Watershed Restoration and Enhancement Plan

WRIA 13
Deschutes Watershed

Final Draft Plan
March 18, 2021

DEPARTMENT OF ECOLOGY
State of Washington

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Acknowledgements

This watershed plan was written as a collaboration between the Department of Ecology, the WRIA 13 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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[1]No longer at entity.

[2]No longer on Committee

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 chair local planning Committees to develop Watershed Restoration and Enhancement Plans that identify projects necessary 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 to collaborate with tribes, counties, cities, state agencies, and other entities and interests in the Deschutes watershed, also known as Water Resource Inventory Area (WRIA) 13. The WRIA 13 Committee met for over 2 years to develop a watershed plan.

As required by the law, and to allow for meaningful analysis of the relationship between new consumptive use and offsets, the WRIA 13 Committee divided the watershed into nine 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 2,616 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 2,616 PE well connections. The projected new consumptive water use associated with the new PE well connections is 435 acre-feet per year in WRIA 13, which the Committee determined to be the "most likely" estimate. This equates to 0.6 cubic feet per second (cfs) or 388,343 gallons per day (gpd) This watershed plan also presents a higher consumptive use estimate as a goal to achieve through adaptive management and project implementation of 513 acre-feet per year (0.7 cfs or 457,977 gallons per day) in order to support streamflows.

This watershed plan includes projects that provide an anticipated offset of 1,316 acre-feet per year to benefit streamflows and enhance the watershed. Additional projects in the plan include benefits to fish and wildlife habitat, such several thousand feet of streambed improvements, dozens of acres of restoration and protection, and many miles of riparian restoration across WRIA 13.

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[2] Some members of the WRIA 13 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.

Out of the 9 subbasins identified by the Committee, 4 subbasins have anticipated project offsets that exceed both the most likely and higher consumptive use estimates; 1 subbasin has anticipated project offsets that do not meet either the most likely or the higher consumptive use estimate; and, 4 subbasins do not have any offset projects identified.

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 fifteen 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 the development of an ongoing implementation group (Deschutes Watershed Council) to support implementation, a tracking and reporting structure to assess progress and make adjustments as needed, and a funding mechanism to adaptively manage implementation.

