use and number of connections, since they would not obtain the Evergreen Estates water right as part of their consolidation.

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

The City is ready to proceed, if and when Evergreen Estates is ready. Evergreen Estates readiness is currently unclear and subject to future agreement.

References

Carollo. 2020. City of Shelton, Evergreen Mobile Estates Consolidation Study. Consolidation Feasibility Study Report. Final. September 2020.

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

General Floodplain Restoration

PROJECT DESCRIPTION

Narrative description, including goals and objectives.

The Kennedy-Goldsborough Watershed (WRIA 14) is within Mason and Thurston counties and includes an extensive network of independent streams that issue from springs, wetlands, small lakes, and surface water drainages. The Kennedy-Goldsborough Watershed has no major river system. These multiple small streams originate from the Black Hills and lower foothills of the Olympic Mountains, emptying into several shallow bays and inlets in South Puget Sound, including Eld, Totten, Skookum, Hammersley, and Case inlets. Principal drainages include (from north to south) Sherwood, Campbell, Deer, Cranberry, Johns, Goldsborough, Mill, Skookum, Schneider, Kennedy, and Perry creeks. The geomorphology of WRIA 14 is strongly influenced by glacial deposits of coarse materials that promote connectivity between surface and groundwaters and the headwaters of many of the stream systems are (or were) dominated by wetlands.

Limiting factors for salmon species in WRIA 14 have been identified by Kuttel (2002) and Mason CD (2004), and are briefly summarized below:

- Fish barriers such as dams, culverts, and grade control structures have inhibited fish passage in WRIA 14.
- Removal of native riparian vegetation and channel modifications have led to deteriorated streambank conditions and reduced quantity and quality of instream habitat.
- Reduced levels of large wood, particularly key pieces that promote the long-term formation of instream and off-channel habitats.
- Groundwater and surface water withdrawals, loss of forest canopy and impervious surfaces have increases in water temperature, reduced dissolved oxygen levels, and very low flows during summer and early fall.

WRIA 14 floodplain restoration projects would address loss of groundwater storage, low flows and water quality conditions. The specific actions proposed for any given project would be specific to the restoration opportunity and habitat capacity of that location. The goal of any given project would be to rehabilitate natural hydrologic and geomorphic processes that are provided by floodplain connectivity. More detailed objectives pursuant to this goal would be specific to each respective project.

Qualitative assessment of how the project will function.

Projects will vary depending on the stream setting, habitat capacity, the impact that has occurred, and the corresponding opportunities for restoration. Potential floodplain restoration actions include the following:

- Channel re-alignment (i.e. re-meander),
- Removing bank protection,
- Installation of large wood to promote hyporheic and floodplain water storage
- Removal of fill or creation of inset floodplain (i.e. excavation of terraces),
- Side channel and off-channel feature reconnections, creation or enhancement.

Conceptual-level map of the project and location.

A mapping utility was used to solicit WRIA 14 floodplain project recommendations from the WRIA 14 Committee. The following data and reasoning was used to select candidate sites in WRIA 14:

- Identify reaches that are unconfined with Lidar hillshade. Unconfined reaches have wider valleys and floodplains.
- Identify reaches in flood zones
- Identify land that is vacant, and therefore potentially available for acquisition and restoration.
- Identify land that is public and potentially easier to acquire for restoration.
- Identify areas of tributary inflow, because they are often areas of biological importance and habitat complexity. They may also be areas more prone to intermittent flooding.

Project locations identified by the Committee are shown in Figure 1 include the following:

- Schumacher – Beaver
- Deer Creek - Beaver
- Johns Creek – Beaver
- Campbell Creek, Upper
- Jarrell Creek
- Mill Creek above BNSF tracks

- Gosnell
- Skookum at Duck Pond
- Skookum, Eich Road
- Skookum, Upper
- Kennedy Creek flats
- Upper Schneider
- Perry Creek

All project locations would be subject to evaluation of feasibility during plan implementation. Other locations may be identified by Committee members or other project sponsors during plan implementation.

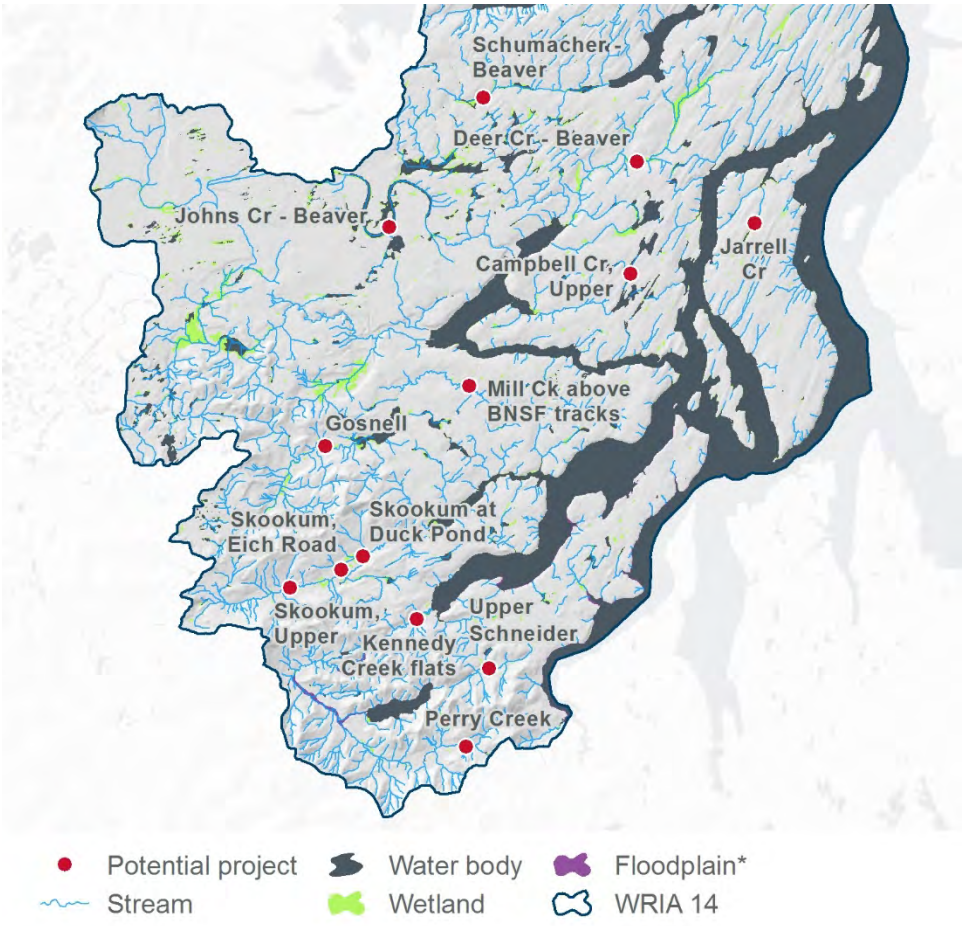


Figure 1. Potential floodplain restoration project locations.
**Floodplain data only available for southern areas in WRIA 14.*

Performance goals and measures.

Performance goals and measures will vary depending on the project. In general, the goals will be to implement the restoration actions with their intended quantity and purpose. The measures will be directly measurable elements such as acres of floodplain, wetland, or riparian habitats restored, stream-miles enhanced, predicted quantity of baseflow volume restored, predicted reduction of temperature, etc.

Description of the anticipated spatial distribution of likely benefits.

Potential floodplain restoration projects have been identified in suitable floodplain areas of Schumacher, Deer, Johns, Campbell, Jarrell, Mill, Gosnell, Skookum, Kennedy, Schneider, and Perry creeks. Restoring floodplain connectivity, along with riparian and wetland habitats could benefit between 2 and 6 miles of these tributaries by storing direct precipitation and floodwaters in these floodplain areas, contributing additional flows during low flow periods.

These streams have been noted for low summer/fall flows for decades (WDF 1975) and improvements to flows and temperatures, as well as floodplain and instream habitats, could provide substantially improved summer rearing habitat for juvenile coho salmon, steelhead and cutthroat trout. Improved flow conditions would also benefit upstream migration of adult Chinook, chum, and coho salmon.

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

The Washington Department of Fish and Wildlife (WDFW 2020a) has identified that coho, and fall chum salmon, and winter steelhead trout are present in all the identified primary drainages in WRIA 14. Fall Chinook salmon are present in Sherwood/Schumacher, Deer, Cranberry, Goldsborough, and Mill creeks and summer chum are present in Sherwood/Schumacher, Deer, and Cranberry creeks. Most salmon species are of wild origin, although some mixed stocks are present from prior hatchery chum and coho releases (WDFW 2020b).

Increased floodplain habitats and improved riparian and instream habitat conditions would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer rearing habitats. This would improve both productivity and survival of juveniles, particularly coho and steelhead. The restoration of floodplain processes and functions could also improve summer/fall base flows and reduce water temperatures. This would improve both juvenile and adult migration conditions. Low flows have been identified as a high priority limiting factor in WRIA 14 (Kuttle 2002) and the restoration and reconnection of floodplain habitats and riparian enhancements provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

No specific projects have been identified.

Potential budget and O&M costs (order of magnitude costs).

No specific projects have been identified.

Anticipated durability and resiliency.

Floodplain reconnection projects are durable as they restore natural processes to a reach of the river, allowing flooding and channel migration to occur unimpeded. Floodplain reconnection projects that provide the river with more room to meander and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

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

No specific projects have been identified.

Documentation of sources, methods, and assumptions.

The following references were used:

Kuttel, M, 2002. *Salmonid Habitat Limiting Factors Water Resource Inventory Area 14, Kennedy-Goldsborough Basin*. Washington State Conservation Commission. November 2002.

Mason CD (Mason Conservation District Lead Entity), 2004. *Salmon Habitat Protection and Restoration Plan, Water Resource Inventory Area 14, Kennedy-Goldsborough*.

WDF (Washington Department of Fisheries), 1975. *A Catalog of Washington Streams and Salmon Utilization*, WRIA 14. Available at: https://www.streamnetlibrary.org/?page_id=95

WDFW, 2020a. Salmonscape. Available at: http://apps.wdfw.wa.gov/salmonscape/map.html

WDFW, 2020b. Salmon Conservation and Reporting Engine. Available at: https://fortress.wa.gov/dfw/score/score/maps/map_details.jsp?geocode=wria&geoarea=WRIA14_Kennedy_Goldsborough

Goldsborough Hilburn Restoration Project

PROJECT DESCRIPTION

Description

The Goldsborough Hilburn Restoration Project (Project) site is located approximately 500 feet upstream of Highway 101 near Shelton, WA, has been impacted by the placement of fill and armoring in the floodplain and immediate stream channel, resulting in a homogenous channel form that is mostly a riffle-glide complex.

The project involves removal of up to 7,800 cubic yards (CY) of artificial fill that is constricting Goldsborough Creek. The constriction is presumably causing higher-than-normal flow velocities during flood events, exacerbating the lack of flood refuge for salmonids, a problem also seen in other areas of Middle Goldsborough, and possibly causing channel incision (e.g. an existing, underground gas-line has been exposed, indicating active incising). Additionally, the project would widen the floodplain from 58 feet to 200 feet and add large wood and riparian vegetation, both of which are lacking in the project area.

Qualitative assessment of how the project will function.

Stream conditions at this site and reach provide little salmonid rearing habitat, holding water, covered pools, or floodplain off-channel areas. The site has a high potential for restoring natural processes and augmenting the habitat with in-stream woody elements, relative to reference quantities (Fox and Bolton 2007).

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

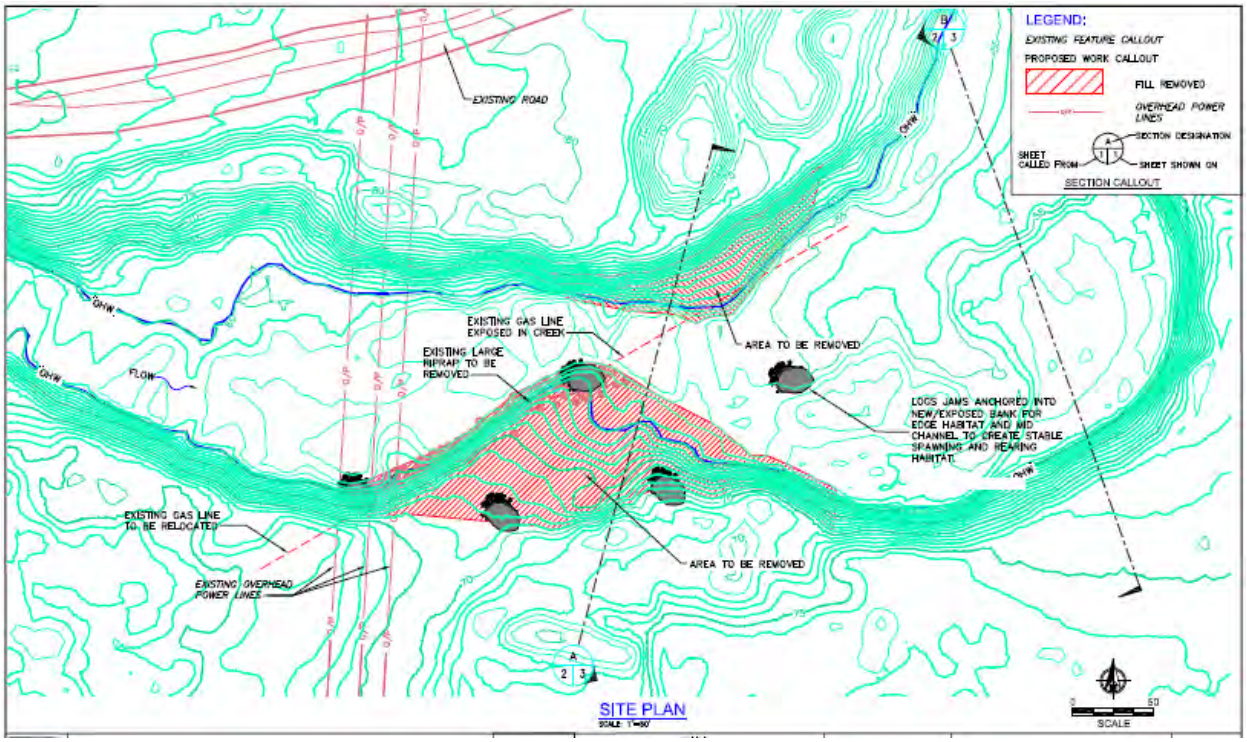


Figure 1. Goldsborough Creek Watershed Fish Habitat Enhancement Site Plan.

Description of the anticipated spatial distribution of likely benefit

The project would restore up to 500 feet of the Middle Goldsborough Segment. This will increase usable aquatic habitat.

Performance goals and measures.

The performance goals are to restore the natural processes and augment the habitat with in-stream woody elements, a need for this reach according. Specific metrics for these attributes will be defined based on the restoration design.

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

This site and reach is used by multiple salmonid species including fall Chinook salmon (presence), coho salmon (spawning), fall chum salmon (spawning), and winter steelhead trout (spawning). Increasing hydraulic and habitat complexity with fill removal and LWD additions would increase habitat quantity and quality for pre-spawn holding in pools, variable current velocities, depths, and substrate composition that would be suitable spawning and rearing habitat for multiple species.

Identification of anticipated support and barriers to completion.

This project is supported by the South Puget Sound Salmon Enhancement Group and the WRIA 14 Lead Entity, but has not been developed enough to identify barriers to completion.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be less than $1,000,000 (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits and would not require operation and maintenance, once it is established.

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

The project sponsor would be South Puget Sound Salmon Enhancement Group.

References

Fox, M. and S. Bolton. 2007. A reginal and Geomorphic Reference for Quantities and Volumes of Instream Wood in Unmanaged Forested Basins for Washington state. North American Journal of Fisheries Management. Volume 27 (1): 342 – 359.

SPSSEG. 2010. Goldsborough Creek Constriction Removal Project. Salmonid Habitat Project Development. December 2010.

Managed Aquifer Recharge Projects in WRIA 14

PROJECT DESCRIPTION

Description

The WRIA 14 WRE Committee has identified managed aquifer recharge (MAR) projects as a viable approach to offsetting the consumptive use associated with permit exempt well growth. MAR projects may include many water sources, such as stormwater, Class A reclaimed water, and peak flows in rivers and streams. This general project is limited to MAR projects that divert, convey, and infiltrate peak seasonal river flows in engineered facilities that are in connection with the local alluvial aquifer that the donor stream or river is also in connection. Flows would be diverted in quantities that would not reduce habitat suitability for salmonids and that do not reduce habitat forming processes. Seepage back into the river would result in attenuation of these flows, increasing base flows across a broader time period, including the late summer and early fall, when flows are typically the lowest, and water demand for consumptive use is the highest.

This project description describes candidate MAR locations, potential methods for diversion and conveyance, potential diversion quantities, typical infiltration basins that would infiltrate those diversion quantities, and the associated offset benefits. Detailed feasibility analysis is not included in this project description and would occur during plan implementation for each specific location.

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

Potential MAR locations were determined based on a screening process (Attachment A). Areas in WRIA 14 with the following features were considered for candidate locations:

- Favorable soils and geology-
    - No wetlands, lakes, or high groundwater areas
    - Exposed till less than 10 feet estimated thickness
- Favorable Land Use
    - Undeveloped or Forestry
- Proximity to potential water source
    - Potential water sources included peak flows from Schumacher Creek, Sherwood Creek, Deer Creek, Cranberry Creek, Johns Creek, Goldsborough Creek, Mill Creek, Skookum Creek, Kennedy Creek, and Perry Creek
    - ½ mile from potential donor waterbody
- Land ownership

This screening resulted in favorable areas and specific locations for consideration during WRE Plan

implementation (Figure 1). Additional candidate locations may be proposed during plan implementation. Additional candidate locations are likely to be within these favorable areas but may also be demonstrated as suitable for MAR based on an independent site-specific analysis.

Potential streams that could be part of MAR projects are those that have a flow record adequate for an assessment of flow diversion quantities and infiltration facility design. Diversion flows could be proposed based on maintaining minimum instream flows and habitat forming processes (i.e. ecological flows). Diversion flows were set at 2 percent of wet season (November – April) minimum flows. Diversion of flow to an MAR facility could occur during days when flows exceed minimum instream flows. These days were tallied for each day in the flow record and summed by month (Table 1). These "diversion days" were averaged across all water years in the flow record. Then those averages were summed during the wet season months. This number of "diversion days" for each site, represents the average number of diversion days.

A more conservative approach was also employed that summed the number of "diversion days" for the wet season (November – April) for each water year. Then, the smallest number of "diversion days" among the years in the flow record was selected (Table 2).

The minimum and average volume of water that could be diverted to one or more MAR facilities in each stream was calculated by multiplying the diversion flow by the number of diversion days, and transforming the volume to acre-feet/ year (Table 3).

Diversion

Typical capture and recovery methods vary by water source but include some combination of a screened gravity diversion/bypass, a screened water lift and/or pump system, or a series of below ground infiltration galleries/collector pipes (e.g. Raney wells) adjacent to source streams. All of these methods would need to be evaluated based on a number of factors including operation and maintenance, fish passage performance, permitting, reliability, public safety, construction and lifecycle cost, and available funding mechanisms (HDR 2017) in order to determine the best fit for the water source. Screened water gravity diversions require the most extensive infrastructure but would need the least amount of effort to get water into conveyance structures. Screened water lift and/or pump systems would require less infrastructure than a screened water gravity diversion however the risk of damage would be greater.

The WRIA 14 Committee acknowledges that some diversion methods including in-channel structures may pose an impact to fish habitat, and strongly advocates for the use of diversion methods that do not include in-channel structures. For example, diverted water could be conveyed through a collector well adjacent to the river (e.g. Ranney Collector well). The WRIA 14 Committee suggests that projects should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Conveyance

After capture and recovery, water would be transported to the MAR site through a conveyance system which would be some combination of open canals/ditches, surface and subsurface closed piping, tunnels, and trenches (e.g. lined and unlined). Conveyance can be facilitated through gravity fed structures or strategic pumping throughout the system. Once constructed or modified, maintenance – including repair, leakage control, preventing recontamination, and the operation of pumping stations where gravity pressure is not enough– has to be ensured. Ideally, source streams and MAR sites would be in close proximity to minimize the complexity of the conveyance system.

Storage and Infiltration

MAR sites (e.g. shallow aquifer recharge sites) are expected to consist of one or more small storage reservoirs (ideally less than 10 AF in volume or less than 6 feet in height). After water is captured during periods of excessive river flow, water will be conveyed into storage reservoirs and allowed to infiltrate into the local water table over time. Infiltration sites must be chosen carefully and evaluated for potential infiltration rates and volumes as well as anticipated hydrologic and water quality effects resulting from the project. Suitable sites would have permeable material at the surface and a water-table deep enough to allow levels to rise without causing problems, such as flooding.

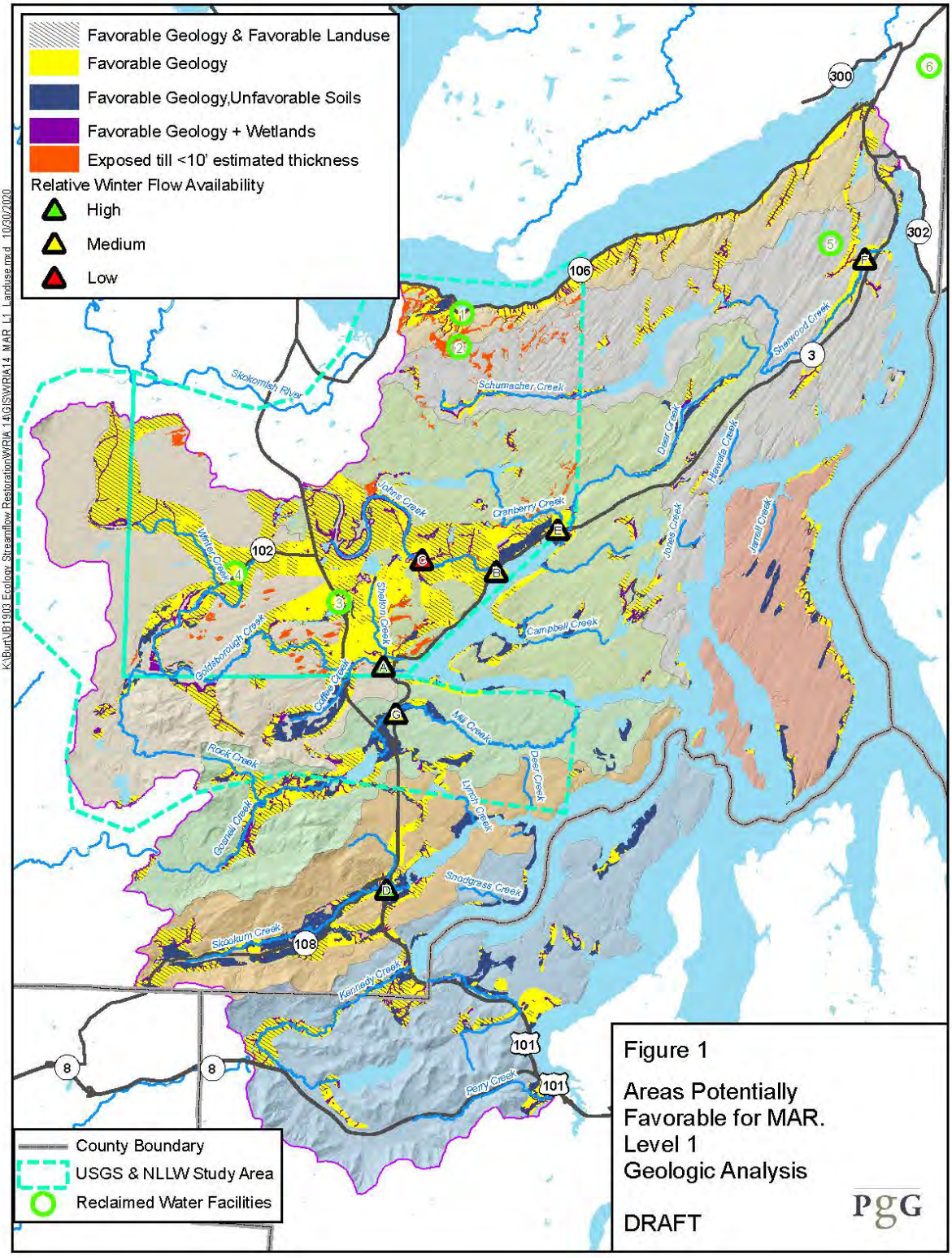


Figure 1. Favorable areas for MAR for feasibility analysis during plan implementation.