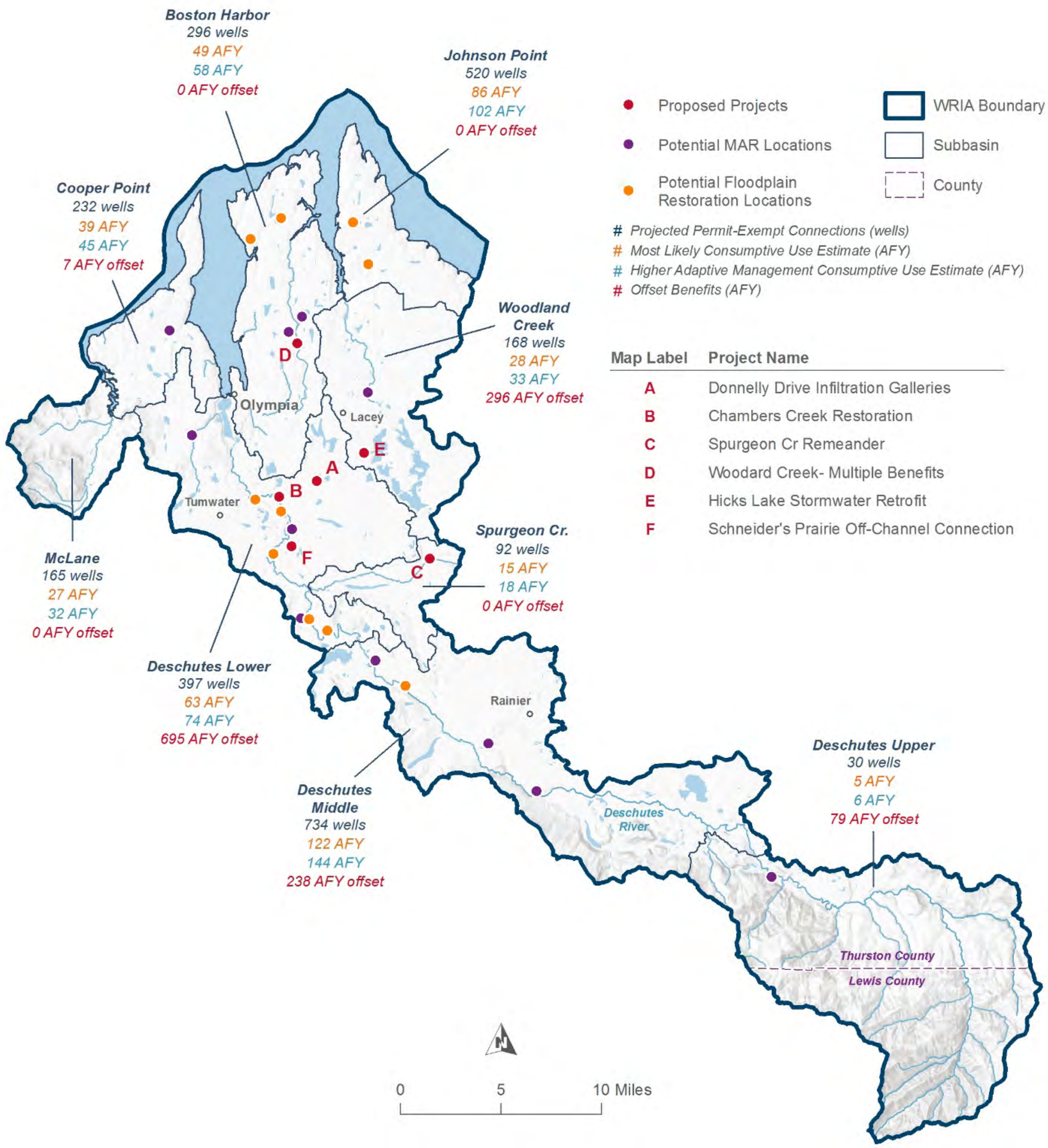

Figure ES 1: Summary of findings of the WRIA 13 Watershed Restoration and Enhancement Plan, including estimates for new domestic permit exempt well growth, consumptive use estimates, and project offset benefits.

Chapter One: Plan Overview

1.1 Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 13 Watershed Restoration and Enhancement Plan is to identify projects and actions necessary to offset the impacts of new domestic permit-exempt wells to streamflows, and provide improved habitat for the recovery of threatened and endangered salmonids. The watershed restoration and enhancement plan is one requirement of RCW 90.94. Watershed restoration and enhancement plans must, at a minimum, 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. WRIA 13 watershed restoration and enhancement plan (watershed plan) considers priorities for salmon recovery and watershed recovery, while ensuring it meets the provisions 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 13 Committee, by completing the watershed plan, has developed, and reached 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 watershed's hydrology, hydrogeology, and streamflow;
3. Summary of the subbasins,
4. Growth projections and consumptive use estimates;

[3] Some members of the WRIA 13 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 13 Committee are described in the Operating Principles in Appendix D.

5. Description of the recommended actions and projects identified to offset the future permit-exempt domestic water use in WRIA 13;

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 13 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 subdivision approvals and building permits for homes intending to use a permit-exempt well for their domestic water supply. The law also requires local watershed planning in fifteen WRIAs, including WRIA 13.[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 13 and are summarized in brief here for the purpose of providing context for the WRIA 13 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 and is subject to state water law.[6] Even though a water right 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

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[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] More information on water availability is available on the Department of Ecology's website: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability.

applicant must satisfy the provisions of RCW 19.27.097 for what constitutes evidence of an adequate water supply.

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 “junior” rights can be curtailed. Seniority is established by priority date — the original 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 “junior” permit exempt water users when they interfere with older, “senior” water rights, including instream flow rules.

RCW 90.94.030 adds to the management regime for new homes using domestic permit-exempt well withdrawals in WRIA 13 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 13 to a maximum annual average of up to 950 gallons per day 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. In addition, Ecology may limit these withdrawals to 350 gpd when an emergency drought order is issued. Ecology has published its interpretation and implementation of RCW 19.27.097 and RCW 90.94 in Water Resources POL 2094 (Ecology 2019a). The WRIA 13 Committee directs readers to 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 13. In doing so, it sets the minimum standard of Ecology’s collaboration with the WRIA 13 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 13 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[7]. In establishing the primary purpose of this watershed plan, RCW 90.94.030 (3) also details both the required and recommended plan elements. Regarding the WRIA 13 Committee’s approach to selecting projects and actions, the law also

[7] 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)

speaks to "high and lower priority projects." The WRIA 13 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 13 Committee that this watershed plan, if fully implemented 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 Deschutes watershed and develop a watershed restoration and enhancement plan (watershed plan) in collaboration with the WRIA 13 Committee. This resulted in a 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

Streamflow Restoration law RCW 90.94.030(3)

(a) The watershed restoration and enhancement plan should include recommendations for projects and actions that will measure, protect, and enhance instream resources and improve watershed functions that support the recovery of threatened and endangered salmonids. Plan recommendations may include, but are not limited to, acquiring senior water rights, water conservation, water reuse, stream gaging, groundwater monitoring, and developing natural and constructed infrastructure, which includes but is not limited to such projects as floodplain restoration, off-channel storage, and aquifer recharge. Qualifying projects must be specifically designed to enhance streamflows and not result in negative impacts to ecological functions or critical habitat.

(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.

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 include the following (pages 7-8):

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 13 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 13 Committee approve the plan prior to submission to Ecology for review for adoption. 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 13 Committee

1.3.1 Formation

The Streamflow Restoration law instructed Ecology to chair the WRIA 13 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. [8]
- 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 13 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 13 Committee.

The WRIA 13 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 13 Committee.[10]

Table 1: WRIA 13 Entities and Membership

Entity Name	Representing
Squaxin Island Tribe	Tribal government
Lewis County	County government
Thurston County	County government
City of Lacey	City government
City of Olympia	City government

[8] The City of Rainier was not able to participate as an active voting member on the WRIA 13 Committee due to staffing restraints; however, they remained informed of the plan development. The WRIA 13 Committee acknowledges that their participation is welcome for future implementation, and that future opportunities for projects may exist in the area of Rainier.