Table 1. Average measured monthly flow, minimum monthly instream flow, and the average number of days each month, where flows exceed minimum flows. Total number of days where flows exceed minimum flows during the wet season (November – April) are summed at the bottom. All flow values are in cubic feet per second.

	Kennedy Creek			Goldsborough (USGS) at S 7th St.			Johns 1 at Hwy. 3			Johns 2 at Johns Cr Rd.			Skookum at Hwy. 101			Mill at Hwy. 3			Cranberry at Hwy. 3			Sherwood at E Sherwood Cr Rd		
Month	Avg	Min. Inst	Days	Avg	Min. Inst	Days	Avg	Min. Inst	Days	Avg	Min. Inst	Days	Avg	Min. Inst	Days	Avg	Min. Inst	Days	Avg	Min. Inst	Days	Avg	Min. Inst	Days
Jan	119	NA	10	341	50	31	97	45	20	63	45	9	140	40	27	153	65	27	99	50	21	140	60	28
Feb	92	NA	10	250	85	28	69	45	12	47	45	13	87	40	19	116	65	21	66	50	16	106	60	22
Mar	100	NA	10	258	85	30	72	45	12	50	45	19	100	40	24	121	65	23	72	50	15	128	60	23
Apr	56	NA	0	196	85	29	54	45	7	38	45	9	57	40	17	81	65	16	48	50	12	79	60	19
May	38	NA	0	119	85	21	34	34	4	24	34	2	29	26	13	49	55	9	29	31	8	50	48	11
June	17	NA	0	75	85	7	21	20	3	15	20	0	13	11	13	29	40	3	17	18	10	32	29	15
July	8	NA	0	51	55	8	14	12	6	9	12	6	5	5	10	18	28	0	10	11	9	19	18	17
Aug	6	NA	0	41	48	2	11	7	13	7	7	11	2	3	5	13	20	0	7	8	6	14	11	15
Sept	5	NA	0	45	45	6	10	7	12	7	7	6	4	3	9	14	20	2	9	8	13	16	11	14
Oct	11	NA	0	82	50	16	17	7	19	12	7	7	22	6	17	32	20	14	18	15	11	34	19	19
Nov	57	NA	0	221	50	29	52	45	9	36	45	3	114	40	21	114	65	19	61	50	12	100	60	19
Dec	99	NA	10	274	50	31	78	45	15	50	45	5	114	40	23	124	65	22	80	50	17	144	60	22
Total			40			177			75			58			131			128			92			133

Table 2. Number of days that flows exceed minimum instream flows during the wet season (November – April) and the minimum number of days among all years for each flow station.

Flow Station	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Minimum
Skookum at Hwy. 101	84	113	117	104	122	158	133	165	104	146	129	157	164		84
Goldsborough (USGS) at S 7th St.		179	172	177	166	181	176	182	180	178	181	182	181	181	166
Johns 1 at Hwy. 3		91	159	87	36	123	151	132	110	74	106	149	181	128	36
Johns 2	14	104	80	38	41	74	82	111	25	64	75	143	113		14
Mill at Hwy. 3		116	127	86	89	145	139	164	89	134	129	159	157		86
Cranberry at Hwy. 3		111	106	50	45	106	87	135	35	87	86	143	118		35
Sherwood at E Sherwood Cr Rd				72	85	172	137	179	90	127	131	169	165		72

Table 3. Potential MAR site locations, facility sizes, and water offsets

Stream	Location	Facility Size (sq ft)	Diverstion Flow (cfs)	Minimum Days Exceeding Minimum Flows (Nov - Apr)			Average Days Exceeding Minimum Flows (Nov - Apr)		
				Total Days of Diversion	Total Water Per Year (cfy)	Total Water Per Year (afy)	Total Days of Diversion	Total Water Per Year (cfy)	Total Water Per Year (afy)
Kennedy Creek	Summit Lake outlet or RM 5	6,200	1	40	3,456,000	79	40	3,456,000	79
Skookum Creek	Downstream of Kamilche Cr; headwaters	3,100	0.5	84	3,628,800	83	131	5,659,200	130
Mill	Downstream of Lake Isabella	6,200	1	86	7,430,400	171	128	11,059,200	254
Goldsborough Creek	~River Mile 7	6,200	1	166	14,342,400	329	177	15,292,800	351
Johns Creek	Downstream of Johns Cr Rd	3,100	0.5	36	1,555,200	36	117	5,054,400	116
Cranberry Creek	~ RM3	6,200	1	35	3,024,000	69	92	7,948,800	182
Sherwood Creek	DS of Mason Lake	6,200	1	72	6,220,800	143	133	11,491,200	264
					Total	910			1,377

Potential streams for MAR diversion, infiltration, and low-flow return in WRIA 14 vary in terms of the quantity of available flows, the seasonality of available flows, and the suitability of soils for MAR sites.

Kennedy Subbasin

Kennedy Creek could have an MAR site(s) at near the outlet of Summit Lake or at approximately River Mile (RM) 5. Both of these areas are forested and have suitable geology and soils for infiltration. Average monthly flows near the mouth range between 92 – 119 cfs between November and March (Table 1). Since no minimum flows are set for Kennedy Creek, the average flows were used as a basis for setting diversion flow quantities. An MAR diversion of 1 cfs during period is proposed over this period, which would be less than 2% of average wet season flows. A conservative estimate of 40 days (a third of the time) is estimated to be above these average flows, while still accommodating a 1 cfs diversion. (Tables 1 and 3).

Skookum Subbasin

Skookum Creek has unfavorable soils for MAR infiltration along much of its stream alignment (Figure 1). However, there are some small areas of suitable geology and soils in the headwaters and near the confluence with Kamilche Creek. Average monthly flows at Highway 101 range between 57 – 140 cfs between November and April (Table 1). Assuming that flows are similar downstream of Kamilche Creek, an MAR diversion of 0.5 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 84 - 131 days were above minimum instream flows, while still accommodating a 0.5 cfs diversion (Table 1 and 2), resulting a potential water offset of 83 – 130 acre-feet/year (Table 3).

Mill Subbasin

Soils and geology are favorable for MAR sites immediately downstream of Isabella Lake (Figure 1). This location would be useful, in terms of providing cool groundwater recharge downstream of the lake. Average monthly flows for Mill creek at Highway 3 range between 81 -153 cfs between November and April (Table 1). An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 86 - 128 days were above minimum instream flows, while still accommodating a 1 cfs diversion (Table 1 and 2), resulting a potential water offset of 171 – 254 acre-feet/year (Table 3).

Goldsborough Subbasin

Soils and geology are favorable for MAR sites near Goldsborough Creek at multiple locations (Figure 1). Average monthly flows for Goldsborough Creek at S. 7th Street (USGS gage 12076800) range between 196 – 341 cfs between November and April (Table 1). An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 166 - 177 days were above minimum instream flows, while still accommodating a 1 cfs

diversion (Table 1 and 2), resulting a potential water offset of 329 – 351 acre-feet/year (Table 3).

Oakland Subbasin

Several streams are located in the Oakland Streams with available flow record include Johns Creek and Cranberry Creek. Average monthly flows for Johns Creek at Hwy 3 range between 81 – 153 cfs between November and April (Table 1). An MAR diversion of 0.5 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 36 - 117 days were above minimum instream flows, while still accommodating a 1 cfs diversion (Table 1 and 2), resulting a potential water offset of 36 – 116 acre-feet/year (Table 3).

Average monthly flows for Cranberry Creek at Highway 3 range between 48 - 99 cfs between November and April (Table 1). An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 35- 92 days were above minimum instream flows, while still accommodating a 1 cfs diversion (Table 1 and 2), resulting a potential water offset of 69 – 182 acre-feet/year (Table 3).

Case Subbasin

The primary streams in the Case subbasin include Schumacher Creek and Sherwood Creek. The two creeks are part of the same drainage, with Schumacher Creek flowing into Mason Lake, and Sherwood Creek flowing from Mason Lake (Figure 1). Average monthly flows for Sherwood Creek at Sherwood Cr Rd. range between 79 - 144 cfs between November and April (Table 1). Water could be diverted from the downstream end of Mason Lake and conveyed to an MAR site directly downstream of the lake outlet (Figure 1). An MAR diversion of 1 cfs (less than 2% of the lowest minimum instream flows) during period is proposed over this period. Between 72- 133 days were above minimum instream flows, while still accommodating a 1 cfs diversion (Table 1 and 2), resulting a potential water offset of 143 – 264 acre-feet/year (Table 3).

Hood Subbasin

Several small streams drain directly to Hood Canal. The unnamed stream that drains Devereaux Lake has suitable soils for an MAR site. This stream does not have flow data. Therefore, no MAR diversion scenario is currently proposed.

Harstine Subbasin

No candidate locations are proposed for the Harstine Subbasin. The only stream large enough to accommodate a small MAR project is Jarrell Creek. However, soils are generally unsuitable near the stream and on most of Harstine Island (Figure 1).

The total potential MAR diversion quantities for all streams proposed herein range between 910 – 1,377 acre-feet/year (Table 3).

Description of the anticipated spatial distribution of likely benefits

The benefits will vary depending on the Creek, fish use. MAR seepage back to any of the proposed creeks would target benefits to the low-flow summer and early fall period. This would benefit rearing for yearling salmonids such as coho, steelhead, and coastal cutthroat trout.

Performance goals and measures.

Performance goals would be the quantity of water diverted and infiltrated. This goal could be measured by metering the conveyance pipe flow and the water depth of the MAR infiltration basin. Secondarily, water table elevations between the MAR and receiving waters, flow in the receiving waters, and seepage observations could be done, as an indication of flow benefits.

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

These MAR projects would increase flow during the summer and early fall periods, increasing usable aquatic habitat, overall.

Identification of anticipated support and barriers to completion.

Mason County may support and implement these projects, with potential support from the Squaxin Island Tribe.

Potential budget and O&M costs.

The estimated costs for MAR projects are based on an assumption of ~$3,443/acre-foot of estimated offset. For the total 910 AFY estimated as potential offset for WRIA 14, this would equate to ~$3 million.

Anticipated durability and resiliency.

The project would require regular operation and maintenance.

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

Thurston County, Mason County, and Mason County PUD #1 have indicated that they would be likely project sponsors, depending on site locations and further review.

Sources of Information

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

Attachment A

Managed Aquifer Recharge Assessment Methodology

Technical Memorandum

To: Department of Ecology WRIA 14 Watershed Restoration and Enhancement Committee

From: Peter Schwartzman, LHG

Re: WRIA 14 Managed Aquifer Recharge Assessment Methodology

Date: December 18, 2020

This technical memorandum documents the methodology used to identify properties that appear to have characteristics favorable for Managed Aquifer Recharge (MAR) in Kennedy-Goldsborough Basin, Water Resources Inventory Area (WRIA) 14. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 14 Watershed Restoration and Enhancement (WRE) Committee (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 potential offsets to projected depletion of instream flows resulting from new, permit-exempt domestic well uses in the WRIAs over the next 20 years.

MAR project sites potentially can support watershed restoration and enhancement projects within the WRIA by potentially offsetting the impacts of permit exempt wells on WRIA streams. For this evaluation, MAR was defined as recharge via infiltration of source water at or near the land surface. A portion of recharged water is expected to follow subsurface pathways and return to hydraulically connected streams. To support development of the WRE plan for WRIA 14, PGG used regional data to assist the Committee in selecting properties within WRIA 14 that appear to have favorable infiltration characteristics and a close enough proximity to source water so that MAR may occur with reasonable economic efficiency. This memorandum outlines the methodology used to identify potentially favorable MAR project sites.

PROCEDURE

Regional soils, geologic, wetlands and land-use coverages were compiled for WRIA 14 using Geographic Information System (GIS) software. A series of screening criteria were then applied to identify sites that appear most favorable.

Screening Level 1- Surficial Geology, Soils, Wetlands and Groundwater Flooding

The initial screen focused on areas where regionally mapped soil and geologic units appear favorable for infiltration. The following criteria were applied:

1. Surficial geologic maps were reviewed and geologic units primarily composed of sand

and/or gravel were identified as favorable for infiltration, while low permeability units (with higher silt and/or clay contents or bedrock) were excluded. Surficial geology was based on regional (1:100,000-scale mapping) by DNR (Schasse, 1987). Favorable geologic units were associated with alluvium, recessional glacial outwash and advance glacial outwash.

2. Areas with unfavorable geology (glacial till exposed at the land surface) were generally excluded; however, PGG identified areas where hydrogeologic characterization performed by the USGS (REF) suggested that the till may be sufficiently thin (<10 feet) that excavation could provide an infiltration pathway to underlying materials (typically advance glacial outwash). This approach differs from infiltration at the land surface in that recharge occurs deeper in the groundwater flow system. Additional hydrogeologic characterization would be required to assess the value of recharge the advance outwash. Although few streams are mapped as penetrating advance outwash, model simulations may suggest reasonable hydraulic connectivity between streams and advance outwash (Massman, 2020).
3. Soils types mapped by the Natural Resources Conservation Service[59] were reviewed and those classified in "Hydrologic Soil Groups[60]" (HSG's) with high runoff potential (low infiltration potential) were excluded from the areas of favorable surficial geology. Unfavorable soils were classified for HSG's "C" and "D", along with "dual hydrologic soil groups" associated with poorly-drained soils exhibiting a shallow water table (e.g. "A/D", "B/D"). Whereas "A" and "B" HSG's indicate low and moderately-low runoff potential, "C" and "D" HSG's indicate moderately-high and high runoff potential (NRCS, 2007).
4. Wetlands, lakes, and high groundwater areas (as mapped within and by Thurston County) were excluded from the favorable infiltration areas defined based on criteria in bullets #1 and #3 (above).

Hydrogeologically favorable areas that meet the Level 1 screening criteria are shown in **Figure 1**.

Screening Level 2 – Favorable Land Use for MAR

PGG obtained GIS coverages of land use from Thurston and Mason counties and identified those land uses that might be most amenable to installation of an infiltration facility where infiltration potential is favorable. Land use data were available for the entire WRIA, of which 15% was listed as "water". Out of the terrestrial portion of the WRIA, land uses deemed potentially favorable for MAR included: commercial lumber and wood (<0.1%), governmental services (2%), educational

[59] https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
[60] https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=22526.wba

services (0.15%), parks (1%) and designated forest land (56%). The remaining land use were deemed 41% of the terrestrial WRIA) were deemed likely unfavorable for MAR. PGG added diagonal hatches to the hydrogeologically favorable areas identified in Screening Level 1 (**Figure 1**).

Screening Level 3- Potential Source Water Considerations

Figure 1 also illustrates potential water sources for MAR. HDR assessed selected streams within WRIA 14 for flow availability by calculating the difference between monthly average flow and the minimum instream flow requirement (HDR, 2020). PGG used the magnitude of these monthly values for the months of November through April to classify steams as having relatively high, medium and low availabilities. Flow availability was evaluated at specific gaging stations within the WRIA, shown as triangles on **Figure 1**. The triangles were colored to indicate high, medium and low relative flow availability, and labeled to correspond to the table below.

Stream/Location	Winter (Nov-Apr) Availability	Map Symbol
Goldsborough (USGS) at S 7th St.	High	A
Johns 1 at Hwy. 3	Med	B
Johns 2 at Johns Cr Rd.	Low	C
Skookum at Hwy. 101	High	D
Mill at Hwy. 3	Med	G
Cranberry at Hwy. 3	Med	E
Sherwood at E Sherwood Cr Rd	Med	F

Figure 1 also includes the locations of reclaimed water facilities (provided to PGG by the Squaxin Tribe) as potential MAR, indexed using the ID numbers below:

ID	Name
1	Alderbrook Wastewater Plant
2	Alderbrook Golf Course
3	Shelton Reclaimed Water Plant
4	Shelton Reclaimed Water Sprayfield
5	Allyn Reclaimed Water Plant, Basins, Sprayfield
6	Belfair Reclaimed Water Plant, Basins, and sprayfield

ADDITIONAL CONSIDERATIONS

As noted above, MAR was defined herein as infiltration of source water at or near the land surface. Another mechanism for MAR would be injection of source waters to deeper portions of the groundwater flow system, most realistically the Vashon advance outwash that occurs beneath Vashon glacial till (hardpan). Recharge to the advance outwash via infiltration is mentioned above, but where the till is thicker, injection wells would need to be constructed to fully penetrate the till and deliver source water to the advance outwash. In some cases, the upper portion of the outwash may be unsaturated, and injection into this unsaturated zone would provide some level of treatment (similar to typical surface infiltration project designs). In some cases, the advance outwash will be fully saturated below the till. Injection directly into saturated advance outwash may require additional levels of pre-treatment. Although WRIA streams typically occur above the till, groundwater modeling has suggested a reasonable degree of hydraulic connection between the advance outwash aquifer and surficial streams (Massmann, 2020). Should MAR by injection be considered, additional modeling work would be needed to better understand the pathways, proportions and timing by which water injected into the advance outwash would return to streams.

Another factor worth considering is the distance between MAR sites and source waters. Close distances reduce the cost of conveyance between the source (stream, reclaimed water facility, etc.) and the MAR site, making MAR projects more economically appealing. However, based on distance and geologic conditions, MAR sites too close to streams may not provide the timing of subsurface return flow desired to enhance streamflow. For instance, if streamflow is available as an MARE source between November and April, one would want a substantial portion of subsurface return flow to reach the stream during alternate months (May thru October, with additional preference for the low-flow months in late-summer and fall). Where proximity and hydrogeologic conditions support quick return flows from the MAR site to the stream (e.g. days to weeks), flow benefit during the desired season is reduced. Effectiveness is improved where

return flow timing is on the order of months or is more even year-round. Year-round availability is an express advantage of reclaimed water sources.

FUTURE STEPS

PGG recommends that individual properties within the areas of identified favorable geology *and* favorable land be identified, prioritized and selected for site specific feasibility analyses. Sponsors for planning, designing, constructing and maintaining MAR projects will also need to be identified and paired with individual projects. Initial project feasibility considerations will include site ownership (and if the owners would consider selling, leasing, or permitting easements on their property to allow MAR) and the relative cost and complexity of providing source water to the site. Different sites will likely have different conveyance requirements that could include pumps, pipelines with significant elevation gain, long-distance subsurface pipelines, and pipeline easements for each property crossed by the conveyance line. For sites that remain favorable following initial owner outreach and conveyance considerations, a site specific hydrogeologic evaluation should be performed to identify local soil and aquifer hydrologic properties, depth to groundwater, and groundwater flow direction and gradient. Groundwater mound height and return flow travel time estimates would be included in this evaluation, as well as potential water quality or treatment concerns (such as the removal of particulate matter) prior to infiltration.

REFERENCES

HDR, 2020. Personal communication between Chad Wiseman (HDR) and Peter Schwartzman (Pacific Groundwater Group) dated 9/3/2020.

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Mason County Rooftop Runoff

INFILTRATION RECHARGE ANALYSIS FOR STREAMFLOW AUGMENTATION NET BENEFITS

TECHNICAL MEMORANDUM

Date:	Tuesday, December 01, 2020
Project:	Watershed Restoration & Enhancement Committees Technical Support
To:	Angela Johnson (Ecology) and David Windom (Mason County)
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 1). The WRIAs have nested subbasins (Figures 2 and 3).