[9] There are no irrigation districts located in WRIA 13.

[10] All participating entities committed to participate in the process and designated representatives and alternates. The law did not require invited entities to participate, and some chose not to participate on the Committee.

Entity Name	Representing
City of Tumwater	City government
Public Utility District No. 1 of Thurston County	Largest publicly-owned water purveyor within WRIA 13that is not a municipality
Washington Department of Fish and Wildlife	State agency
Washington Department of Ecology	State agency
Thurston Conservation District	Agricultural interests
Building Industry Association of Washington (previous participation from Olympia Maser Builders)	Residential construction industry
Deschutes Estuary Restoration Team	Environmental interests
WRIA 13 Salmon Habitat Recovery Lead Entity (ex officio)	n/a
LOTT Clean Water Alliance (ex officio)	n/a
Nisqually Indian Tribe (ex officio)	n/a
City of Yelm (ex officio)	n/a
City of Tenino (ex officio)	n/a

The WRIA 13 Committee roster with names and alternates is available in Appendix C.

The WRIA 13 Committee invited the WRIA 13 Salmon Habitat Recovery Lead Entity, LOTT Clean Water Alliance, Nisqually Indian Tribe, City of Yelm, and City of Tenino 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 13 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 13 Committee held its first meeting in October 2018. Between October 2018 and January 2021 [UPDATE LAST MEETING DATE, IF NEEDED], the WRIA 13 Committee held 28 committee meetings open to the public. The WRIA 13 Committee met monthly, and as needed to meet deadlines. In March 2020, the COVID-19 pandemic restricted in-person meetings; from that time on, all Committee and workgroup meetings were held online.

The two and a half years of planning consisted of training, research, and developing plan components. Ecology technical staff, WRIA 13 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 13 Committee chair, Ecology staff provided administrative support and technical assistance, and contracted with consultants to provide facilitation and technical support for the WRIA 13 Committee. The facilitator supported the WRIA 13

Committee's discussions and decision-making, and coordinated recommendations for policy change and adaptive management. The technical consultants developed products that informed WRIA 13 Committee decisions and development of the 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. The technical consultants developed all of the technical memorandums referenced throughout this plan.

During the initial WRIA 13 Committee meetings, members developed and agreed to operating principles.[11] The operating principles set forward a process for meeting, participation expectations, procedures for voting, structure of the WRIA 13 Committee, communication, and other needs in order to support the WRIA 13 Committee in reaching agreement on a final plan.

The WRIA 13 Committee established technical, project, and policy workgroups to support planning efforts and to achieve specific tasks throughout plan development. The workgroups were open to all WRIA 13 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 13 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 13 Committee approve the final plan prior to Ecology's review,[12] it was important for the WRIA 13 Committee to identify a clear process for making decisions. The WRIA 13 Committee strived for consensus, and when consensus could not be reached, the chair and facilitator documented agreement and dissenting opinions. All agreements and dissenting opinions were documented in meeting summaries that were reviewed and agreed upon 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 13 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 13 Committee reached initial agreement on the final watershed plan, broader review and approval by the entities represented on the WRIA 13 Committee was

[11] Agreed upon operating principles can be found on the WRIA 13 Committee EZ View webpage.

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

sought as needed. The WRIA 13 Committee reached final agreement on the Watershed Restoration and Enhancement Plan on XX DATE 2021.

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 13

Water Resource Inventory Areas (WRIAs) are large watershed areas established in chapter 173-500 WAC for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeological regimes, levels of development, and variable natural resources. WRIA 13, also referred to as the Deschutes Watershed, is one of the 62 designated major watersheds in Washington State. The 270 square mile Deschutes Watershed is almost entirely within Thurston County, with only the headwaters of the Deschutes River in Lewis County (see Figure 1). The Deschutes River is the major hydrologic basin in WRIA 13, with a number of smaller independent tributaries that drain into four saltwater inlets: Nisqually Reach, Henderson, Budd, and Eld. Other principal streams include Woodard and Woodland Creeks, which are the largest of the major tributaries to Henderson Inlet (Haring et al. 1999). The Black lake catchment drains to both the Black River (WRIA 23) and Percival Creek (WRIA 13);however, for planning purposes, the Black Lake catchment was included in the Chehalis (WRIAs 22 and 23) Watershed Plan Update and not the WRIA 13 Watershed Plan.

2.1.1 Land Use in WRIA 13

Approximately 26 percent of the watershed is within a city or designated urban growth area. Much of the designated Urban Growth Areas for Olympia, Lacey, Tumwater and Rainier, along with agriculture, rural residential areas and commercial timberlands are within WRIA 13.

Rural residential development has primarily occurred in the unincorporated areas of Thurston County. The portion of the Deschutes Watershed that is in Lewis County is entirely comprised of forest land and is assumed to have no rural growth (Figure 1).

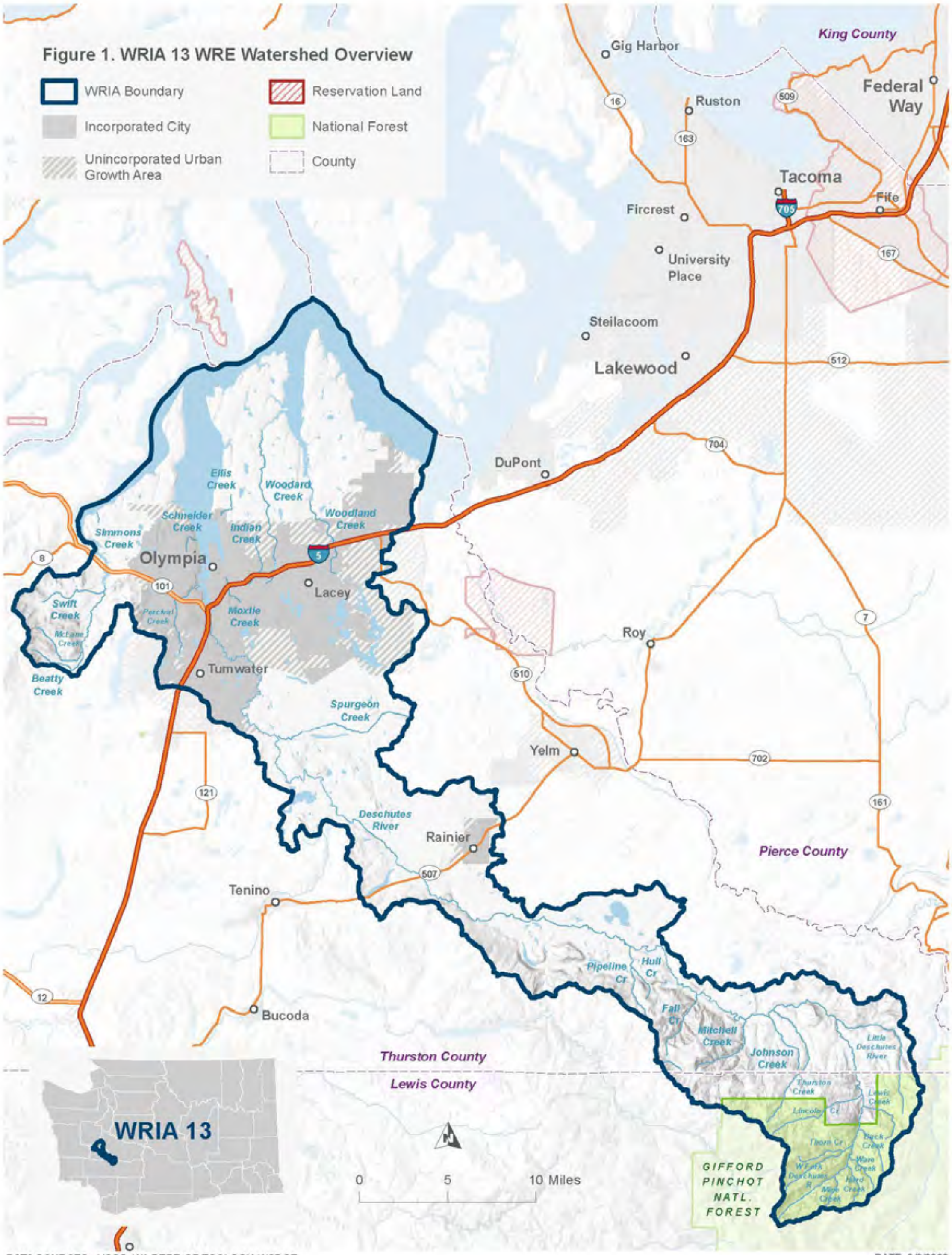

Figure 1: WRIA 13 WRE Watershed Overview

The upper third portion of the Deschutes Watershed is predominantly commercial timber production with some commercial and non-commercial agricultural ventures overlapping in the lower extent. The middle third of the watershed is comprised of commercial and non-commercial agriculture production with rural residences found throughout the mid-watershed and the outer peninsulas. Land use in the lower watershed, near the mouth of the Deschutes River and inner Budd Inlet is mostly urban, with residences along the shoreline of the three inlets (Haring et al. 1999).

2.1.2 Tribal Reservations and Usual and Accustomed Fishing Areas

The Squaxin Island Tribe holds reserved fishing rights in the Deschutes watershed under the 1854 Treaty of Medicine Creek. The Tribes hold Treaty-reserved water rights in WRIA 13 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 13 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.

2.1.3 Salmon Distribution and Limiting Factors

The Deschutes Watershed is an important and productive system for endangered and threatened salmonids. Anadromous salmonid spawning occurs from Tumwater Falls to Deschutes Falls. The Deschutes River and its tributaries often experience low streamflows during critical migration and spawning time. In addition, culverts, dams, and other flood control measures have further limited habitat along the streams in WRIA 13 (Haring et al. 1999). With changing weather patterns, summer flows are expected to change, causing an additional disruption to the salmon as they migrate, spawn and rear (NWIFC, 2016).

The Deschutes Watershed is one of diverse land uses. Industry, agriculture (including salmon fisheries), commercial facilities, and municipalities compete for a limited water supply, causing a strain on water availability, especially during low seasonal flows in productive salmonid streams. Many people depend on the salmon fishery for commercial, sport, and subsistence harvest. This includes tribes with usual and accustomed fishing areas that overlap with the Deschutes watershed, such as the Squaxin Island Tribe.