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 6: WRIA and Washington Counties within Project area

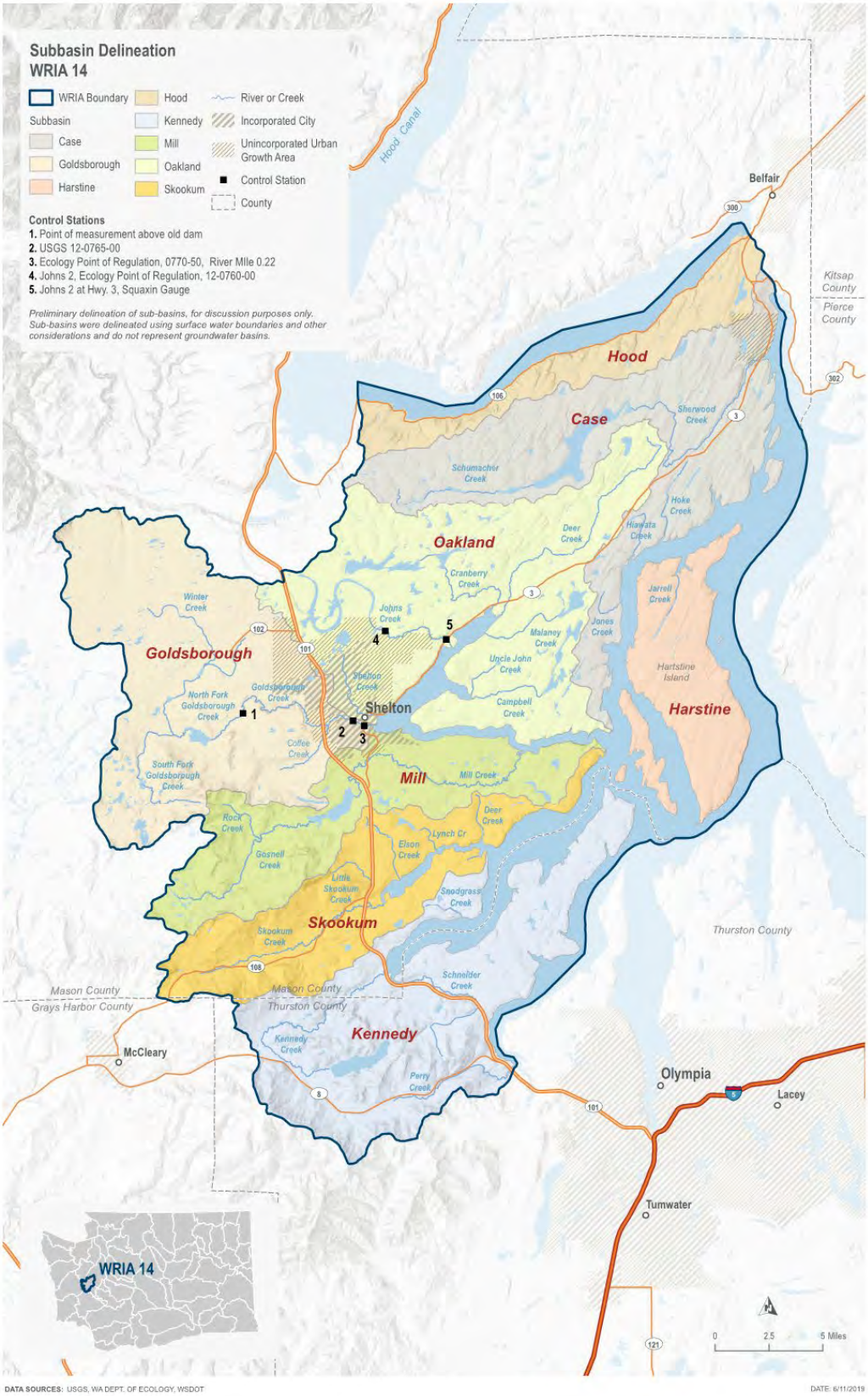


Figure 7: WRIA 14 subbasins

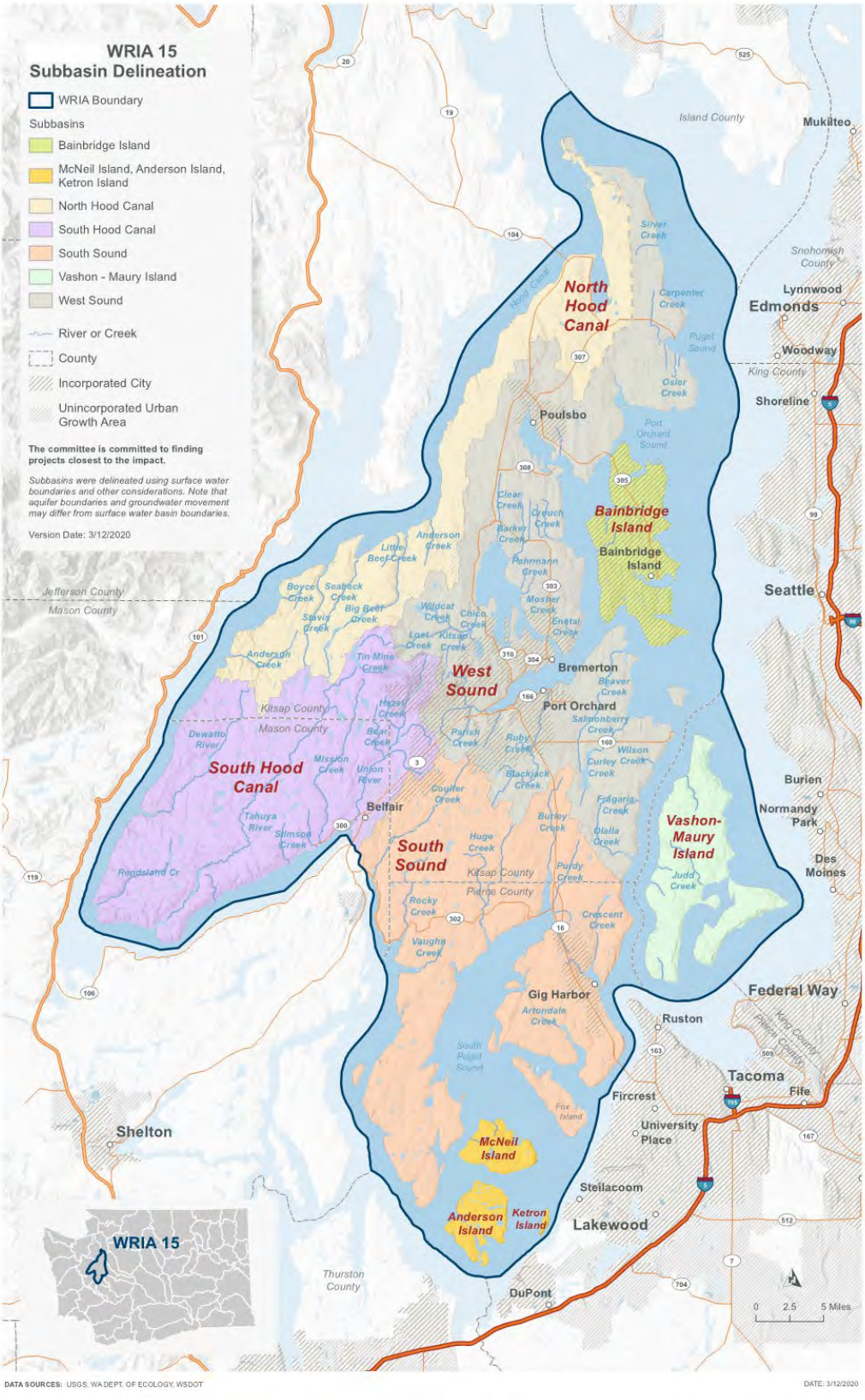


Figure 8: WRIA 15 subbasins

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 4). That collective land use totals approximately 186,000 acres of rural residential developable lands (Table 1), 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 (Figure 4). 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 15: 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**

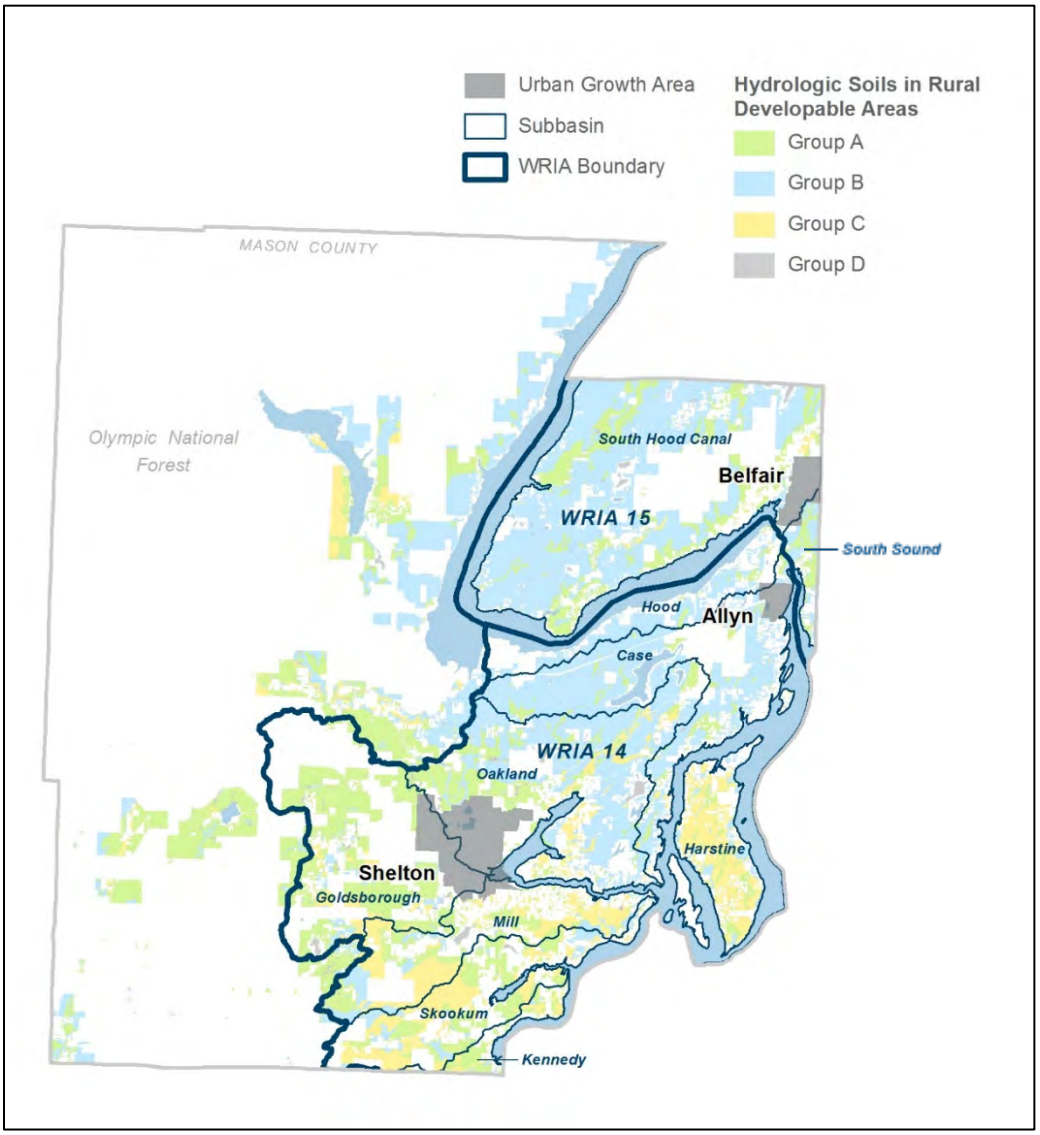


Figure 4: Rural residential buildable lands classified by hydrologic soil type.

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 2. 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 16: 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 3 and Figure 4).

Table 17: 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%

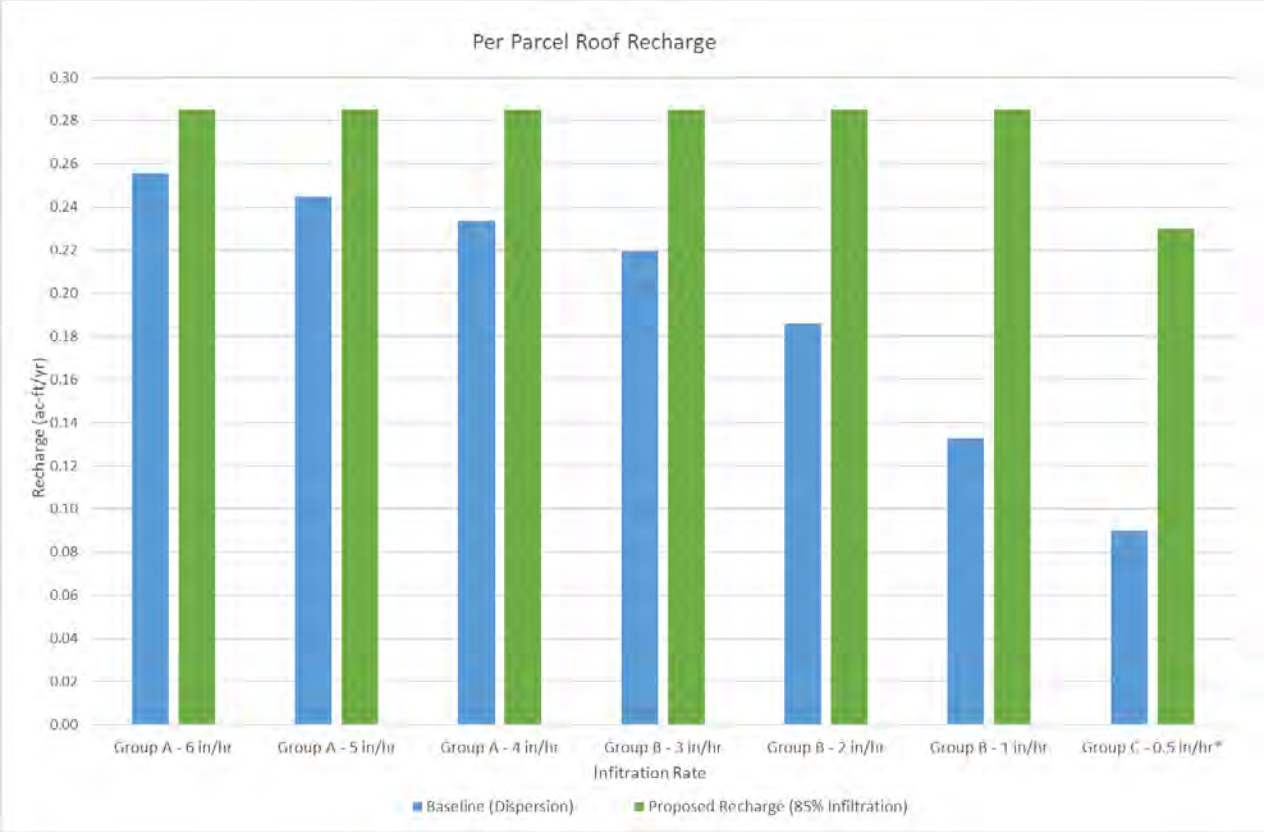


Figure 9: Parcel roof recharge comparison by soil group

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 249 ac-ft/yr, at 85 percent recharge on an average annual basis. (Table 5).

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 5).

Table 5: WRIA 14 and 15 project area roof 85 percent estimated recharge and projected water offset from baseline by subbasin

85% Infiltration*											
WRIA	Subbasin	Mason County Rural Projected No. Permit-Exempt Wells	Soil Type Proportion			Well Proportion			Projected Offset (ac-ft/yr)		
			A	B	C	A	B	C	A	B	C*
14	Case	396	0.11	0.88	0.02	42	347	7	2	34	1
14	Goldsborough	338	0.82	0.08	0.11	276	26	37	11	3	5
14	Harstine	143	0.14	0.18	0.69	20	25	98	1	2	14
14	Hood	78	0.09	0.91	0.01	7	71	0	0	7	0
14	Kennedy	59	0.61	0.05	0.34	36	3	20	1	0	3
14	Mill	434	0.30	0.19	0.51	132	80	221	5	8	31
14	Oakland	955	0.24	0.67	0.10	226	636	93	9	63	13
14	Skookum	363	0.39	0.14	0.47	141	51	172	6	5	24
	Totals	**2766**								**249**	
15	Sough Hood Canal	834	0.22	0.76	0.01	186	637	11	7	63	2
15	South Sound	92	0.46	0.52	0.02	42	48	2	2	5	0
	Totals	**926**								**79**	

*Proposed C soils only infiltrate 69%

Project Costs

At this time, all estimated project costs are expected to be included in costs of construction for new homes, which could range from $3,780-$9,300 per home. For WRIA 14, this results in a total of ~$17 million for the total project (based on total projected PE well growth).

Response to WRIA 14 and 15 Committee Comments on Draft Analysis Memorandum

Ecology provided HDR comments from various committee participants based on the HDR Draft Technical Memorandum summarizing this analysis, dated September 4, 2020. Those comments consider committee feedback received from presentation of this analysis at prior committee meetings. HDR's response to those comments is included as Appendix A.

Mason County Rooftop Runoff Appendix A - HDR Response to Committee Comments on Draft Technical Memorandum

Mason County Rooftop Runoff Project

Comments Received as of 10/5/2020

Paul Pickett (Squaxin Island Tribe) Comments sent to Angela Johnson 9/23/2020

- A factor should be included to reduce total offsets to account for properties where the facility cannot be installed (site limitations like wetlands, slope, other setbacks)

  HDR Response: We did exclude all parcels with Type D hydrologic soil group (HSG) (typically wetland soils where roof infiltration (and parcel development) would typically not be allowed or feasible. We did not consider steep slopes and other setbacks, but the assumption is that some portion of 5 ac parcels may still be developable. There are more existing parcels than PE Wells, so we factored back the number of parcels to match the # of PE Wells to evaluate on a consistent basis with consumptive use, allocated by the various HSG areas.

- Soils should be assessed in PE growth hot spots within subbasins, not the entire subbasin, because those are the areas that facilities would be installed.

  HDR Response: This evaluation addresses potential incremental benefits per parcel as development occurs in the various subbasins, so the net benefits would accrue with parcel development wherever it occurs as PEWs are installed to serve those parcels. This evaluation was intended to be high level for project screening evaluation of potential cumulative benefits over time, and was not intended to be parcel location specific.

  The proportion of HSG types used in this analysis are based on the same buildable lands analysis that was used to spatially allocate PE Well growth for the consumptive use analysis.

- Where did the infiltration value come from? No citation was provided.

  HDR Response: The citation will be added. They were assumed from expected average long-term design infiltration rates for the various HSGs (Type A = 4 in/hr; Type B = 2 in/hr, Type C = 0.5 in/hr). Design infiltration rates under Ecology SWMMWW guidance are factored values from field measured values, typically established from a Pilot Infiltration Test (PIT). Typically cumulative factoring back of measured rates for long-term design infiltration rates ranges from about 0.2 to 0.4. So for example, for Type A soils, measured PIT infiltration rates would need to be in the 10-20 in/hr range for a 4 in/hr factored design infiltration rate, which would be typical of Type A soils. The typical long-term, factored infiltration rate in a Type C soil is normally around 0.5 in/hr, but can

be lower. Type B soils would fall in between, and can be highly variable, so 2 in/hr was assumed as a design infiltration rate for analysis. Therefore, the reference for this information is the Ecology SWMMWW (2019).

- How was the depth to water table determined? No citation was provided. Type C soils are likely to have shallow winter water tables. This is another factor that may make some parcels poor candidates for the facility.

  HDR Response: It was not determined at this screening level of analysis, but assumed to be of adequate depth (5 ft or greater from existing grade) to allow an infiltration trench BMP to be installed. This assumption can be added. Depth to water table would be variable depend on the depth of overburden soils (which may be more permeable) to underlying till. If adequate depth to shallow groundwater does not exist on a particular parcel, then those parcels may not be viable for this type of roof runoff infiltration BMP. Again, recharge benefits are incremental with parcel development, and associated only with parcels where the proposed County roof runoff development standard are technically feasible to implement.

- Average rainfall was used, but rainfall varies with time, and during wet spells soils may become saturated. Some analysis is needed for the amount of rainfall that would be in excess of infiltration capacity, based on patterns of rainfall in infiltration and soil saturation capacity. A factor should be applied for the reduction in potential infiltration.

  HDR Response: Rainfall variability is accounted for in the MGSFlood modeling analysis that is conducted using a long-term continuous time-series precipitation record and runoff simulation and recharge response to it. We're assuming a constant infiltration rate for subgrade soils based on soil type, even though some variability would likely exist over time. Generally, infiltration facilities tend to start with higher infiltration rates and performance, and can degrade over time with partial occlusion of subgrade soils. That effect is generically accounted for in the factored infiltration design rate.

- In Tables 3 and 4:

  - Only 15% of rainfall infiltrates in Group C soils. This suggests that 85% of the rainfall occurs at times when the soils are at capacity. Should the analysis assume that, if the soils can only infiltrate 15% of rainfall, it will also only infiltrate 15% of rooftop runoff?

    HDR Response: These values come from the MGSFlood continuous simulation modeling results. They suggest that under infiltration rates assumed for Type C (till) subgrade soils (0.5 in/hr design rate) that only 15% of the roof runoff volume would infiltrate in the infiltration trench area on an annual basis, under existing

development standards (min trench area per standards), and that 85% would result in overflow. Additional incidental infiltration down-gradient of the infiltration trench BMP could result in additional infiltration (not modeled), but for Type C soils, that would likely be limited, and result primarily in surface runoff to collection systems.

- What does "Net Average Annual Recharge Volume Gain" mean, and why does it get larger with less porous soils? I would expect the less infiltration capacity, the less recharge volume would result.

  HDR Response: It is the difference in roof runoff recharge volume per parcel on an annual average basis between baseline conditions (infiltration BMPs following existing development standards) and parcel developed conditions (larger infiltration facilities with sizes targeted to achieve either 95% or 100% infiltration). We analyzed the infiltration facility area that is required to achieve those post-developed infiltration volumes, which of course gets significantly larger in tighter soils. Since there is more change from baseline infiltration for Type C soils compared to Type A soils, the net recharge volume increases. I would expect that if we consider incidental infiltration beyond the infiltration BMP, that for Type A soils, the baseline would come up significantly in value, but for Type C soils, I would expect very little increase in baseline infiltration, so the net benefit in those tighter soils per parcel should remain relatively consistent with reported values. Type B soils would fall in between. Based on the GIS analysis conducted, the largest number of PE Wells were shown to be in Type B soils.

- If infiltration decreases with the Soil Group, the amount of offset benefit should decrease by soil group. Nowhere in the memo is this relationship shown.

  HDR Response: It is accounted for in the design infiltration rate, which under baseline conditions, results in less annual volume of infiltration progressing from Type A to Type C soils. In the parcel developed condition, we are adding to the infiltration BMP surface area to with tighter soils to achieve either the 95% or 100% average annual volume of infiltration. Therefore, the incremental net recharge benefit increases from Type A to Type C soils, as is demonstrated with the reported modeling results.

WDFW Comments sent to Angela Johnson 10/5/2020

- This approach proposes increasing the rate of infiltration of roof-top intercepted rainwater; therefore, any benefits would accrue within a short time period of the rainfall. The impacts of permit exempt wells are presumed continuous across the year and are likely to increase during dry periods. This makes it unlikely that any benefits accrued

from increased infiltration, would match the seasonal impacts of well withdrawals during critical flow periods.

HDR Response: Benefits from added recharge at parcels would primarily be seasonal (fall-spring) as noted, but the timing of those benefits to receiving water stream flow augmentation would be variable and extend over longer durations depending on hydrogeology/shallow groundwater interflow characteristics and travel paths to receiving waters. Agree that less recharge and stream flow augmentation benefit would be expected to occur in summer months. But the assumptions used in evaluation for annual volumes in water balance are the same as used in the for PE wells consumptive use evaluation for consistency.

- There are major assumptions imbedded throughout the technical memo including:
    - The analysis appears to only consider changes in infiltration based on soil type and roof/infiltration trench area. It is unclear whether the consumptive losses of evapotranspiration (ET) are considered in this analysis or accounted for in the MGSFlood model. ET losses could be significant but are not mentioned in the report.

      HDR Response: For the analysis, the estimated change in recharge compared to baseline applies only to the directly connected roof area. For the continuous simulation MGSFlood analysis, ET losses are built into the MGSFlood model runoff analysis, although I expect limited to evaporation that would be small for the impervious roof areas. For other parcel areas considered in a separate baseline analysis, ET losses are also evaluated in the runoff analysis from the various pervious area PERLND (soil type, veg cover) surfaces evaluated. That analysis doesn't enter into the net benefits evaluation.