The Deschutes WRIA watersheds primarily support Chinook salmon, coho salmon, chum salmon, and winter steelhead (Tables 2 and 3). Chinook salmon, coho salmon, and winter steelhead are all listed as threatened.

Table 2: Anadromous Salmonid Species and Status in WRIA 13

Common Name	Scientific Name	Population[1]	Critical Habitat	Regulatory Agency Status
Puget Sound				
Chinook Salmon	Oncorhynchus tshawytscha	Puget Sound Chinook	Yes/2005	NMFS/Threatened/ 1999
Chum Salmon	*Oncoryhnchus keta*	Puget Sound Chum	No	Not listed
Coho Salmon	*Oncorhynchus kisutch*	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/1997
Winter Steelhead	*Oncoryhnchus mykiss*	Puget Sound Steelhead	Yes/2016	NMFS/Threatened/ 2007

Chinook salmon enter WRIA 13 streams in the late summer and fall and spawn through the fall (Table 3). Incubation occurs through the following winter. Juvenile rearing occurs throughout the spring and early summer, with smolt outmigration occurring shortly thereafter.

Coho salmon enter WRIA 13 streams in the fall and spawn through the winter and fall (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 13 streams in the late fall to early spring (Table 3). Incubation occurs through the late winter. Juvenile rearing and smolt outmigration occurs from that spring to early summer.

Winter steelhead enter WRIA 13 streams in the late fall through the following spring and spawn in the spring (Table 3). Incubation occurs through the following summer. Juvenile rearing occurs for over a year before smolt outmigration 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 the WRIA 13 Streams and Rivers

Salmonid Life History Timing in WRIA 13																										Subbasin Presence
Species	Freshwater Life Phase	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		
Chinook (fall)	Upstream migration												X	X	X	X	X	X	X	X	X					Woodland Deschutes Lower Deschutes Middle Deschutes Upper McLane Creek
	Spawning																	X	X	X	X	X				
	Incubation	X	X	X															X	X	X	X	X	X	X	
	Juvenile rearing	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
	Juvenile outmigration				X	X	X	X	X	X	X	X	X	X	X	X	X									
Coho	Upstream migration															X	X	X	X	X	X	X				All
	Spawning	X	X																X	X	X	X	X	X	X	
	Incubation	X	X	X	X	X	X	X	X												X	X	X	X	X	
	Juvenile rearing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Smolt outmigration					X	X	X	X	X	X	X	X	X	X											
Chum	Upstream migration																						X	X	X	Woodland Deschutes Lower McLane Creek Johnson Point Boston Harbor Cooper Point
	Spawning	X	X																				X	X	X	
	Incubation	X	X	X	X	X	X	X	X														X	X	X	
	Juvenile rearing				X	X	X	X	X	X	X	X	X	X												
	Juvenile outmigration				X	X	X	X	X	X	X	X	X	X												
Steelhead Trout (winter)	Upstream migration	X	X	X	X	X	X	X	X	X	X											X	X	X	X	Woodland Deschutes Lower Deschutes Middle Deschutes Upper McLane Creek Boston Harbor Cooper Point
	Spawning					X	X	X	X	X	X	X														
	Incubation					X	X	X	X	X	X	X	X	X	X	X										
	Juvenile rearing	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Smolt outmigration							X	X	X	X	X	X	X	X											

Salmonid habitat limiting factors have been defined by the Washington State Conservation Commission Limiting Factors Analysis (Haring and Konovsky 1999) and the Deschutes River Coho Salmon Biological Recovery Plan (Confluence 2015). Haring and Konovsky (1999) identified specific limiting factors for specific waterbodies, but also provide the following general themes throughout WRIA 13 streams and rivers on a multi-species basis:

- natural stream ecological processes have been significantly altered due to adjacent land management practices and direct actions within the stream corridor,
- fine sediment (<.85 mm) levels in the stream gravels regularly exceed the <12% level identified as representing suitable spawning habitat,
- lack of adequate large woody debris in streams, particularly larger key pieces that are critical to developing pools, log jams, and other habitat components important to salmonids,
- lack of adequate pool frequency and large, deep pools that are important to rearing juvenile salmonids and adult salmonids on their upstream migration,
- naturally high rates of channel movement in this geologically young basin, but further exacerbated rate of streambank erosion and substrate instability due to loss of streambank and riparian integrity, and alteration of natural hydrology,
- loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, lateral erosion, streambank stability, instream habitat conditions, etc.,
- the presence of a significant number of culverts/screens/dams/etc. that preclude unrestricted upstream or downstream access to juvenile and adult salmonids,
- significant alterations to the natural stream hydrology in streams where the uplands have been heavily developed, and the threat of similar impacts to streams that are experiencing current and future development growth, and
- estuarine/marine function is significantly impacted by physical alteration of the natural estuary, by poor water quality in the estuary, and by significant alteration of nearshore ecological function due to shoreline armoring.

2.1.4 Water System Distribution and Impacts in WRIA 13

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally. Surface water may be influenced by groundwater pumping such that flows are diminished. Group A and Group B water systems withdraw greater amounts of water and have more impact than PE wells. Group A systems generally have water rights and are regulated by the Department of Health. Group B systems often have permit-exempt wells and are regulated by counties. Within WRIA 13, there are approximately 151 Group A water systems, approximately 205 Group B water systems, and approximately 16,560 PE wells[13]. 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 (Ecology 1995). As required by RCW 90.94, this Plan includes projects and actions chosen by the Committee that are necessary 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 13

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 13 for decades. The Deschutes Planning Unit completed a draft watershed plan in October 2004, but were unable to reach consensus on the document. A brief summary of broad watershed planning efforts as they relate to the past, present, and future water availability in the Deschutes Watershed is provided in Section 2.2.1.

2.2.1 Current Watershed Planning Efforts in WRIA 13

The WRIA 13 watershed plan is building on many of the past and current efforts, including previous watershed planning efforts under RCW 90.82. Other efforts include the Local Integrating Organization (LIO) Alliance for a Healthy South Sound (AHSS)[14] ecological recovery plan[15], and salmon recovery planning by the WRIA 13 Salmon Habitat Recovery Lead Entity. 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.[16] The planning process to develop an ecosystem recovery plan is community-based with engagement by local, state and federal agencies. The AHSS has engaged the community in a collaborative planning process to help understand priorities and support the health and sustainability of the watershed.

The WRIA 13 Salmon Habitat Recovery Lead Entity is a collaboration of local governments, state, federal, and tribal partners, and nonprofit organizations focused on protecting and enhancing wild salmon populations. The Salmon Habitat Protection and Restoration Plan for WRIA 13 identifies and prioritizes projects that protect and restore habitat for salmonids that occur in the marine and freshwater environments of WRIA 13.

The AHSS and Salmon Recovery Lead Entity include many of the same organizations and individuals that participate in the WRIA 13 Watershed Restoration and Enhancement

[13] Estimates at the time of development of the watershed plan based on Ecology's well log database

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

[15] The AHSS boundaries include WRIA 13, except a small area in Lewis County which is not within a Local Integrating Organization.

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

Committee. This history of collaborative planning and shared priorities has supported the success of the watershed restoration and enhancement plan development in WRIA 13.

The Squaxin Island Tribe has been leading restoration planning for coho in the Deschutes River (NWIFC, 2016). Restoration planning included modeling coho habitat requirements, evaluation of existing habitat conditions, defining salmon habitat limiting factors, and recommendations for habitat restoration.

The Department of Ecology led an effort to develop a total maximum daily load (TMDL) for the Deschutes Basin to address multiple water quality parameters including temperature, fine sediment, and bacteria.[10] Coordinated efforts to reduce water temperatures and restore low flows in the watershed are directed through the establishment of the TMDL as summarized in the *Deschutes River Watershed Recovery Plan* (Schlenger et al. 2015). Actions to restore low flows are encouraged to increase coho production, in part through the improved water temperatures and instream flows, through efforts that focus on reduction in withdrawals and the establishment of total maximum daily loads. More information on TMDLs in WRIA 13 can be found in section 2.3.4 below.

The Public Water System Coordination Act of 1977[17] requires each water purveyor in a Critical Water Supply Service Areas (CWSSA) to update 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 13 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.[18]

Thurston County last updated their Coordinated Water System Plan (CWSP) in 1996, as mandated by the Public Water System Coordination Act of 1977. WAC 246-290-100 requires public water systems with more than 1,000 connections submit a water system plan for review and approval by the Department of Health (DOH) every ten years. Within Thurston County, this includes the water systems of Lacey, Tumwater, Olympia, Tanglewilde-Thompson Place, and Pattison.[19] This ensures that water system service areas are consistent with local growth management plans and development policies. Water system service areas and related policies determine whether new homes connect to water systems or rely on new permit-exempt domestic wells. While the CWSP boundary covers the cities in North Thurston County and some surrounding areas, it does not cover most rural areas.

2.2.2 Coordination with Existing Plans

[17] RCW 70.116.070

[18] Thurston County water system planning information is available at: https://www.thurstoncountywa.gov/planning/Pages/comp-plan.aspx

[19] North Thurston County Coordinated Water System Plan, 1996, WA State DOH Sentry Database

Throughout the development of the watershed plan, Ecology streamflow restoration staff have engaged with staff from the Salmon Habitat 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 WRIA 13 Committee chair conducted outreach to the WRIA 13 Salmon Habitat Recovery Lead Entity regarding coordination with the WRIA 13 Committee to ensure alignment of salmon recovery priorities and the streamflow planning process. Throughout the planning process, the WRIA 13 Committee has coordinated closely with the lead entity, including inviting the lead entity coordinator to take part as an ex-officio member on the WRIA 13 Committee, The WRIA 13 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.

Development of this plan also involved consideration of the Thurston County Comprehensive Plan, which is guided by the Growth Management Act and the Thurston County County-wide Planning Policies, a framework created in collaboration with the seven cities and towns within Thurston County. The Comprehensive Plan contains goals and policies to govern the unincorporated areas of Thurston County, and in turn, the Plan guides other specialized plans like the Joint plans for Urban Growth Areas, subarea plans, and other functional plans. The Comprehensive Plan also guides Development Regulations, Capital Facilities planning, land use permits, inter-local agreements, and other County programs, all with the main goal of effectively managing the county's physical growth. The committee used the Thurston County Comprehensive Plan as the basis for determining likely areas of future rural growth, conceptual projects, and implementation hurdles.