    - It is unclear how the difference between pre-development infiltration and post-development infiltration is accounted for. The analysis appears to assume that nearly all water (95-100%) routed to the infiltration trench would contribute towards the estimated benefit.

      HDR Response: It is accounted for in the increased area of the infiltration trench BMP being used to simulate rooftop runoff infiltration characteristics and recharge quantities. For baseline conditions (existing County development standards), we set the roof infiltration trench length/area equal to the minimum development standard for that BMP type (20 sf per 700 sf of roof area) and evaluated for the various HSGs. For parcel developed conditions, we analyzed the required length/area of trench required to achieve annual infiltration volume of 95% and 100% of the annual roof runoff volume for the various HSGs based on assumed design infiltration rates (considered typical factored design values). There is a significant increase in infiltration facility size to go from 95% (approximately 2-yr event) to 100% full infiltration, so a slightly lower target (95%) makes more sense in setting a reasonable modified development standard for parcels infiltration facility sizing.

- Among other modelled assumptions, it is unclear how assumptions of average water table depth and average 1-acre clearing sizes were determined. Depth to water table and the effects of canopy interception from overhanging trees could significantly impact the estimated benefits.

  HDR Response: At this screening level of analysis, the assumption is that adequate depth to water table exists to apply a parcel development roof runoff infiltration BMP (typically 3 ft min from infiltration area subgrade, so 5 feet total including 2 ft depth of infiltration trench). The size of the cleared parcel is based on our understanding of what the County typically allows on a 5 ac parcel. We have not accounted for changes in recharge associated with the cleared area land cover area conversion at this level of analysis. Also, to our understanding, the County is not proposing a change in that criterion with the development standard change, which is focused on requiring only enhanced rooftop runoff infiltration) So that doesn't enter into the net benefits evaluation results as shown.

- There is no references section and the author of the memo is not listed.

  HDR Response: These will be added.

MEMO From Skokomish Tribe and Aspect Consulting with HDR Responses

Project No.: 190315

October 28, 2020

To: Dana Sarff, Skokomish DNR

cc: Seth Book, Skokomish DNR

From: Jonathan Turk, LHG; Jay Pietraszek, LHG

Re: **Technical Review of "Mason County WRIA 14 and 15 Rooftop Runoff Infiltration Recharge Analysis for Streamflow Augmentation Net Benefits"**

This memorandum presents Aspect's review of HDR's Technical Memorandum (Memo) "Mason County WRIA 14 and 15 Rooftop Runoff Infiltration Recharge Analysis for Streamflow Augmentation Net Benefits" (HDR 2020). The Memo was produced for the WRIA 14 and 15 Watershed Restoration & Enhancement Committees and documents the predicted benefits of capturing and infiltrating rooftop runoff for future rural residential (RR) development in Mason County. Aspect's review focused on the assumptions and methodology used by HDR. The model results and outputs presented in the Memo were not checked in detail.

Background

The Memo presents the predicted benefits to infiltration and recharge volumes from using rooftop collection and infiltration systems at future RR developments. Infiltration volumes were predicted for two conditions: a roof-down drain system (baseline) and infiltration trenches designed to capture all roof runoff (proposed) using MGSFlood, an Ecology-approved continuous simulation hydrologic model. The infiltration trenches under the proposed condition were varied in size based on soil hydrologic classifications. The increase in infiltration volumes under the proposed condition were extrapolated to represent the net-gain in recharge based on the proposed parcel buildouts in WRIA 14 and 15.

General Comments

We agree with the key principle behind the project: increasing infiltration of rooftop runoff will have a net benefit on groundwater recharge and streamflows and creates the potential for offset credits. We acknowledge that accurately quantifying the benefits is difficult. HDRs assumptions and methods produced results that may represent a best-case scenario but could be deemed unrealistic.

The simplified approach of extrapolating unit infiltration trench simulations to the watershed scale has inherent spatial and temporal limitations. Consideration of a more conservative approach and/or the use of a range of input values to account for uncertainties and unknown variability may be warranted. We recommend conditioning the interpretation of the results from the rooftop runoff analysis to consider:

- ***Water losses under the baseline condition:*** In the current model runoff that doesn't infiltrate into the roof-down drain system does not reinfiltrate and is considered lost (i.e., consumptive). In reality, at least a portion of this "overflow" could pond or disperse and eventually re-infiltrate. Some of the overflow may run onto an impervious surface and/or be lost to evapotranspiration. Differentiating between these portions may be needed to accurately assess the offset quantities

  HDR response: The analysis has been updated to estimate the extent of baseline conditions infiltration beyond the infiltration trench using a filter strip BMP (simulating an improved lawn area), conservatively sized, and analyzed within MGSFlood to estimate residual infiltration beyond the infiltration trench. Also note that a wider range of infiltration rates have been evaluated, and a slightly higher average infiltration rate (5 in/hr) has been applied for baseline analysis in Group A soils for the net recharge benefit analysis (Group B and C soils average infiltration rates remain the same).

- ***Differentiate between infiltration and recharge:*** The proposed modifications will increase the amount of roof runoff that will infiltrate into the soil. The infiltrated water will either remain in the soil, discharge to surface water as subsurface stormflow (i.e., interflow) or percolate and recharge shallow groundwater. Soil water may eventually be lost to evapotranspiration. Both the stormflow and groundwater recharge volumes may discharge to surface water (with variable time lags) or exit the basin as groundwater flow. Increasing the amount of infiltration will have a net benefit surface water but the timing and magnitude of the surface water benefits, and benefits to baseflows, are dependent on numerous factors. The implication in the Memo is that 100 percent of the infiltration will eventually report to surface water, which is not necessarily certain.

  HDR response: Comment acknowledged, but the scope of the analysis doesn't include more advanced hydrolgeologic analysis, and the database at this higher level of evaluation doesn't support that analysis. Evapotranspiration losses are considered in the MGSFlood model runoff analysis, but for runoff generated by rooftop surfaces, that component is minimized (it is a larger component of vegetated pervious areas runoff generation). Also, the assumptions pertaining to the timing of recharge are consistent with the consumptive use assumptions on PE well withdrawals.

Specific Questions/Comments and Recommendations

Background Section

1. Some terminology is presented in this section and used in later sections should be clarified. Specifically, the terms 'recharge', 'infiltration', 'infiltration recharge', 'roof infiltration', and 'groundwater recharge' are used somewhat interchangeably and should be defined in this section.

- Recommendation: Revise text to provide clarification to the terminology, particularly with the last sentence in the first paragraph.

  HDR response: The terminology regarding infiltration and recharge has been clarified as appropriate with revisions to the technical memorandum.

2. Is there anything that can be identified with respect to the design of a typical infiltration trenches (construction details, completion depths, etc.) to indicate that infiltration into a trench will be more efficient than a typical downspout dispersion system beyond simply the size?

   - Recommendation: Provide clarification and details in the text, if possible.

     HDR response: Mason County standards provide typical sections of infiltration trenches and other infiltration BMPs for rooftop runoff downspout infiltration. Infiltration through an infiltration trench sited appropriately on subgrade soils are typically more efficient than dispersion onto surficial soils with the same area footprint for the following reasons 1) an infiltration trench is a gravel lined facility intended to intersect more permeable subgrade soils, 2) it will allow up to 2 feet depth (per Mason County standards), increasing the hydraulic gradient and infiltration discharge for a given soil permeability value on the infiltrating surface, and 3) Surficial soils typically have more fines, which tend to limit the their permeability and infiltration rates through them. The filter strip analyzed in the revised analysis demonstrates that for limited infiltration volumes for a much larger area compared to the modeled infiltration trench larger infiltration volumes.

Methods Section

1. A single soil permeability rate (infiltration rate) for each soil type was used in the analyses. It would be helpful to provide a reference for these values. Further, there is considerable variability in infiltration rates and a single value may not be a representative of actual conditions, for Group C soils in particular. The infiltration rates for Group C soils may be much lower than the value used in the analyses. For example, the range of infiltration rates for Group C soils with turf vegetation is 0.03 to 0.06 inches per hour in the Western Washington Hydrologic Model (WWHM; Appendix B of the User's Manual)[61]. These rates are much lower than the 0.5 inches per hour used in the analyses.

   - Recommendation: Consider using a range of infiltration rates to illustrate variability. Using lower rates for Group C soils would result in much larger infiltration trenches than those already indicated. Consider the feasibility and practicality of the size requirements for the infiltration trenches in till soils.

     HDR response: The revised analysis does include a larger range of infiltration values, with an average value used for the net benefit analysis. HDR certainly understands

[61] WWHM is referenced in Volume III-2.2 SWMMWW as a recommended hydrologic model.

that infiltration rates can be highly variable in a given soil group, and the range of values applied is typical in western WA for long-term operational design using factored infiltration rates compared to field-measured rates in accordance with the 2019 Ecology SWMMWW. Some classes of till soils can have smaller infiltration rates, but the average value assumed for analysis is within a range of values that can extend up to or above 0.75 in/hr. For soils much less than 0.5 in/hr, infiltration facility sizes to accommodate target infiltration rates for proposed conditions would not be practical, and roof infiltration systems in those tighter soils are acknowledged as likely not feasible.

2. The analyses base the infiltration volumes as either 95 percent or 100 percent of the annual precipitation. This may be an overestimation. Consider, for example, that: (1) rooftop runoff coefficients may range from 0.75 to 0.95 (e.g., Dunne and Leopold 1978), and (2) correction factors are recommended to account for long-term reduction in infiltration system performance (due to clogging, etc.).

    - Recommendation: Consider using reducing the volumes available for infiltration to account for the inefficiencies described above.

      HDR response: The analysis was conducted using the MGSFlood model considering the roof as a non-pollution generating impervious surface. Loss rates are built into the model. Based on the modeling results, a typical 2,800 sf (0.0642 ac) roof generates an average runoff volume of 0.335 ac-ft/yr. Considering the modeling is done for a MAP of 70 inches, the precipitation volume falling on the roof is 0.375 ac-ft/yr, so the modeled roof runoff volume is approximately 89 percent of the precipitation volume, within the range of coefficients noted in the comment. Therefore, the analysis results do account for about 11 percent loss in runoff volume compared to precipitation volume.

Results Section

1. The results that show 50 percent of the annual precipitation is recharged over the pervious portions of the lots needs further clarification. The implication that 50 percent of the total precipitation on undeveloped land is recharged to groundwater is most likely an overestimation. It is understood that the analyses for pervious land infiltration was not used in the offset calculations.

    - Recommendation: Provide clarification.

      HDR response: The analysis results for a typical parcel development (beyond the roof area analyzed separately) are output from the MGSFlood model based on the collective land cover and area assumptions as stated. That result will vary with soil group, with a group A highly pervious soil generating significantly more runoff that a group C till soil. As noted, these results are only provided as background, and would be the same under both analysis scenarios, so they do not affect the net recharge benefit analysis results.

2. The results show that large infiltration trenches are required to infiltrate the full volumes in Group C soil types. Consideration of the practicality of constructing and maintain a large

trench, as well as, the long-term performance of an infiltration trench completed in a Group C (glacial till) soil (particularly with respect to the uncertainty with Group C soil infiltration rates described above).

- Recommendation: Consider the overall impact to the net recharge calculations of either removing the Group C soils from analyses entirely or assuming only a certain percentage of the residences with Group C soils will have functional infiltration trenches.

  HDR response: This has been addressed in the analysis based on discussions between and agreed to resolution between Ecology and Mason County staff. The outcome was to evaluate group C soils under proposed conditions using a maximum area infiltration trench that Mason County is in agreement with (620 sf), and determine the expected infiltration volume where less than the target value agreed to for other soil groups (85% annual infiltration volume typical). Based on the revised modeling at 0.5 in/hr permeability, the maximum volume accommodated by that size trench per parcel is 0.230 ac-ft/yr or 69 percent of the annual roof runoff volume.

Limitations

Work for this project was performed for the Skokomish Tribe (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

North Steamboat Project

PROJECT DESCRIPTION

Description

The Steamboat Island Peninsula has many small first order streams that originate from wetlands and flow to surrounding marine waters. On the north end of the peninsula, just south of the Carolyn Beach Homeowners Association water system, is a recently formed pond (Figure 1). The pond is on a private parcel that also contains a residential home. The pond appears to be a recent impoundment, with aerial imagery as recent as 2011 indicating timber and a field in the location of the current pond.

The pond is part of a sensitive groundwater zone with hydric soils (Bellingham silty clay loam). It's likely that the pond results in slow recharge back to the local aquifer and may be in connection with an intermittent stream that drains to the west in Eld Inlet.

The proposed project would increase the elevation and spatial extent of the pond, thereby increasing hydraulic gradient and increasing infiltration of water into the local aquifer. With the existing condition, that extra water would be presumably draining to the local intermittent stream. The pond could potentially be increased by two feet without causing flooding off of the current parcel.

Qualitative assessment of how the project will function.

A feasibility study would need to investigate the cause and use (if any) of the impoundment by contacting the private landowner. The feasibility study would evaluate the hydrologic accounting of the existing and proposed condition to determine if there is enough of a net gain in local groundwater and streamflow gain (during the low flow period) to warrant the project.

The project could be increased from an elevation of 78 to 80 ft in elevation without affecting other parcels (Figure 1)

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

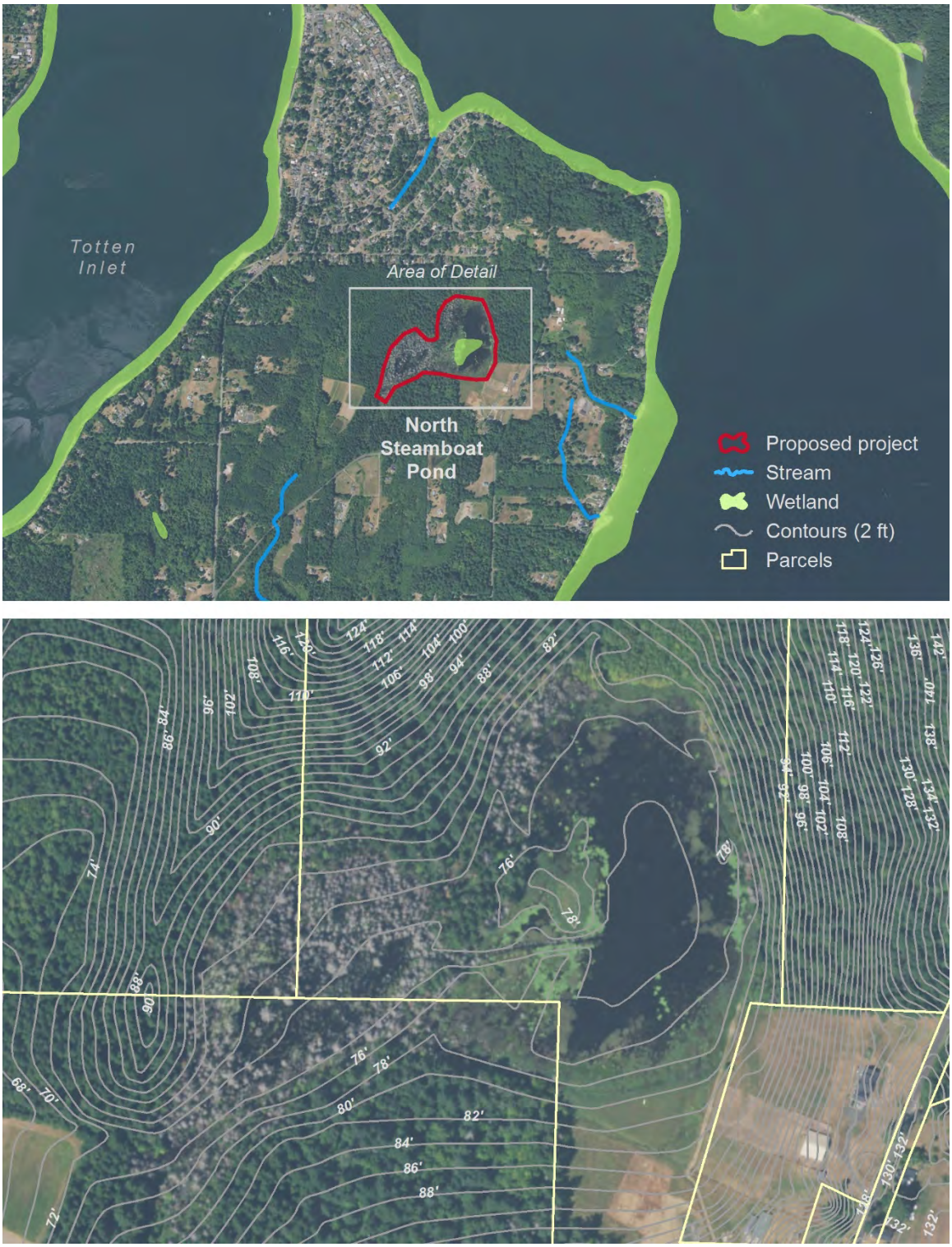


Figure 1. North Steamboat Pond.

Description of the anticipated spatial distribution of likely benefits

The Project will increase local aquifer storage and may increase streamflow in intermittent streams to the north, south and east (Figure 1).

Performance goals and measures.

The performance goals are to increase the pond elevation by up to two feet in elevation during the wet season, This performance goal could be measured with a staff gage in the pond. Increasing summer baseflow in the surrounding intermittent streams during the summer low-flow period is also a performance goal, but would be more difficult to discern, given seasonal and annual variation in flow. If pursued, measurement of this performance goal would require pre-project baseline and post-project monitoring for a sustained period of time to detect an increase in flow, if it occurred.

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

No salmonid species appear to use the streams near the proposed project (WDFW Salmonscape 2020), presumably because of the intermittent nature of the streams. The streams may provide seasonal habitat for estuarine fish species and seasonal pocket estuaries for use of multiple aquatic species, including outmigrating subyearling Chinook and chum salmon.

Identification of anticipated support and barriers to completion.

The proposed Project is located on private land, and any would therefore require landowner permission, conservation easement, or land acquisition from the private landowner.

Potential budget and O&M costs.

Total costs are anticipated to be less than $1,000,000. Costs would include the potential need for land acquisition, and installation of a water control structure or berm.

Anticipated durability and resiliency.

The project would have lasting benefits and would not require minimal operation and maintenance, once it is established.

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

The project sponsor would be the Thurston County. Thurston County would begin Project implementation with a feasibility and design study.

References

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

Skookum Valley Railroad Culvert Blockages

PROJECT DESCRIPTION

Description

Skookum Creek is a tributary that flows into Little Skookum Inlet in South Puget Sound. Skookum Creek and its tributaries support chum and coho salmon, as well as a prolific population of sea run cutthroat trout. Steelhead are present but rare. Multiple tributaries to Skookum Creek are blocked by culverts that run under the railroad on the north side of the valley. This railroad is called the Puget Sound and Pacific Railroad (PSAP), and it is owned by Genesee and Wyoming (Darien, Connecticut). Replacing those culverts could open up as much as 5 miles of spawning and rearing habitat in the Skookum watershed.

Qualitative assessment of how the project will function.

This is a proposal to replace a minimum of 8 culverts, perhaps as many as 15 culverts along the PSAP railroad that are full or partial barriers to upstream fish passage.

Tasks:

- Survey length of railroad through Skookum Valley to fully inventory all culverts.
- Field verify amount of available fish habitat upstream of blocking culverts. This will also involve field verification of stream location and correction on WDFW maps.
- Reach out to Genesee and Wyoming to ask for their cooperation to replace all blocking culverts.
- Set in place a culvert replacement schedule and plan with Genesee and Wyoming (PSAP).
- Work to ensure that the culvert replacement schedule is followed.
- Work with WRIA 14 Lead Entity on prioritization schedule for replacement based on their comprehensive barrier prioritization tool.

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

See map on the next page of blocking culverts under the PSAP Railroad. The map was generated from the WDFW fish passage map and then annotated.

Listed below are the culvert ID numbers, as listed on WDFW's fish passage map. The number of miles of fish habitat upstream that would be accessible by fish, if these culverts were open to fish passage, has been estimated. Individual reports for each listed culvert can be accessed by clicking on the culvert location in the fish passage map.

MC263- ~2,400 ft

MC264- ~12,000 ft

MC265- ~1,200 ft

MC266- ~4,000 ft

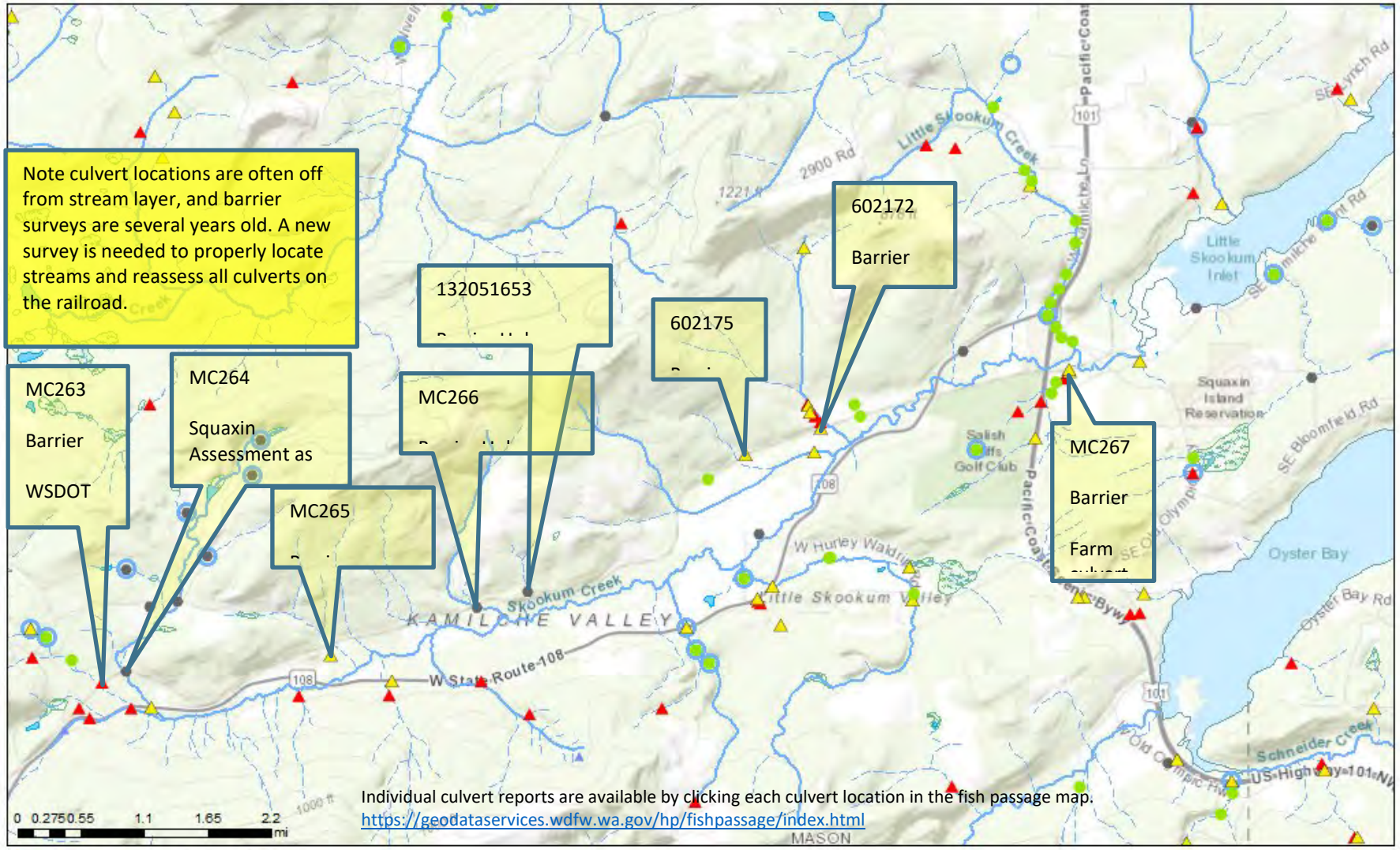
132051653- Unknown

602175- ~3,200 ft

602172- ~3,000 ft

MC267- ~1,800 ft

Total = ~27,600 or 5.2 miles of fish habitat could be made accessible again.



Individual culvert reports are available by clicking each culvert location in the fish passage map.
https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html

Washington State Fish Passage

Washington Department of FISH and WILDLIFE

- Not a barrier
- Partial Fish Passage Blockage
- Total Fish Passage Blockage
- Barrier, Unknown Percent Passable
- Diversion
- Natural Barrier - Verified
- Unknown
- Corrected Barriers
- NHD Coastline

NHD Rivers
- Stream / Perennial
- Intermittent / Ephemeral
- Canal, Ditch
- Pipeline
- Connector

NHD Waterbody
- Lake, Pond, Reservoir
- Swamp, Marsh
- Ice Mass

http://apps.wdfw.wa.gov/fishpassage/?extent=-123.2305,47.0853,-123.0566,47.1571

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Description of the anticipated spatial distribution of likely benefits

Access to tributaries on the north side of Skookum Valley, from headwaters to Little Skookum Inlet on Puget Sound.

Performance goals and measures.

Number of miles of habitat made accessible to anadromous fish, as each culvert is removed.

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

The Washington Department of Fish and Wildlife has identified that coho salmon, chum salmon, steelhead trout, and coastal cutthroat trout have spawning populations in Skookum Creek (WDFW Salmonscape 2020. Steelhead may be present, but are rare. The extent of fish depicted in Salmonscape is an underestimation.

Identification of anticipated support and barriers to completion.

It is likely that there will be broad support for a project like this in the WRIA 14 WREC Committee, as well as generally. The most difficult challenge in this project would be acquiring the cooperation of the Genesee and Wyoming Railroad Company.

Potential budget and O&M costs.

Costs are estimated to be between $1-5 million, depending on design.

Anticipated durability and resiliency.

Design life of these culverts would probably be at least 50 years.

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

The project sponsor would be the SIT. The SIT would begin Project implementation with a feasibility and design study.

References

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

WDFW (Washington State Department of Fish and Wildlife). 2020. Fish passage map. https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html

Skookum Valley Ag Project

PROJECT DESCRIPTION

Description

Skookum Creek is a tributary that flows directly to Little Skookum Inlet and is important for supporting coho salmon, chum salmon, winter steelhead, and coastal cutthroat trout. Habitat in Skookum Creek has been simplified, in part, due to habitat simplification from agricultural land use within the Skookum Valley floodplain. Some reaches of the Creek have been moved to the edge of the valley wall to maximize agricultural production, and not allowed to meander through its channel migration zone. This has resulted in channel incision (streambed downcutting) loss of side channels, loss of off-channel habitat, and reduced floodplain connectivity.

The proposed Skookum Valley Ag Project (Project) will re-align a reach of the stream channel that is currently confined to the valley wall, back into its historical alignment and natural meander pattern. This Project is intended to be the first step in larger scale realignment into historical alignment and allowed to meander through its channel migration zone.

Qualitative assessment of how the project will function.

The proposed project will increase stream length from 920 feet to 1530 feet, an increase of 610 feet (Figure 1). The re-alignment will include instream structures (e.g. large woody debris and engineered log jams) that) that will increase habitat complexity. These structures will contribute to bedload retention and will contribute to reduction of channel incision, in combination with other future projects. Riparian vegetation will be established around the new stream alignment.

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

Figure 1. Skookum Valley Ag channel relocation.

Description of the anticipated spatial distribution of likely benefits

The Project will increase channel length in Skookum Creek by 610 feet. This will increase usable aquatic habitat.

Performance goals and measures.

The performance goals are to increase stream length by 610 feet with an appropriate channel geometry, large woody debris density, pool density and residual depth, stable banks, and riparian zone establishment. Specific metrics for these attributes will be defined based on the restoration design.

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

The Washington Department of Fish and Wildlife has identified that coho salmon, chum salmon, steelhead trout, and coastal cutthroat trout have spawning populations in Skookum Creek (WDFW Salmonscape 2020). WDFW (2020, 1975).

Skookum Creek has several habitat factors that are limiting to fish productivity, including low summer base flow, high summer water temperature, suboptimal large woody debris and pool density, and spawning gravel quality, This Project will contribute to addressing these factors at the reach scale. The increased channel length and re-alignment may allow for more groundwater contribution. The presence of the impoundment directly to the northwest of the proposed alignment would provide a hydraulic gradient to push cool groundwater into this stream alignment. The installation of large woody debris and establishment of riparian vegetation will contribute to optimal

large woody debris density, pool density, and will create the hydraulic complexity to sort sediments, leading to pockets of suitable spawning gravels.

Identification of anticipated support and barriers to completion.

The proposed Project is located on land previously acquired by the Squaxin Island Tribe (SIT). The SIT is supportive of this Project.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be <$1.0 million, based on an order of magnitude cost estimate (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits and would not require operation and maintenance, once it is established.

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

The project sponsor would be the SIT. Project implementation would begin with a feasibility and design study.

References

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/

Water Right Screening Methodology

TECHNICAL MEMORANDUM

To: Department of Ecology WRIA 14 Watershed Restoration and Enhancement Committee

From: Peter Schwartzman, LHG

Burt Clothier, LHG

Re: Water Right Screening Methodology

Date: December 22, 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 the Kennedy-Goldsborough Basin, Water Resources Inventory Area (WRIA) 14. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 14 Watershed Restoration and Enhancement (WRE) Committee (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 potential offsets to 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 14, PGG assisted the Committee in selecting a focused set of water rights for further review to assess potential benefits and their 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 14. 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 removed during the screening process.

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

The Committee identified several criteria for identifying potential water-rights where acquisition would have the greatest benefit:

- Surface-water sources were considered to be more useful than groundwater sources, as they provide direct improvement to streams.
- Preferred water-right purposes include irrigation (IR) and commercial/industrial (CI). Later in the process, PGG introduced consideration of domestic multiple (DM) water rights, since nearby municipal water systems (e.g. Shelton) potentially could have capacity to supply smaller Group A or B water systems. All other domestic categories (domestic single and domestic general) and municipal rights were excluded from the analysis based on the expectation that these rights would be unavailable for mitigation or too small (unless otherwise identified by the Committee).
- The Committee identified five priority subbasins (Goldsborough, Mill, Hood Canal, Oakland and Skookum) which include 11 key creeks: (Mill, Gosnell, Sherwood, Schumacher, Skookum, Goldsborough, Cranberry, Johns, Deer, Alderbrook and Twanoh). Prioritization was based on consideration of habitat (Salmon tier "A" and Salmonscape miles) and streamflow regulation (instream flow requirements and closures).

FINDINGS

Approximately 400 active water right files were identified within the five priority subbasins. PGG prepared histograms that sorted IR and CI water rights by quantity towards meeting the desired mitigation offset.

- Surface-water rights were initially sorted by instantaneous quantity (Qi). Among a total of 165 rights representing 672 cfs (159 IR and 6 CI rights), 70 had Qi less than 0.03 cfs and 150 had Qi less than 0.5 cfs. Five water rights were identified with Qi greater than 1 cfs, of which 3 are associated with CI (gravel mining/processing and timber processing) and two are associated with IR.
- Surface-water rights were also sorted by annual quantity (Qa); however, 87 of the 165 surface water rights had no stated Qa, For these cases, PGG estimated Qa based on stated irrigated acreage (77 of 87 rights had irrigated acreage listed) and an assumed irrigation duty of 2 feet. Out of 155 water rights with stated or calculated Qa totaling 4,053 acre-feet/year (af/yr), 96 had Qa less than 10 af/yr and 114 had Qa less than 20 af/yr. Sixteen "large" (>80 af/yr) rights were identified, of which 15 are associated with IR and one is associated with CI.
- Groundwater rights were sorted by annual quantity (Qa). Among 33 IR rights and 16 CI rights (a total of 49 rights representing 24,327 af/yr), 21 had Qa less than 10 af/yr and 30 had Qa less than 20 af/yr. Twelve "large" (>80 af/yr) rights were identified, of which 10 are associated with CI (timber processing, shellfish) and two are associated with irrigation.

In order to identify higher-value water-right acquisition possibilities and provide a more manageably sized list, water rights with a Qa of less than 10 af/yr were removed. This arbitrary cut-off resulted in reducing the list from 400 to 99 water rights with a combined allocated volume of 28,021 af/yr (24,242 from groundwater and 3,778 from surface water).

Table 1 lists the water rights in the five preferred subbasins that could potentially be converted, purchased, or retired as mitigation water, while **Table 2** is a general summary of the focused water right list. **Table 2** provides summed (total) Qa's for the water rights listed in **Table 1** for each priority subbasin, but does not provide summed Qi's because Qi is often not representative of the actual volume of water allocated. Some surface-water rights do not have Qa's listed (**Table 1**); therefore, these rights are not included in the totals on **Table 2**.

These summaries should not preclude the Committee from pursuing specific water rights in other subbasins that could be identified in the future by other means. Therefore, moving forward, the Committee should investigate the availability of rights in the focused study area as well as in the broader WRIA if specific rights are identified. In addition, the Committee may wish to investigate expected Qa for surface-water rights without specific Qa allocations.

It is understood that the offset credit from retiring or increasing the efficiency of IR rights is limited to the associated reduction in *consumptive* use rather than the reduction in *total* use. Similarly, CI water rights were recognized to have both consumptive and non-consumptive portions, of which only consumptive portions could be used for mitigation offsets. Some of the larger water rights listed in the attached tables are for CI purposes associated with timber and sand & gravel operations, and may include a significant portion of non-consumptive use.

The Committee provided input on known water rights. Several IR rights had been acquired by the Squaxin Tribe and were no longer available for mitigation. PGG used satellite imagery to assess evidence of irrigation for the largest 13 IR rights (50-200 irrigated acres) within the five preferred basins, and noted that while most had cleared (or potentially cultivated) land nearby, only four (two golf courses and two agricultural properties) showed observable evidence of irrigation. Committee members agreed that windshield or desktop surveys would better confirm the occurrence of active IR water rights. Thurston County staff performed a limited windshield survey and identified 14 IR rights in Thurston County (Kennedy subbasin) that appear to be in current use. The Squaxin Island Tribe performed additional desktop aerial surveys which resulted in a "targeted" list that the Committee has identified will be a priority for future investigation or acquisition.

Finally, PGG used GIS analysis to identify which smaller DM public water systems are located within or near the Shelton water system service area, with the idea that smaller systems could potentially be sourced from the Shelton system to make their water right available for mitigation offset. PGG identified 27 PWS located within a mile of the Shelton service area. The closest ones have relatively small water rights (Qa <40 af/yr). Larger systems had Qa's of 166 af/yr (2,700 feet away), 160 af/yr (a mile away) and 90 af/yr (4,900 feet away). The Committee considered it unlikely that these water systems would be able to "hook up" to Shelton and operate under their water right.

Source Substitution on Schneider Creek

Project Name:	Source Substitution on Schneider Creek (TC Project #143)
Project Location:	Kennedy Creek management unit in northwestern Thurston County. See Figures 1 and 2. *Lon. -123.05114 Lat. 47.09222*
Project Description:	☑ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other **Project Overview** Conceptually this project involves the purchase and retirement of existing irrigation water right certificates, replacement with new irrigation source well(s) under a new water right permit, irrigation efficiency improvements, and ditch removal with stream restoration. See Figures 1 and 2 for maps of project details: • Water right certificates for consideration for possible full/partial retirement as part of a source-substitution project. • Future well location(s). The hypothetical new irrigation source wells would be located near well AKR885 (log attached) to substitute for part of the valid portion of these certificates. • WSDA pasture where irrigation was observed in the field, and where the proposed surface water rights' Place of Use may apply. • MODFLOW groundwater streamlines (steady-state) from the hypothetical well(s) pumping 300gpm. • Potential stream restoration zone along a Schneider Creek tributary. The current ditch draining wetlands could be replaced with a re-meandered stream approximately replicating the historic stream channel. The project involves a cluster of pastures on the north side of US101 along Schneider Creek that collectively appear to be associated with five certificated surface water rights (See Figure 1). The amount of potential water available is sizeable: +1.4cfs irrigation combined, with water rights that appear to be at least

partially active. Field windshield screening indicated they have some visible irrigation works. These five certificates are as follows:

1. **Surface water certificate S2-*10859CWRIS** is the most significant in terms of the water it could provide – namely 1 cfs and enough water to irrigate 100 acres. Part of this use was field-verified in July 2020 by observing irrigation works and apparent be irrigation of 40 acres. The use period for this water right is April 15 through October 1.
2. **Surface water certificate S2-*09745CWRIS** is an irrigation-only water right with an April 15 through October 1 use period.
3. **Surface water certificate S2-*10229CWRIS** has irrigation and domestic purposes of use, and the use period for the irrigation portions end October 1st.
4. **Surface water certificate S2-*02995CWRIS** has irrigation and domestic purposes of use, and the use period for the irrigation portions end October 1st.
5. **Surface water certificate S2-*02996CWRIS** permits domestic water-use only.

The attached copies of water right certificates indicate original authorizations to irrigate up to 150 acres of land. However, in Washington State, water rights are subject to a 5-year relinquishment standard and only remain valid to the extent they are thus put to use. Assuming an irrigation duty of 1.3 feet of water per season (the pasture annual irrigation rate for Shelton listed in the Washington Irrigation Guide), 150 acres of irrigated water use would require about 195 afy (acre-feet per year) of water towards a maximum of approximately 700 afy. However, due to Washington State's water right relinquishment standard, it is quite possible only a portion of that quantity is still valid.

The project element involving ditch removal and stream restoration is highlighted on Figure 2. The ditched part of the wetlands on the north tributary of Schneider Creek is about 3,400 feet long. The current ditch drains wetlands, but that could be replaced with a re-meandered stream approximately replicating the historic stream channel, with significant habitat improvements.

Site Hydrogeology

Hydrogeology in the project vicinity has not been extensively studied. Thurston County has developed a groundwater flow model across the project area based on

geologic mapping by the WA Geological Survey, and this is generally calibrated to approximate well water levels and streamflows. However, many questions remain.

The site-specific hydrogeologic information used in this project summary comes from three main well logs (see attachments):

- **Well AGK602 – Holiday Valley Estates (1968).** This older Holiday Valley well produced 233 gpm from torch-cut slots, with about 22 feet of drawdown over 4 hours, from a sand and gravel unit between 116-127 feet below ground surface. The well encountered several layers that appear to be aquitards. Please see the attached well log, and Figure 2 for the well location.

- **Holiday Valley Estates (1981).** This 10-inch diameter cased-and-screened production well was drilled to 133.5 feet and terminated at basalt bedrock. From 117 to 133.5 feet below ground, in sand and gravel immediately above bedrock, the well produced 200 gpm with 26 feet of drawdown during a 4-hour test from two 5-foot screened sections. The well encountered several layers that appear to be aquitards. Please see the attached well log, and Figure 2 for the well location.

- **Well AKR885 – Vaugh Litchfield (2004).** This 6" ID open pipe domestic well was drilled to 218 feet near Schneider Creek. The well produced 30 gpm during a one-hour open-pipe airlift test (i.e. no well screen, no measured drawdown). The well encountered several layers that appear to be aquitards. Please see the attached well log, and Figure 2 for the well location.

In summary, according to testing performed at the time of drilling, yields from two wells were at/over 200 gpm, suggesting very productive rates were possible from the confined aquifer at the Holiday Valley water system wells. Well AKR885 produced at least 30 gpm from a short open section and no screen. These results suggest the following:

- Assuming that even higher production rates will be possible with future wells, target irrigation flowrate of 300 gpm may be achievable using one to three new source wells (groundwater flow modeling assumed this rate in Figure 2).
- The target aquifer is confined. Long-term well performance should be evaluated, including seawater intrusion and effects on other nearby wells.

- Induced stream baseflow losses may be reduced near the new irrigation wells because confining layers exist. However, some stream baseflow losses may occur in more distant areas yet to be determined.
- Current MODFLOW modeling suggests that source waters feeding the wellfield are from upland areas south of the wells (see Figure 2), but this must be evaluated during the project.
- Modeled steady-state groundwater elevations with a pumping rate of 300 gpm are near/below sea level. Although the proposed pumping will be seasonal, induced saltwater intrusion and effects on nearby wells' water levels should be evaluated.

Background

Substituting a deep GW source for the current surface water irrigation will lessen the hydrologic impact to the stream overall (assuming that the deep aquifer primarily discharges to seawater). However, there are legal hurdles associated with this approach. Chapter 173-514 WAC places a seasonal closure on Schneider Creek from May through October. Although it has yet to be evaluated, it is quite possible that groundwater pumping associated with a new irrigation source would impact Schneider Creek baseflow. And, since the effects of seasonal pumping would take some time to work their way through the hydrogeologic system, under that scenario the effects of pumping on Schneider Creek would not cease on October 1st. At least the largest of the 5 subject water rights, S2-*10859CWRIS, has an October 1st cut-off date, so any effects due to groundwater pumping of that water right would spill over past that water right's authorized use period. Some of the other water rights may face similar hurdles, but more research would be needed to make that determination.

In years past it might have been possible to mitigate impacts during the month of October more creatively. However, the 2015 Washington State Supreme Court Foster decision has changed the legal framework for source substitution projects. Due to the Foster decision, it is quite possible the only way to deal with the month of October would be to have a situation where there are no adverse impacts due to pumping during that month.

	At least part of the solution to reducing or eliminating potential October impacts could involve relinquishment of the water rights other than S2-*10859CWRIS. More research is needed, but if any of those water rights permit water use throughout October, those rights could be used to cover at least part of the late-season impacts. However, a cursory look at the other water rights suggests that only one, S2-*02996CWRIS, does not have an October 1st cutoff, and the Qi associated with S2-*02996CWRIS is only 0.02 cfs. Another potential option for reducing or eliminating October impacts would involve pairing this source substitution project with some sort of flow augmentation project or perhaps an MAR project that would somehow utilize water that is available at some other times of year to then provide an offset during October. However, this option may be cost prohibitive. Finally, there is the possibility that the Washington State legislature could change the law with a so-called "Foster fix, to allow more latitude with regard to source exchange projects in the future. **Summary of Major Project Elements** • Feasibility Study to determine what type of project is viable, including the following elements: o Assessment of the extent and validity of the 5 certificates. o Determine what fraction of the valid part of these rights can be retired. o Install, aquifer test and model the effects of source substitution well(s). o Determine the irrigated area and the efficiency of the new irrigated area for supply by the new wells. o Negotiate the purchase, new irrigation configuration and partial retirement options for the five water rights. o Determine the impacts to nearby streams and any resulting mitigation requirements. o Evaluate the engineering feasibility and cost options for the project. • Following approval of a feasible option: o Obtain a groundwater withdrawal permit(s) from Ecology o Provide the production wells, irrigation works/modifications, utility connections and permits. o Implement any permit-required mitigation. o Implement the ditch removal and stream restoration elements of the project.

Description of Benefits:	1. **Summary of potential water offset benefits from the project: (**195 afy) x (0.33 irrigation efficiency improvement/retirement fraction) = (64 afy water offset benefit), depending on multiple factors. This assumes the benefit incorporates any mitigation required for the new groundwater permit. Water offset benefits may be smaller if groundwater permit mitigation complexities emerge. 2. **Increased streamflows on Schneider Creek.** 3. **Improvement in stream function for fish habitat.**
Is Water Quantity a Limiting Factor In this Subbasin?	Unknown.
Location & Spatial Extent of Benefits:	Flows could be increased in Schneider Creek from the area of stream restoration, through the area of the five water rights "Points of Diversion", then downstream to its confluence with Totten Inlet.
Anticipated Water Offset (if applicable):	**Summary of total potential water offset benefits** from the project: approximately 64 afy, depending on multiple factors.
Project-Type Specific Information	
Estimated Project Cost:	Several hundred thousand dollars, at minimum, for new source wells, engineering, permitting and new infrastructure.
Performance Goals & Measures:	Weather and water quality monitoring is already performed by Thurston County; however, additional monitoring is likely to be needed. (See: https://www.thurstoncountywa.gov/sw/Pages/monitoring-dashboard.aspx).
Anticipated Local and Partner Support & Barriers to Completion:	1. The Squaxin Island Tribe has indicated that it may support this project. 2. This project depends heavily on achieving sufficient new well yields. Significant questions exist regarding pumping well production. 3. Some form of required mitigation for the new groundwater permit is likely.

	4. Modeled steady-state groundwater elevations with a pumping rate of 300 gpm at the proposed new wellfield are near/below sea level. Although the proposed pumping is expected to be only seasonal, induced saltwater intrusion and effects on nearby wells' water levels should be evaluated.
Project Sponsor, Implementation Start Date and End Date:	Thurston County may sponsor this project, depending upon Feasibility Study outcomes. The project will need a thorough assessment of well yields, a Report of Examination from a CWRE, plus additional hydrogeological, legal, financing and engineering feasibility studies.

Steamboat Middle Storage Enhancement and Habitat Improvements

Project Name:	Steamboat Middle Storage Enhancement and Habitat Improvements (Thurston County ID 110)
Project Location:	Project is in WRIA 14 on the Steamboat Island peninsula, northwest of the City Olympia, north of US 101 and just south of Steamboat Island Road NW (see Figure 1). Kennedy Creek management unit. The project includes unnamed tributary streams feeding Young Cove. *Longitude: -122.9894, Latitude: 47.1208*

Project Description:	☐ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other The Steamboat Middle project consists of expanded water storage in an existing forested/non-forested wetland. The project would expand water storage in a low-lying area between elevation 114 and 118 as depicted in Figure 1. Blue shading indicates the potential extent of additional water storage to max. elevation 118 (datum: NAVD88). Some additional habitat may be created during this project. This project concept envisions the retention an additional 28-121 acre-feet of wet season precipitation, of which half (14-61 acre-feet) would likely provide a water-offset benefit by seeping back into the unnamed tributaries feeding Young Cove. We assume that the remainder would be lost to evapotranspiration. The project area is very flat, with two main basins, each with a differing base elevation. The project area has existing wetlands and hydric soils, likely overlying glacial till based on nearby geology (see Attachment A Well Logs). All elevations are referenced herein using the NAVD88 datum and Thurston County's 2011 LiDAR data. Assuming a low dike and gate/outfall to sustain higher water levels up to approximately elevation 118, two configurations of the water storage area can be conceptually evaluated as follows: 1. At a **"Low Water Stand"** the northern basin could retain about one additional foot of water depth within the existing ponded area, for about 28 acre-feet of additional storage.