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 both the Puget Sound Lowlands and the Cascade Mountain Range. Reaching a maximum extent during the Vashon stage of the Fraser Glaciation approximately 13,500 years ago, an ice sheet advanced southward into present day Puget Sound (Drost et al. 1999). Multiple advances and retreats of the ice sheet formed the Puget Sound Lowlands, depositing a complex sequence of glacial and interglacial sediments.

The general geology of WRIA 13 is dominated by a broad drift plain formed from a sequence of unconsolidated glacial and interglacial deposits. These deposits are locally incised by current and former river valleys. The southern terminus of the Pleistocene glacial advance occurs in Thurston County, resulting in thick sediment deposits in the north part of WRIA 13 (over 1,800 feet thick on the Johnson Point peninsula) and progressively thinner sediment deposits to the south and southwest (Drost et al. 1999). WRIA 13 is bounded by the bedrock outcrops of the Bald Hills to the south and the Black Hills west of McLane Creek. Local bedrock knobs (some at land surface and some in the subsurface) also exist, especially in the Tumwater Falls area.

Understanding the geologic setting allows characterization of surface and groundwater flow throughout 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

The USGS described the hydrology of WRIA 13 in a hydrogeologic framework report based on previous studies and published reports for Thurston County (Drost et al. 1999). The hydrogeologic units of the area are described as being either water-bearing (“aquifer”) and non-water-bearing (“aquitard” or “confining layer”) sediments. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments throughout the central and lower regions of the watershed. More recent studies have identified glacial outwash channels that eroded through regional aquitard units, and were then backfilled mostly with sands to form locally distinct aquifer units in the lower Deschutes Valley and along Woodland Creek.[20]

Groundwater in WRIA 13 aquifers generally flow north towards Puget Sound or locally toward the Deschutes River, Woodland Creek, or McLane Creek. Groundwater flow on the northern peninsulas is generally radially outward toward Puget Sound (Drost et al. 1999). Summer base flows in the watershed are sustained by groundwater. Groundwater in the eastern portion of the Deschutes and Woodland Creek watersheds generally move towards the Nisqually flats, in WRIA 11 (See Figure 19 in Drost et al. 1999). Similarly, groundwater in the southestern portion

[20] Walsh and others, 2003; Walsh and Logan, 2005; Golder, 2008; PGG, 2010

of the Deschutes River watershed flows to the Black River, in the Chehalis Basin (See Figure 19 in Drost et al. 1999)

The USGS describes the hydrogeology of the watershed as six sedimentary units, typically alternating between aquifer and non-aquifer layers. Four of the six sedimentary units identified are aquifers and are present throughout much of the watershed . This information is summarized in Appendix E: Regional Aquifer Units in WRIA 13, and in Table 1 of Drost et al. (1999). These aquifers are the most likely sources for new permit-exempt wells. The upper two units will also be the main source of direct recharge or baseflow to the surface water system. Aquifer Qc generally does not have surficial expressions except for immediately adjacent to and below sea level in Puget Sound; surficial expressions of TQu only occur below sea level in Puget Sound.

2.3.3 Hydrology and Streamflow

WRIA 13 can be characterized by its three primary drainages, each draining into a separate saltwater inlet: Henderson Inlet to the east, Budd Inlet, and Eld Inlet to the West (Figure 1). The Deschutes River which drains into Budd Inlet is the major freshwater basin in WRIA 13. A portion of WRIA 13 drains to the Nisqually Reach.

Henderson Inlet, located in the northeast section of WRIA 13 drains approximately 30,000 acres from the Boston Harbor Peninsula, Johnson Point Peninsula and the Woodland Creek Basin. Woodland and Woodard Creeks are the largest of the main tributaries to Henderson Inlet, draining 80% of the Henderson Inlet watershed. The other streams in the watershed, Dobbs Creek (East Henderson), Meyer Creek (Inlet), and Sleepy Creek (West Henderson), drain small areas of the Dickerson Point and Johnson Point peninsulas.[21,22] Because most of the basin lies at an elevation of less than 200 feet above sea level, groundwater is the primary source of streamflow during low flow months. Groundwater-fed springs maintain year round base flow in Woodard Creek and Woodland Creek.[23] Temperature and low flow impacts are not tempered by glacial melt in late summer and fall in WRIA 13.

The approximately 120,000 acre Budd Inlet/Deschutes River Basin is comprised of 143 identified streams providing over 256 miles of drainage, approximately 84% of WRIA 13. The Budd Inlet/Deschutes River Basin includes the 52 mile-long Deschutes River along with other notable streams (Percival/Black Lake Ditch, Ellis, Moxlie, Indian, Adams, Mission and Schneider Creeks) within the Budd Inlet drainage system. The Deschutes River drops from its highest point within the watershed of 3,870 feet near Cougar Mountain to the lowest point near sea level at the mouth of Capitol Lake. The Deschutes River has a mean annual flow of 254 cubic feet per second (cfs).[24,25] Late summer flows average around 50 cfs near Rainier (USGS Station 12079000) and 100 cfs at the E-Street Bridge in Tumwater (USGS Station 12080010).