2. At a **"High Water Stand"** the southern basin would also fill, to a depth of 1.11 feet, on average. At a "High Water Stand," the northern basin depth would increase to a depth of 2.35 feet, on average. Both average depths assume a maximum of 118 feet NAVD88, as controlled by a dike and gate with an outfall structure.

Table 1 Summarizes these features:

	Flooded Acres *	Average Water Depth – Low Water Stand (ft)	Average Water Depth - High Water Stand (ft)
Northern basin	28	1	2.35
Southern basin	50	0	1.11
	Storage acre-feet	28	121.3
	Water Offset Benefit With 50% ET losses	14	60.65

Site hydrogeology

a. **Geology:** probably shallow outwash gravels over glacial till.
b. **Depth to water:** ground surface – wetlands exist.
c. **Stream connection to aquifer:** Partial connection - Project-level calculations required. LiDAR flown in June 2011 did not indicate flow in the two unnamed tributary streams draining the project area. However, DFW modeling indicates fish presence is likely in both small tributaries.
d. **Estimated fraction of recharge that discharges to nearest streams:** Assumed 50% of additional storage reaches the two unnamed tributary streams as new base flow. Project-level calculations required.
e. **Initial estimate of streamflow benefit timing:** Project-level calculations required
f. **Suggested Plan benefit estimate:** 14 to 61 afy, based on 50% of storage reaching both streams.
g. **Probability of benefit:** High (i.e. use 100% of the calculated 14 to 61 afy benefit)
h. **Probability of construction:** Moderate – land access and permit questions will need further feasibility assessment.

	i. **Surface water source evaluation:** None yet - Project-level calculations required j. **Dates when streams are closed:** Discharges to salt water – closure status unknown k. **What type of water rights would need to be acquired to provide water from that source?** Unknown l. **What stream reach likely would benefit from this project?** Unnamed tributaries to Young Cove. m. **What is the anticipated benefit to that reach?** 14 to 61 afy additional streamflow, including flow from groundwater seepage. n. **What fish species will benefit?** WDFW data list fall chum salmon observed and resident coastal cutthroat presumed in the streams feeding Young Cove. MODFLOW groundwater flow modeling exists across this project site and can be used to test project concepts. In addition, significant LiDAR data are available for project assessment (one-foot LiDAR topography).
Description of Benefits:	• Conceptually, this project could provide infiltration of 14 to 61 afy water offset. • These benefits would require quantification as part of a Feasibility Study. • The project would improve streamflow later in the year, i.e. groundwater seepage that would provide stream base flow. • The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process, and monitoring during operation. • Habitat could be incrementally improved. • Wetlands may expand as a result of the additional water storage area. • Habitat benefits/protection may be part of the project.
Is Water Quantity a Limiting Factor In this Sub-basin?	Unknown. Habit assessments would be required.
Location & Spatial Extent of Benefits:	Unnamed tributaries to Young Cove.
Anticipated Water Offset (if applicable):	14 to 61 acre-feet per year are anticipated. The WRIA 14 Committee conservatively claimed 14 AFY as a water offset to include in the plan.

Project-Type Specific Information	
Estimated Project Cost:	Feasibility study costs of ~$250,000, plus capital cost of several hundred thousand dollars for civil works, and the costs for land access rights or ownership. Operations & Maintenance costs expected. A cost estimate of $1 million is included in this watershed plan for planning purposes.
Performance Goals & Measures:	Streamflow, habitat or groundwater monitoring would likely be required for this project.
Anticipated Local and Partner Support & Barriers to Completion:	Unknown. Obstacles may include costs for land or rights to inundate lands adjacent to the project; conversely, landowner willingness to allow inundation may reduce the feasible water offset quantity.
Project Sponsor, Implementation Start Date and End Date:	Not yet sponsored.

Summit Lake Alternative Water Supply and Use

Project Name:	Summit Lake Alternative Water Supply and Use (TC Project #76)
Project Location:	Kennedy Creek management unit in northwestern Thurston County. See Figure 1. *Summit Lake Lon. -123.1064 Lat. 47.0538*
Project Description:	☑ Water Right Acquisition ☑ Non-Acquisition Water Offset ☐ Habitat/Other Conceptually this project involves determining alternative solutions for safe water supply to the Summit Lake community. It involves a substantial portion of the lakefront residents of south shore drive along Summit Lake currently using surface water from the lake itself. An alternative water supply could supply water and reduce the use/demand for 235 homes on south Summit Lake Shore Drive South. One potential source of water could include new source wells installed in aquifer material near the Boy Scouts of America Camp Thunderbird. Well yields of 10 gpm to 30 gpm have been identified in at least five existing wells – including the Camp Thunderbird well (rated by WA DOH as capable of serving 9,000 gpd). This could require obtaining a new water right in compliance with Chapter 173-514 WAC, which would be difficult with the current instream flow rules because the location is in direct hydraulic continuity with Kennedy Creek. There may also be conflicting legal concerns with obtaining a water right as a result of the Washington State Supreme Court Foster decision. Another potential source of water could be from piping water from a public water system located outside the Summit Lake drainage. This option could be more expensive but provide a more reliable water source and flow benefit to Kennedy Creek. Other water sources could also be explored, should the opportunity become available. A net water offset benefit could occur in two ways: 1) by limiting irrigation for homes newly connected to a new water supply, and 2) by retiring some non-certificated permits and purchase/retirement of some certificated water rights. Finding an alternative to surface water withdrawals for a portion of the Summit Lake community could result in the retirement of surface water withdrawal permits for homes with newly available supplies. Some of

	these permit revocations may include the 193 temporary withdrawal permits. These permits date to after 1992, when Ecology agreed with Thurston County to temporarily issue new permits for indoor water use only, with the condition that these rights be relinquished when a public water supply became available. Finding an alternative, safe water supply would reduce public health risk for residents and clarify uncertain permitting, including those undeveloped lots surrounding Summit Lake that are currently without access to water. **Background** The approximate altitude of the lake is 460 feet. The drainage is steep and rugged with ridges as high as 1200 feet and slopes up to 80 percent. There are numerous springs and intermittent streams that flow into the lake. The outlet at the west end of the lake is controlled by a dam with overflow flash boards, regulated under a superior court order issued under Chapter 90.24 RCW, which allows lake overflow to feed Kennedy Creek. Summit Lake is one of the deepest lakes in Thurston County, with a maximum depth of 30 meters (100 feet). Groundwater is difficult to find in the thick basalts surrounding the lake, typically requiring homeowners to rely on surface water instead of drilling a permit exempt well. It should also be noted that all Lake area parcels have on-site septic systems that ultimately discharge household wastewater back into the lake via shallow groundwater percolation. Prior to the passage of the Streamflow Restoration Act, significant streamflow concerns existed in the Kennedy Creek basin. For example, the Department of Ecology has noted that each new surface water withdrawal permit adds to ongoing impairment of the Kennedy Creek instream flow right and tribal rights, and the public interest test (RCW Chapter 90) is not met by incrementally diminishing critical instream flows (See Attachment A). Chapter 173-514 WAC, adopted in January 1984, closed Kennedy Creek and its tributaries to new appropriations of water from May 1 through November 15. While there is an exemption in WAC 173-514 for single domestic in-house use if no other source is available, Ecology has determined that the cumulative impact of the existing diversions under the existing water rights is resulting in harmful impacts to Kennedy Creek and its fisheries and the cumulative impact of existing diversions exceeds the available flow in Kennedy Creek during the WAC closure period, preventing any new water allocations from Summit Lake. Parcel owners may elect to install a permit exempt well in an attempt to find a sustainable water source, but that is likely to result in very deep “dry holes” due to inability to access groundwater. In 1992, there were 139 active surface water permits and certificates on Summit Lake, which Ecology agreed to issue as temporary permits with

	the condition that these rights be relinquished when a public water supply became available. Combined with the 193 temporary permits since 1992, there are 332 total known existing diversions of Lake water. Thurston County and Ecology independently determined that the +600 lots surrounding Summit Lake number greater than the permits on record. These include upland lots that require easements from lakefront property owners to install pumps and water lines. Thurston County has also provisionally identified up to 73 lots with possible permit-exempt wells. Note that the Streamflow Restoration Act does not apply to surface water withdrawals where a water right permit is required. Most Summit Lake water use is therefore not permit-exempt. In addition to water offset benefits, an important driver for the project is the toxicity of potential drinking water used by residents of Summit Lake. Water quality advisories have been issued for Summit Lake residents relying on surface water in 2014, 2016, 2017, 2018, 2019 and 2020. The concerns centered around detections of anatoxin-a above public health advisory concentrations. Anatoxin-a is a potent neurotoxin that is fast-acting and can cause serious illness or death. During health advisories issued in the above years, Thurston County Public Health and Social Services recommends that residents do not drink the lake water. The state advisory level for Anatoxin-a is one microgram per liter. These recurring lake advisories associated with detections of anatoxin-a in laboratory-analyzed surface water samples are now nearly annual. They have raised additional concerns about the reliability of Summit Lake as a safe source of drinking water for residents. During health advisories, the Boy Scouts of America have often donated water from their Camp Thunderbird well to supply some resident needs. **Major Project Elements** • **Conduct a feasibility study to determine the best alternative water source.** Pumping tests, sampling, and permitting research. • **Engineering feasibility study of production and water quality for the appropriate water source,** to develop an engineering basis and approximate costs for the alternative water supply. A crucial engineering feasibility cost-tradeoff analysis is required because of known prior limitations on well yield. • **Community outreach** will be an important element of evaluating cost-benefit tradeoffs because resident acceptance rates in the Summit Lake vicinity will likely be less than 100% (based on prior outreach efforts). This could also include educational aspects or working with residents to address their concerns. • **Identification of a process necessary to negotiate required water rights and any associated mitigation requirements** with the

	Department of Ecology. Relinquishment of some water right permits may be a part of this dialog. • **Identification and approval of a suitable funding mechanism(s).** • **Identification of next steps necessary for approvals of alternative water supply plan by local and state authorities.** • **Identification of financial impacts to residents**.
Description of Benefits:	**1. Potential water offset benefits from the project: 96.7 afy to 132.5 afy,** depending on multiple factors. Water offset benefits may be larger if demand reduction measures can be implemented successfully. 2. **Significant health risk reduction** and the improvement of public health outcomes by limiting surface water connections to Summit Lake at 235 homes. **3. Coho, steelhead, and cutthroat would benefit.** **4. Increased streamflows on Kennedy Creek.** 5. **Benefits are potentially scalable:** additional homes might be served if alternative water supply can be established. 6. **Dual permit/exempt benefits:** the proposed source substitution and re-configuration would include co-located benefits from both permit-required and permit exempt mitigation.
Is Water Quantity a Limiting Factor In this Subbasin?	The Department of Ecology has also noted that a water right comment letter dated January 2, 2018, from the Department of Fish and Wildlife (DFW), states that "…any further reduction in [Kennedy Creek] flows will be detrimental to production of coho, steelhead, and cutthroat and the cumulative impact of numerous small diversions from Summit Lake would reduce flow in Kennedy Creek." DFW further requests denial of applications for diversions of surface water from Summit Lake (see Attachment 1).
Location & Spatial Extent of Benefits:	Flows could be increased in Kennedy Creek from Summit Lake downstream to its confluence with Totten Inlet.
Anticipated Water Offset (if applicable):	**Reduction in demand for a water offset of 16.8 afy to 52.6 afy,** depending on the assessment assumptions and methodology (See Table 1), by restricting some types of outdoor water use (e.g. lawn watering). **Retirement of up to about 79.9 afy of permitted surface water rights at approximately 235 homes.** A source substitution would require about 54 afy pumping at a new downstream Group A wellfield, for a net water

	offset benefit of up to about 26 afy: (235 homes) x (0.34 afy/home median permitted water right) = (79.9 afy in estimated total permits). This calculation assumes that some method can be found to incentivize permit retirement. **Summary of total potential water offset benefits** from the project: 96.7 afy to 132.5 afy, depending on multiple factors. Water offset benefits may be larger if demand reduction measures can be implemented successfully.
Project-Type Specific Information	This project depends heavily on achieving sufficient new well yields downstream of Summit Lake or an alternative water source. Significant questions exist regarding pumping well production.
Estimated Project Cost:	Several million dollars, at minimum, for new source wells, engineering, permitting and new infrastructure.
Performance Goals & Measures:	Weather and lake water quality monitoring is already performed by Thurston County; however, additional monitoring is likely to be needed. (See: https://www.thurstoncountywa.gov/sw/Pages/monitoring-dashboard.aspx).
Anticipated Local and Partner Support & Barriers to Completion:	The Squaxin Island Tribe has indicated that it may support this project. Based on resident comments received in connection with similar proposals in the 1990s and again in 2018-2019, incentives and educational outreach may be required for residents to be supportive of alternative water supply solutions.
Project Sponsor, Implementation Start Date and End Date:	Thurston County may sponsor this project, depending upon Feasibility Study outcomes. The project will need a thorough assessment of well yields or other alternative water sources, a Report of Examination from a CWRE, plus additional hydrogeological, legal, financing, and engineering feasibility studies.

Appendix J – Project Inventory

WRIA 14 Project Inventory for Inclusion in the Watershed Restoration and Enhancement Plan

CATEGORIES (does not reflect prioritization)

I. Likely to be implemented and provides quantitative offset value (see Chapter 5).

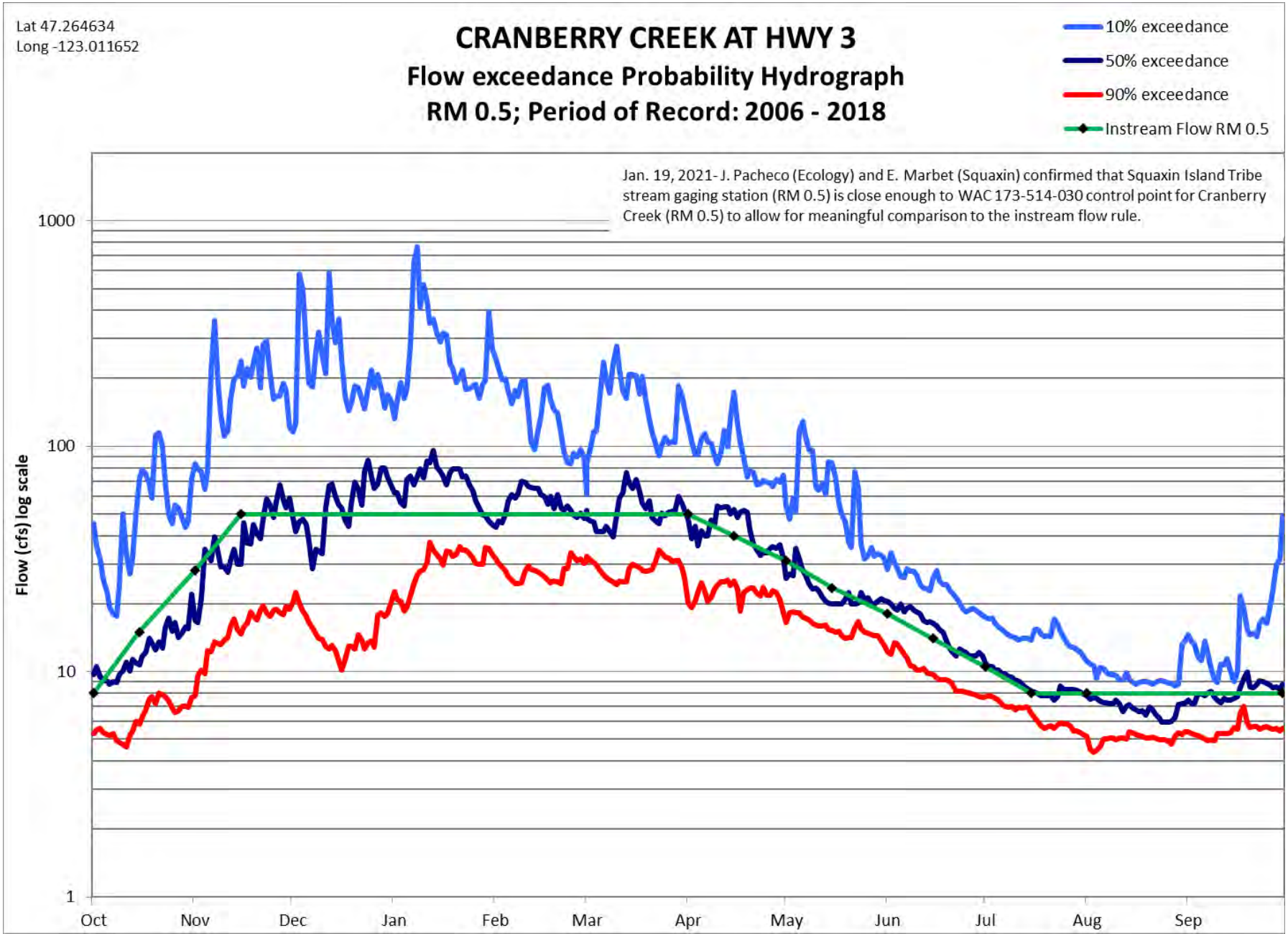
II. Likely to be implemented and provides habitat benefit and/or un-quantifiable streamflow benefit (See Chapter 5)

III. Unable to be implemented at this time because the project is highly conceptual or has other constraints.

Project inventory available online:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA14/Final%20Plan/WRIA14-WREC-FinalDraftPlan-Feb2021-AppendixJ.pdf

Appendix K – WRIA 14 Streamflow Statistics

The following information was prepared by Jim Pacheco (Department of Ecology) and Erica Marbet (Squaxin Island Tribe) for the WRIA 14 Committee for the purposes of this watershed plan.


Lat 47.264634
Long -123.011652
CRANBERRY CREEK AT HWY 3
Flow exceedance Probability Hydrograph
RM 0.5; Period of Record: 2006 - 2018
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 0.5
Jan. 19, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that Squaxin Island Tribe stream gaging station (RM 0.5) is close enough to WAC 173-514-030 control point for Cranberry Creek (RM 0.5) to allow for meaningful comparison to the instream flow rule.
Flow (cfs) log scale
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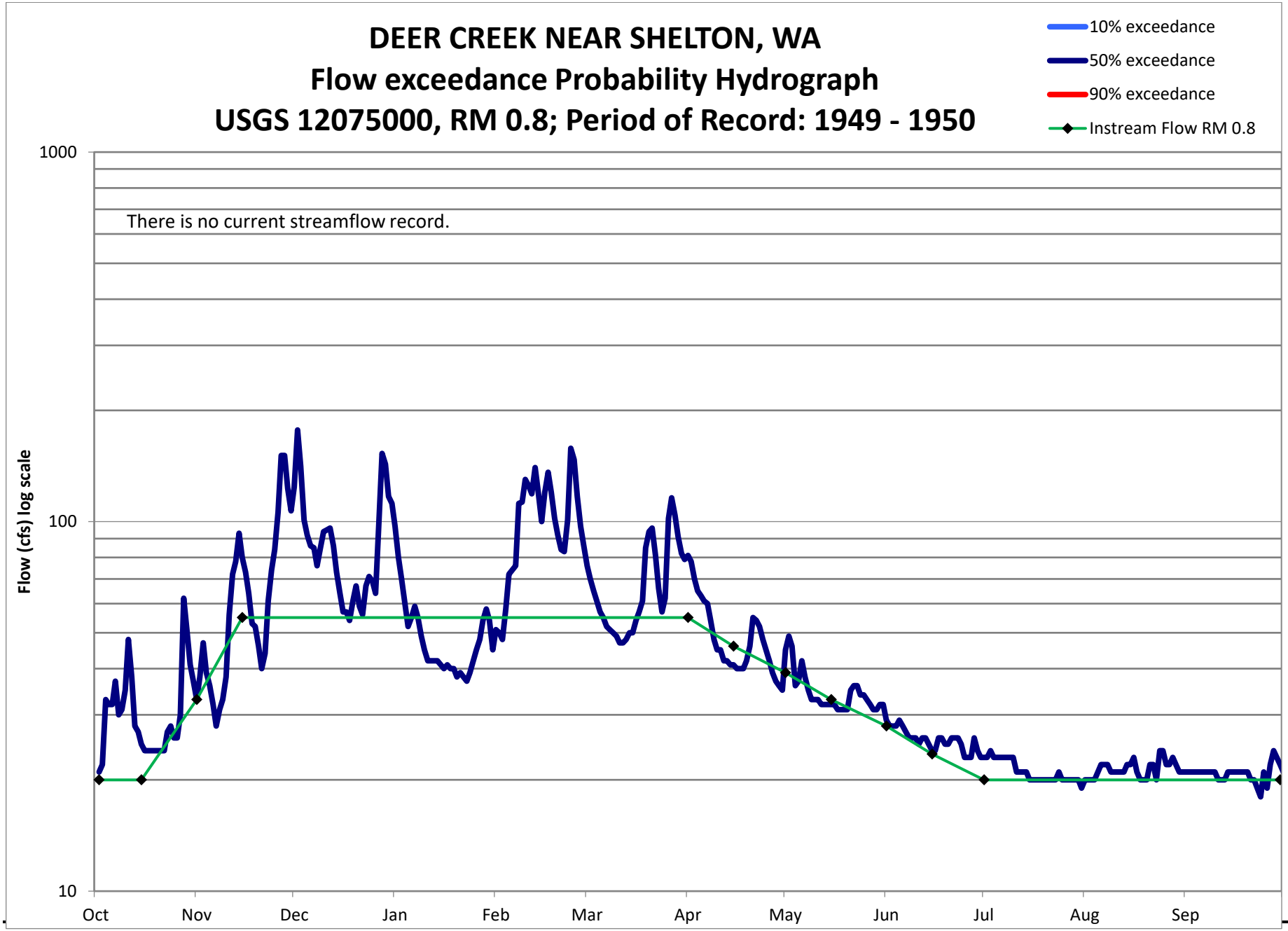
DEER CREEK NEAR SHELTON, WA
Flow exceedance Probability Hydrograph
USGS 12075000, RM 0.8; Period of Record: 1949 - 1950
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 0.8
There is no current streamflow record.
Flow (cfs) log scale
1000
100
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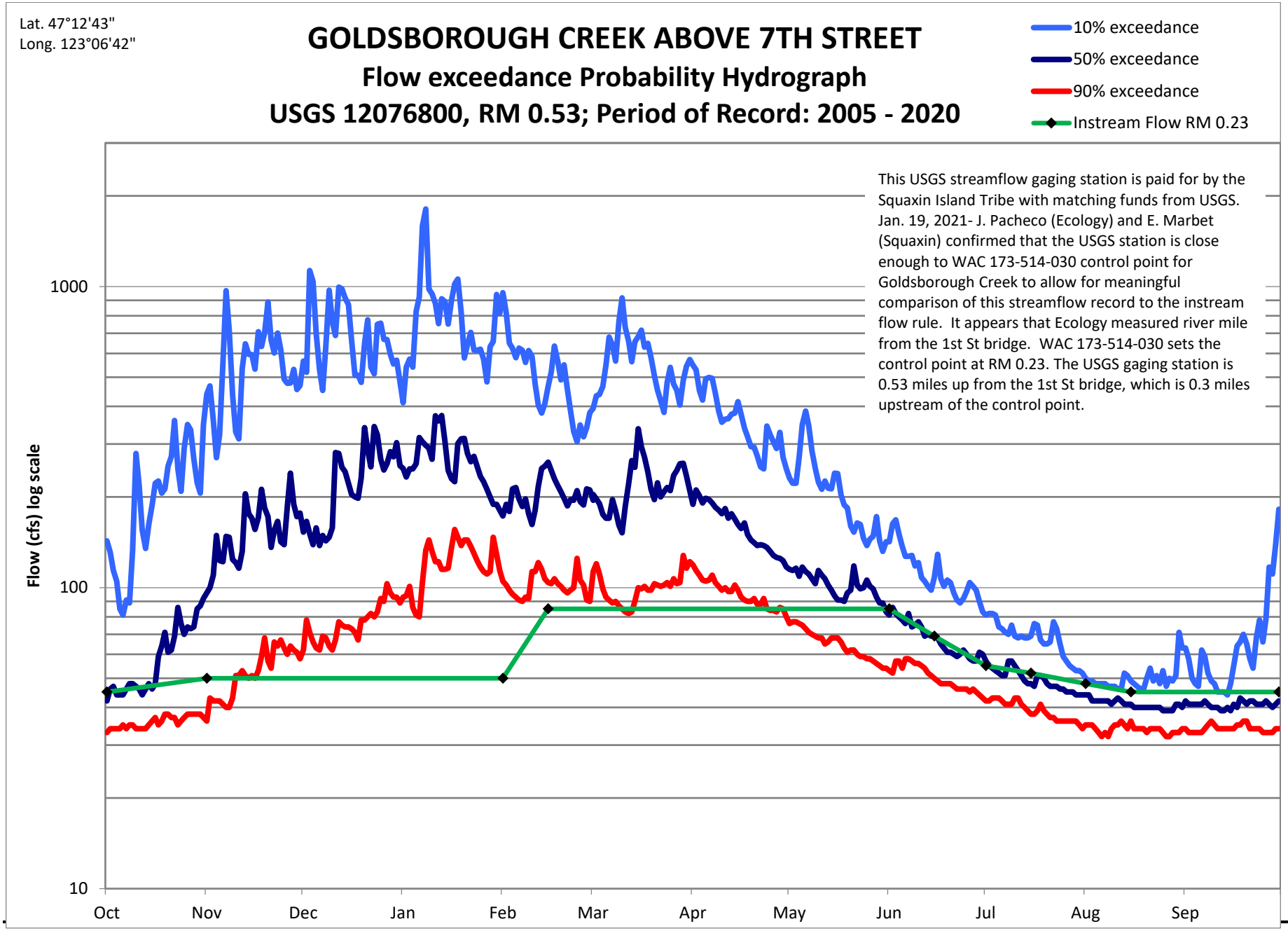
Lat. 47°12'43"
Long. 123°06'42"
GOLDSBOROUGH CREEK ABOVE 7TH STREET
Flow exceedance Probability Hydrograph
USGS 12076800, RM 0.53; Period of Record: 2005 - 2020
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 0.23
This USGS streamflow gaging station is paid for by the Squaxin Island Tribe with matching funds from USGS. Jan. 19, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that the USGS station is close enough to WAC 173-514-030 control point for Goldsborough Creek to allow for meaningful comparison of this streamflow record to the instream flow rule. It appears that Ecology measured river mile from the 1st St bridge. WAC 173-514-030 sets the control point at RM 0.23. The USGS gaging station is 0.53 miles up from the 1st St bridge, which is 0.3 miles upstream of the control point.
Flow (cfs) log scale
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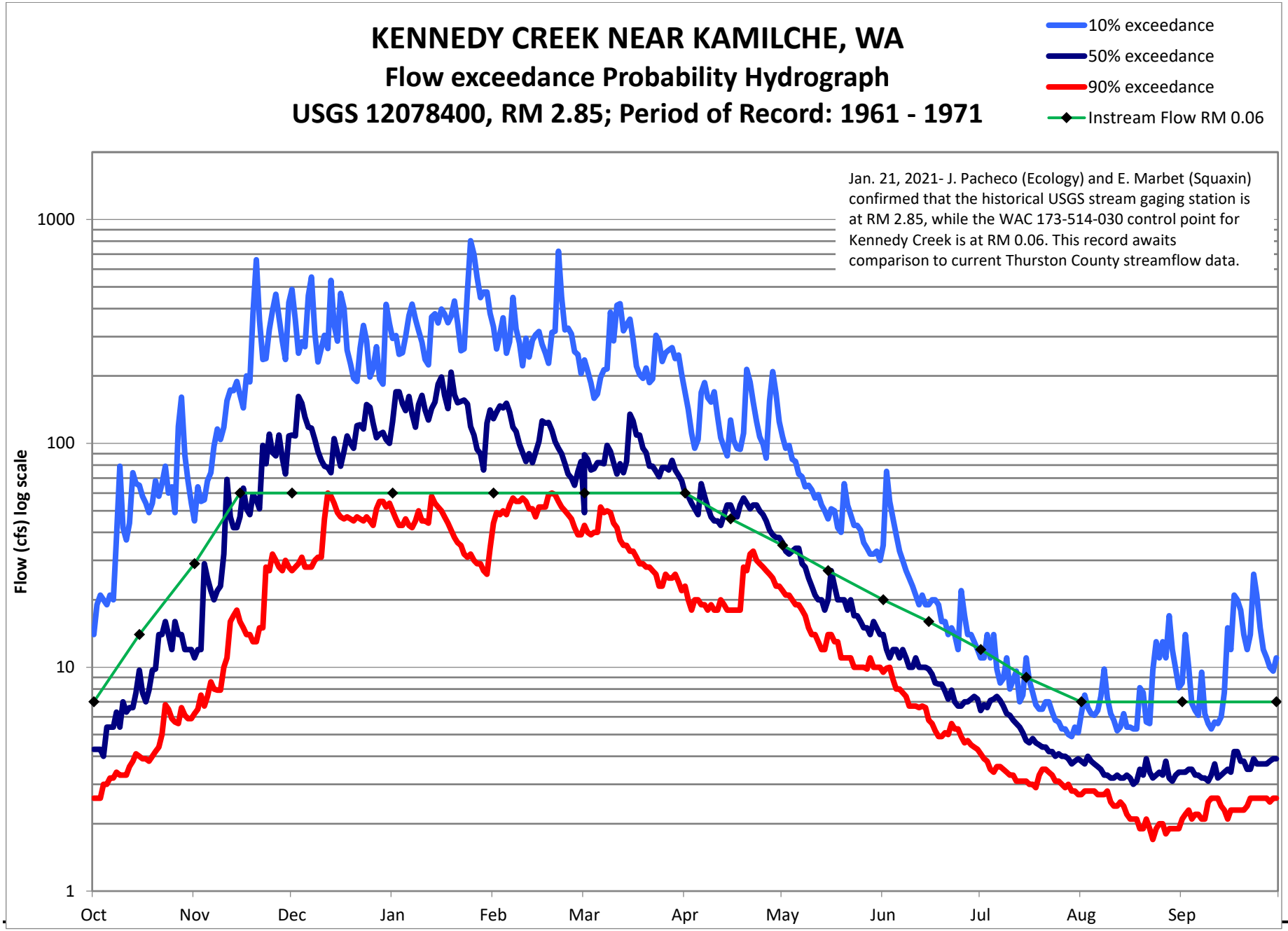
KENNEDY CREEK NEAR KAMILCHE, WA
Flow exceedance Probability Hydrograph
USGS 12078400, RM 2.85; Period of Record: 1961 - 1971
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 0.06
Jan. 21, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that the historical USGS stream gaging station is at RM 2.85, while the WAC 173-514-030 control point for Kennedy Creek is at RM 0.06. This record awaits comparison to current Thurston County streamflow data.
Flow (cfs) log scale
1000
100
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Nov
Dec
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Jun
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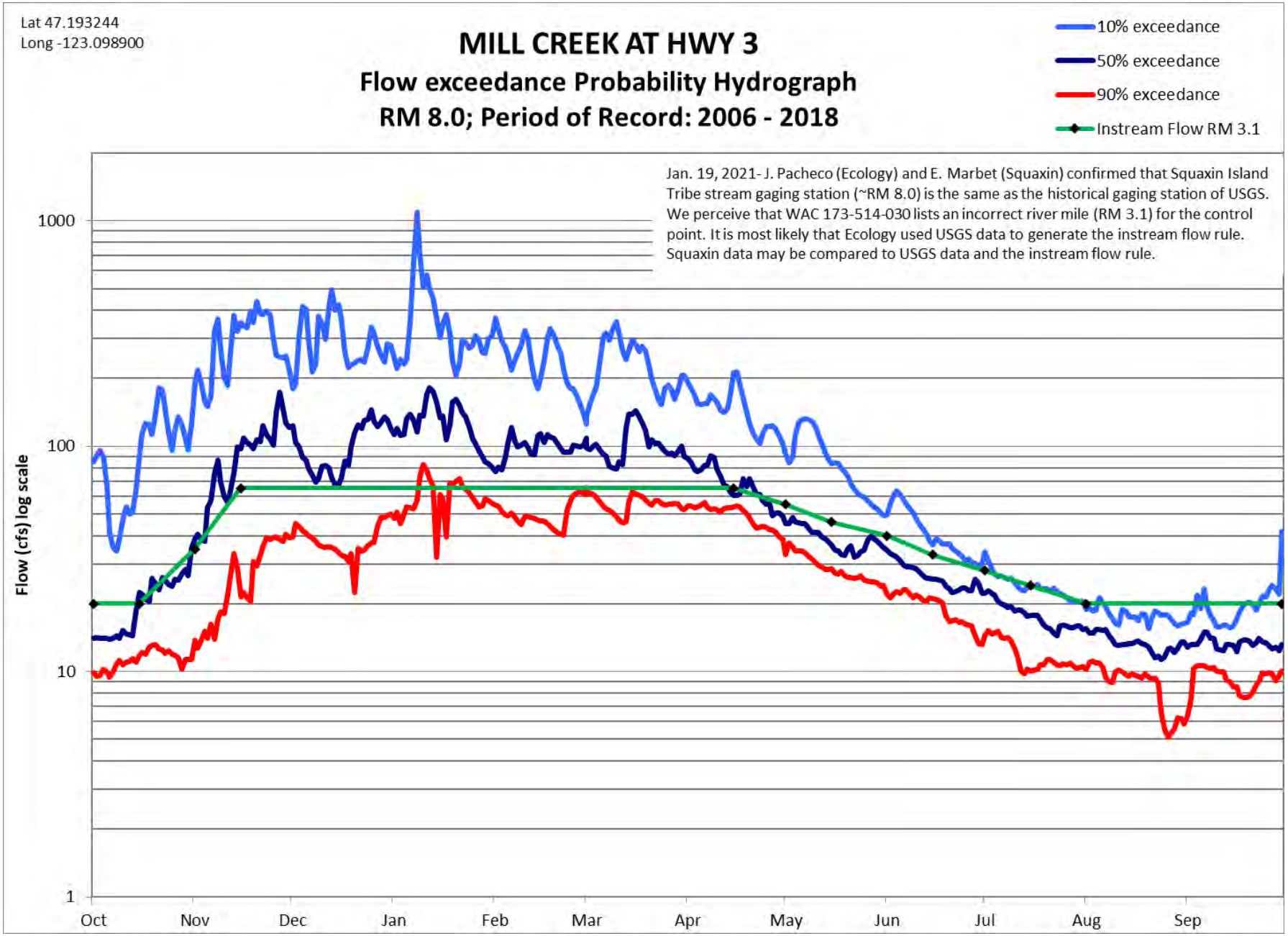
Lat 47.193244
Long -123.098900
MILL CREEK AT HWY 3
Flow exceedance Probability Hydrograph
RM 8.0; Period of Record: 2006 - 2018
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 3.1
Jan. 19, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that Squaxin Island Tribe stream gaging station (~RM 8.0) is the same as the historical gaging station of USGS. We perceive that WAC 173-514-030 lists an incorrect river mile (RM 3.1) for the control point. It is most likely that Ecology used USGS data to generate the instream flow rule. Squaxin data may be compared to USGS data and the instream flow rule.
Flow (cfs) log scale
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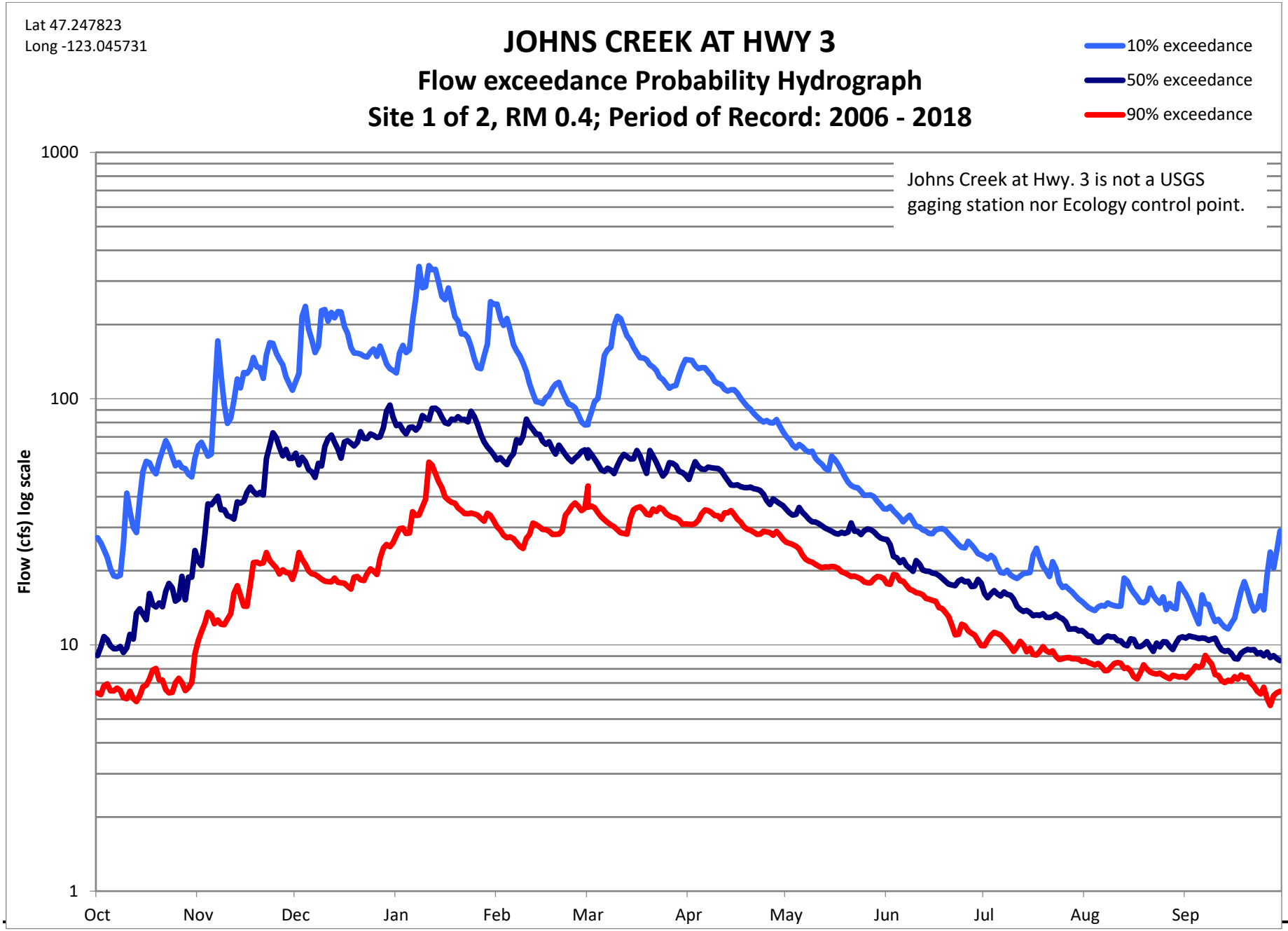
Lat 47.247823
Long -123.045731
JOHNS CREEK AT HWY 3
Flow exceedance Probability Hydrograph
Site 1 of 2, RM 0.4; Period of Record: 2006 - 2018
10% exceedance
50% exceedance
90% exceedance
Johns Creek at Hwy. 3 is not a USGS gaging station nor Ecology control point.
Flow (cfs) log scale
1000
100
10
1
Oct
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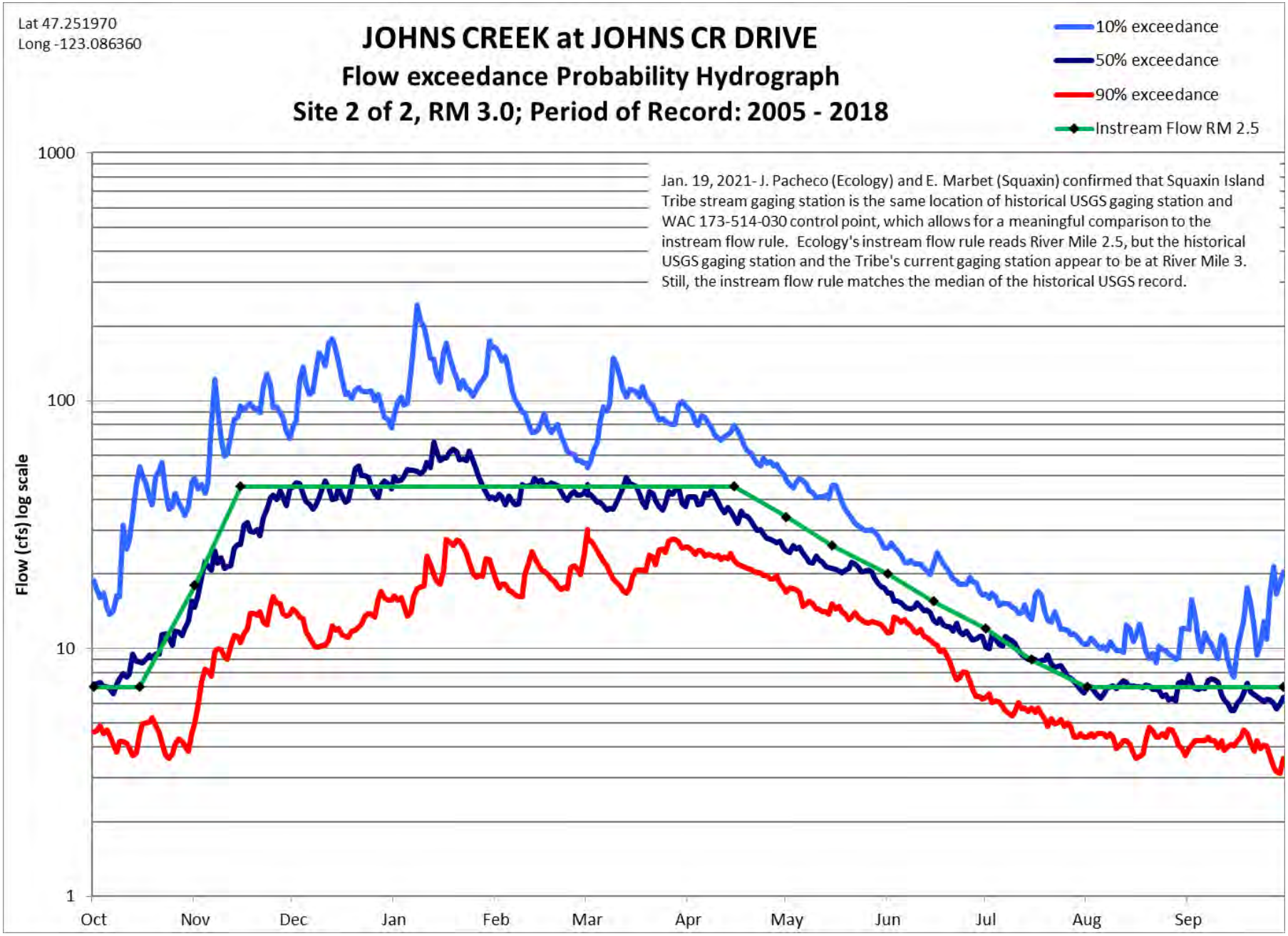
Lat 47.251970
Long -123.086360
JOHNS CREEK at JOHNS CR DRIVE
Flow exceedance Probability Hydrograph
Site 2 of 2, RM 3.0; Period of Record: 2005 - 2018
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 2.5
Jan. 19, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that Squaxin Island Tribe stream gaging station is the same location of historical USGS gaging station and WAC 173-514-030 control point, which allows for a meaningful comparison to the instream flow rule. Ecology's instream flow rule reads River Mile 2.5, but the historical USGS gaging station and the Tribe's current gaging station appear to be at River Mile 3. Still, the instream flow rule matches the median of the historical USGS record.
Flow (cfs) log scale
1000
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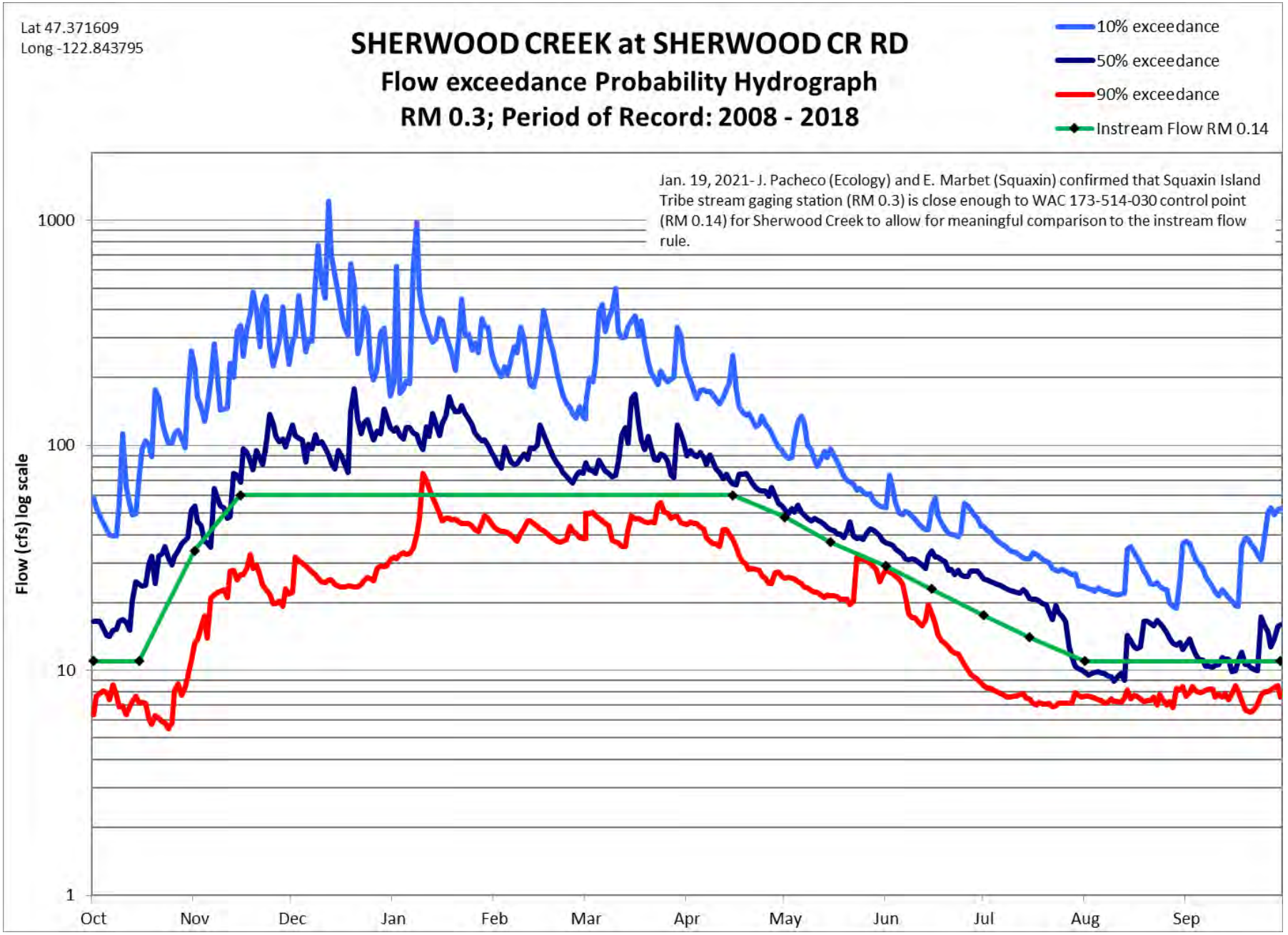
Lat 47.371609
Long -122.843795
SHERWOOD CREEK at SHERWOOD CR RD
Flow exceedance Probability Hydrograph
RM 0.3; Period of Record: 2008 - 2018
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 0.14
Jan. 19, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that Squaxin Island Tribe stream gaging station (RM 0.3) is close enough to WAC 173-514-030 control point (RM 0.14) for Sherwood Creek to allow for meaningful comparison to the instream flow rule.
Flow (cfs) log scale
1000
100
10
1
Oct
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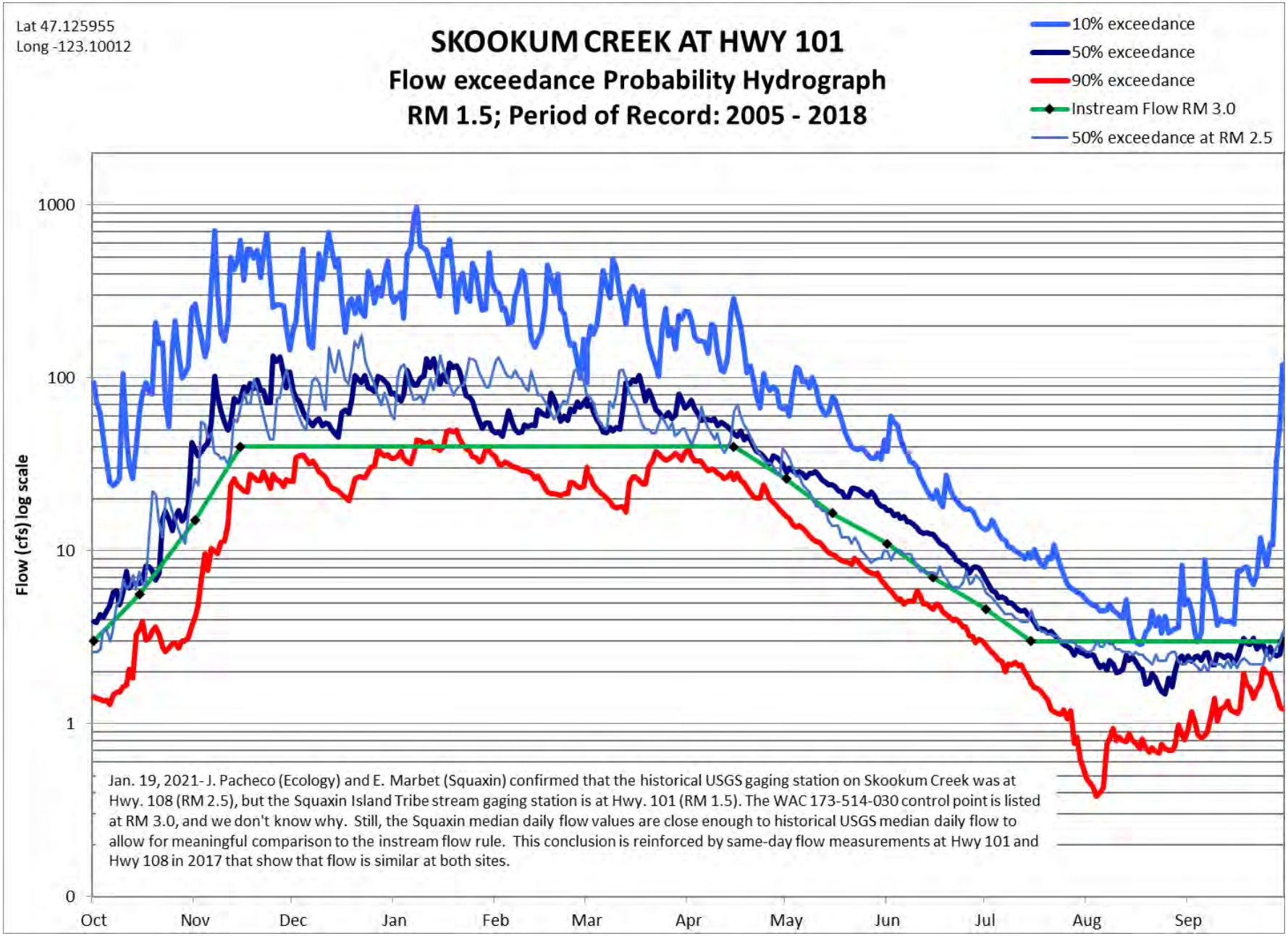
Lat 47.125955
Long -123.10012
SKOOKUM CREEK AT HWY 101
Flow exceedance Probability Hydrograph
RM 1.5; Period of Record: 2005 - 2018
10% exceedance
50% exceedance
90% exceedance
Instream Flow RM 3.0
50% exceedance at RM 2.5
Flow (cfs) log scale
1000
100
10
1
0
Oct
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Jan. 19, 2021- J. Pacheco (Ecology) and E. Marbet (Squaxin) confirmed that the historical USGS gaging station on Skookum Creek was at Hwy. 108 (RM 2.5), but the Squaxin Island Tribe stream gaging station is at Hwy. 101 (RM 1.5). The WAC 173-514-030 control point is listed at RM 3.0, and we don't know why. Still, the Squaxin median daily flow values are close enough to historical USGS median daily flow to allow for meaningful comparison to the instream flow rule. This conclusion is reinforced by same-day flow measurements at Hwy 101 and Hwy 108 in 2017 that show that flow is similar at both sites.

Appendix L – Mason County PUD #1 Water Consumption Data

Appendix M – Policy Recommendation Proposals

Name: Upgrade Well Reporting

Entity: Squaxin Island Tribe

Type of policy idea (see list below): Information process improvement

Description of policy idea (a short abstract)**:**

1. *Identify the potential implementers and other key players.*
    a. Ecology
2. *Describe proposed actions (including current policies or codes, existing programs and their limitations, problems to be corrected, etc.).*
    a. See attached document "Proposed Improvements to the Department of Ecology's Well Reporting Processes"
3. *Identify who the action impacts (if different than primary implementer).*
    a. Well drillers, all users of well database information
4. *Describe benefits and challenges/obstacles.*
    a. Benefits: better well location data; streamlined data collection and uploading; improved data access
    b. Challenges: requires resources for development, roll-out, and training.

Description of purpose:

1. *How would this recommendation enhance the WRIA 14 plan? Describe the desired result and its purpose in this plan (we want to be clear how this relates to offsetting impacts from PEW OR be explicit that this is a benefit to the watershed even if not directly related to PEW impacts).*
    a. Accurate well data is critical for all parties to make water management decisions that are protective of the environment and beneficial to communities. Improvements in the quality of well data in Washington State are essential for monitoring and management of shared water resources in the State of Washington. This supports the goals of the Plan.
    b.

Description of concerns:

1. *What, if any, concerns with this policy idea have WRIA 14 members expressed or that you anticipate?*
    a. None anticipated, other than perhaps the allocation of limited resources.
2. *If you have discussed this with concerned members, what was the result of those discussions?*
    a. Concept has been discussed, with general support.
3. *Are there other potential downsides or objections to the proposal that you anticipate?*

a. None anticipated.

4. *In what ways does your proposal address those concerns?*
    a. Proposal stands by itself. Investment in this improvement in the short term will have long-term benefits.

Cost and funding sources:

1. *What elements of the proposal are likely to require funding?*
    a. Platform development, testing, roll-out, and user training and support
2. *Provide a rough cost estimate (if known) and discuss potential funding sources and whether funding is one time or ongoing.*
    a. Not yet known.
3. *Explain costs to other affected parties besides implementing regulators (for example: costs will increase for well drilling or new requirements on homeowners/home builders).*
    a. There may be a small cost to well drillers for technology.

Proposed Improvements to the Department of Ecology's Well Reporting Processes: The "Upgrade Well Reporting" Proposal

Developed by the Squaxin Island Tribe in consultation with Ecology's Well Construction and Licensing Office

Contributors: Ecology - Joe Witczak, Scott Malone, and Tara Roberts
Squaxin Island Tribe - Erica Marbet

Final Draft May 28, 2020

Purpose:
Accurate well data is critical for all parties to make water management decisions that are protective of the environment and beneficial to communities. The quality of well data in Washington State can be improved with changes to how the State collects information from drillers. These improvements are essential for monitoring and management of shared water resources in the State of Washington.

Background:
In 2018, at the request of the Squaxin Island Tribe, Ecology assigned staff to assess the accuracy of water well location reporting in Mason County. The project checked 187 water well reports (2.1% of the 8,910 water well reports from the county). Ecology uses the Public Land Survey system (PLS) to record well locations by township, range, section, quarter and quarter-quarter. Currently wells are mapped by 40-acre quarter-quarter centroids on the State Well Report Viewer. The results showed that 79% of well locations could be verified with the information on the report. Of those that could be verified, 33% had incorrectly reported PLS locations. Ecology performed a similar, statewide assessment of well location data and found a 24% error rate for all types of regulated wells.

As Tribes utilize Ecology's well report database frequently, tribal staff would benefit by improving well location data management and processes. In discussions between Ecology, Squaxin, and Mason County, all agreed that improvements to Ecology's well reporting processes could help reduce the error in water well location reporting.

Ecology is eager to expand their web-based well reporting options. In 2019, Ecology surveyed well drillers to determine their preferences regarding format and features. Of 133 respondents, 63% placed a high importance on a new well location mapping tool that would use recent aerial imagery to determine a well's PLS location and coordinates. Only 6% responded that this effort would be of low importance. These results showed drillers preferred to submit well reports from a web form in the current well report format.

We propose the following changes to Ecology's well data processes:

1. **New well location mapping tool for drillers**
   An interactive web-based mapping tool that provides an intuitive means of determining PLS location has been implemented in Oregon recently. Ecology is interested in developing their own web tool which provides the PLS and coordinates location (latitude/longitude) for a new well automatically. The Notice of Intent web form would shell into a new GIS application utilizing recent aerial imagery, a parcel overlay, and a tool that updates the quarter-quarter and coordinates on the NOI. The well driller need only click on the interactive map to generate a well location. When a driller finishes a well report, they can utilize the same tool to refine their coordinates and PLS location.

2. **Require coordinates on well reports**
   Coordinates can perfectly describe a well location within a parcel. Adding latitude and longitude on well reports will serve to verify a well's location on the ground accurately and easily. Ecology intends to require well coordinates on reports, though a WAC change may eventually be needed.

3. **New web-based well reporting application**

- Ecology is determining the best approach for implementing a new web-based well reporting application. According to a recent survey of drillers and their support staff, a web-form mimicking the current well report forms that uploads directly to Ecology's database is desired. The benefits of using a web-based well reporting process are numerous:
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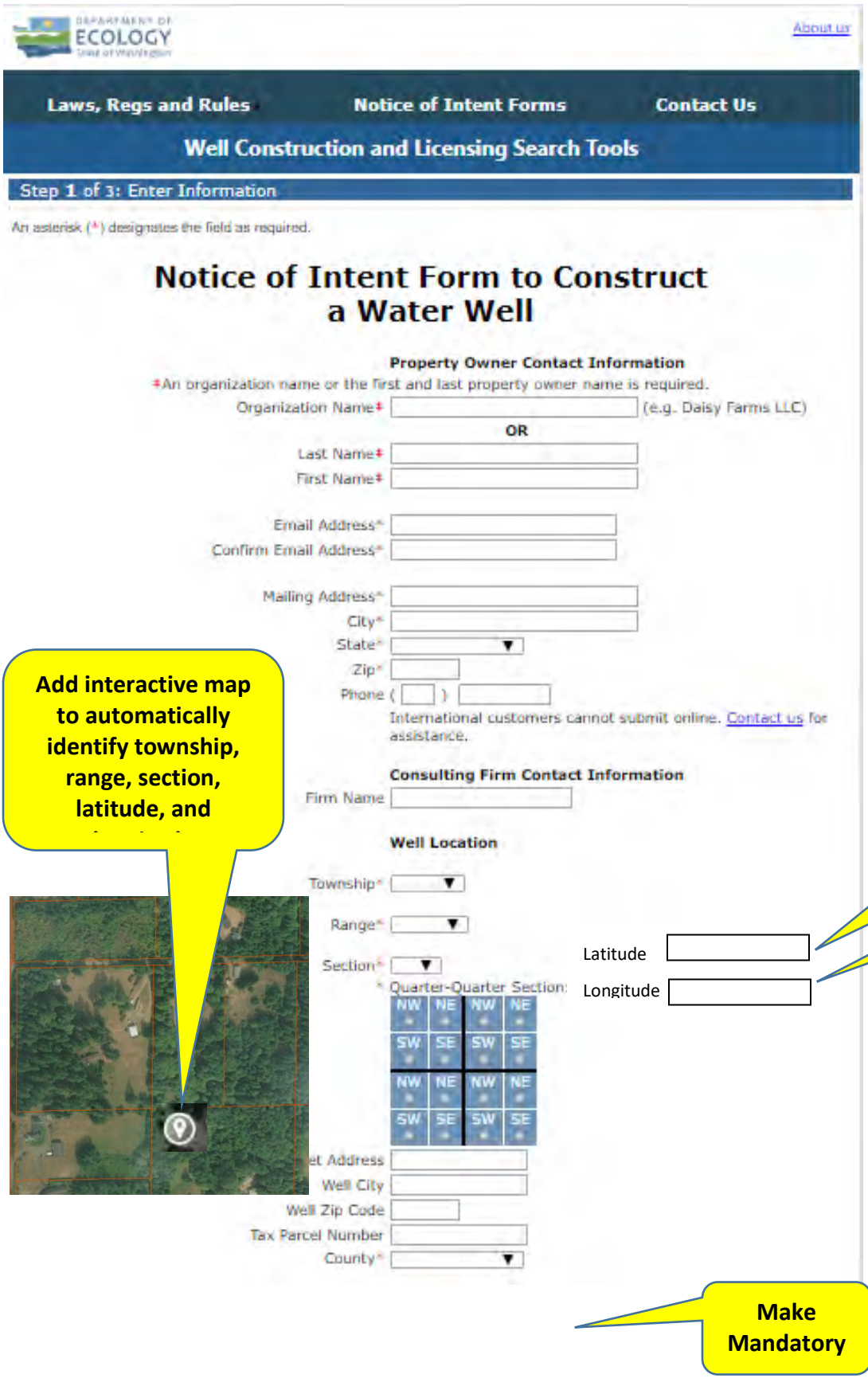
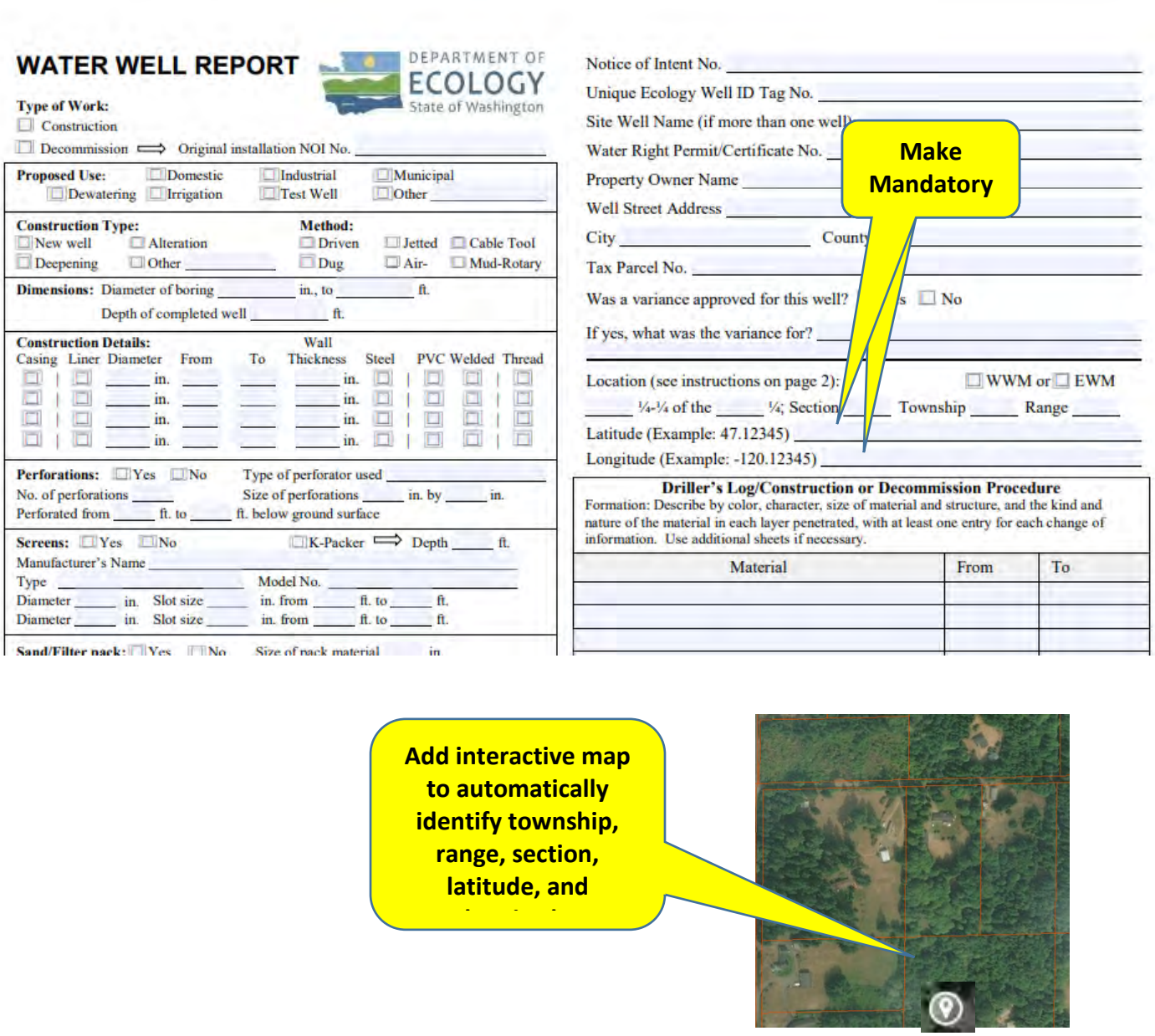
    - Less backlog of scanning and data entry - more time for Ecology staff to vet well reports
    - Legible text, fewer written responses
    - Digitizing all well report data, not just the fields that were captured by Ecology staff during the scanning process
    - A smart form format can eliminate out-of-range entries
    -
- By capturing digitized well location data, it would be feasible in the future to automate the process of verifying well locations and water right information. Tracking well location and permit-exempt wells is a need of users who download geospatial datasets from Ecology's GIS data page (https://ecology.wa.gov/Research-Data/Data-resources/Geographic-Information-Systems-GIS/Data)

The Well Construction and Licensing Office at Ecology needs more capacity to vet well reports. Automation from web-based reporting would free up staff to do more vetting, because the office's staff would not have to do as much scanning of paper documents and manual entry of data fields for each report. They need more automation, not FTEs.
https://appswr.ecology.wa.gov/wellconstruction/Wells/NoticeOfIntentForm.aspx?form=noiwaterwellform


About us
Laws, Regs and Rules
Notice of Intent Forms
Contact Us
Well Construction and Licensing Search Tools
Step 1 of 3: Enter Information
An asterisk (*) designates the field as required.
Notice of Intent Form to Construct a Water Well
Property Owner Contact Information
*An organization name or the first and last property owner name is required.
Organization Name*
(e.g. Daisy Farms LLC)
OR
Last Name*
First Name*
Email Address*
Confirm Email Address*
Mailing Address*
City*
State*
Zip*
Phone ( )
International customers cannot submit online. Contact us for assistance.
Consulting Firm Contact Information
Firm Name
Well Location
Township*
Range*
Section*
* Quarter-Quarter Section:
NW NE NW NE
SW SE SW SE
NW NE NW NE
SW SE SW SE
et Address
Well City
Well Zip Code
Tax Parcel Number
County*
Latitude
Longitude
Add interactive map to automatically identify township, range, section, latitude, and
Make Optional
Make Mandatory

https://fortress.wa.gov/ecy/publications/documents/ecy050120.pdf



Change this water well report into a web form.