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[21] Thurston County Department of Water and Waste Management, 1995
[22] WRIA 13 Planning Committee, 2004
[23] WRIA 13 Draft Bill Watershed Plan, 2004
[24] Measured at USGS stream gage 1207900 near Rainier, WA from 1949 through 2019. The 2019 mean annual flow was 149.3 cfs.
[25] USGS. National Water Information System. Water-Year Summary for Site USGS 1207900.

Streamflows are typically lowest during the late summer and early fall, when precipitation is low and infrequent. Flows are sustained by groundwater during this period. 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 a paucity of summer precipitation. Extreme low flows can be characterized in terms of the lowest 7-day running average discharge in a river that occurs on average once every 10 years (7Q10 flows). 7Q10 flows are estimated from 1991 - 2001 to be 21 cfs near Rainier (USGS Station 12079000) and 56 cfs at the E-Street Bridge in Tumwater (USGS Station 12080010) (Ecology, 2012). These extreme low flows have decreased over time at both stations, indicating hydrologic impacts. The Puget Sound Vital Signs program[26] indicates that decreasing low flow trends for the Deschutes River continues to be a concern.

The upper extent of the Deschutes River (river mile (RM) 41 to 52) has a moderately steep gradient and the river drops rapidly over Deschutes Falls at RM 41, forming a complete barrier to fish passage.[27] Much of the upper watershed lies in the transient snow zone of 1100 -3600 feet elevation. This is an area where rain-on-snow precipitation events are relatively common, making estimation of runoff and infiltration more difficult.

The lower 41 miles of drainage is lower gradient along a broad prairie-type valley floor.[28] The mainstem Deschutes River is composed of alternating gaining and losing reaches, ranging from a loss of 1.14 to a gain of 3.61 cfs per river mile, with an overall gain of groundwater of 41.4 cfs, between river miles 42.3 and 0.50, respectively (Ecology 2007a). Groundwater losses occur between RM 42.3 - 28.6, gain between RM 28.6 – 20.5, loss between RM 20.5 – 19.1, gain between RM 19.1 – 9.2, loss between RM 9.2 – 6.8, and gain between RM 6.8 – 0.5.

The Eld Inlet drainage area encompasses approximately 23,220 acres. The primary streams in this drainage area are McLane Creek, its tributaries (including Cedar Flat, Swift and Perkins Creeks) and Green Cove Creek, as well as various unnamed tributaries.[29,30] This drainage area also lies at relatively low elevation. Streamflow is fed primarily from groundwater recharge.

The climate of the region is typical Northwest maritime. Summers are relatively dry and cool while winters are mild, wet and cloudy. Annual precipitation averages about 45 inches[31] in Olympia to over 90 inches in the upper watershed (Miller et al. 1973).

Much of the climate related research in the south sound area has focused on flooding rather than low instream flows (Mauger et al. 2015). Many of the lower elevation drainages to the inlets are characterized by extremely high peak flows that develop quickly during heavy rains and decline rapidly as rain subsides, and prolonged low flow or dry periods in the summer. The

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[26] https://vitalsigns.pugetsoundinfo.wa.gov/
[27] River mile delineation is digitized and available from Department of Ecology: https://geo.wa.gov/datasets/fff25ee77f9e43ff9539688ba8ab3af3_0
[28] Methodology to a Watershed Based Approach to Clean Water and Natural Resource Management, 2013
[29] WRIA 13 Draft Bill Watershed Plan, 2004
[30] Methodology to a Watershed Based Approach to Clean Water and Natural Resource Management, 2013
[31] Precipitation data is from the weather station at the Olympia Regional Airport

basic water quantity habitat issue of concern is the alteration of the natural hydrologic regime, including:

- alteration of the frequency and magnitude of high flow events (usually associated with increased stormwater runoff from impervious surfaces), and;
- reduction of summer base flows that affect the salmonid rearing capacity of streams (usually associated with reduced infiltration of groundwater, water withdrawals, or excess coarse sediment that can cause the flow to go subsurface).[32]

The Climate Impacts Group has developed numerous downscaled global climate models to forecast streamflow and precipitation changes in the Puget Sound, including WRIA 13. General trends such as increased stream temperatures, earlier streamflow timing, increased winter flooding, and lower summer minimum flows are expected (Mauger et al. 2015). Comparison of August average stream temperatures between 1992 and 2011 with projections of stream temperature from moderate climate forecasts for 2070 – 2099 indicate a rise of approximately 7.2 degrees F. Water temperatures impact salmonid survival, growth and fitness. Higher temperatures are made worse by low stream flow (Anchor Environmental 2008).

Flows typically are lowest in late summer and impact juvenile salmon (coho) and steelhead rearing in the watershed, adult salmon (most likely chinook) migrating and spawning in the river, and resident trout present in the river. Low flows limit the amount of wetted area available to rearing salmonids, and also limit productivity due to increased water temperatures and decreased dissolved oxygen (Haring et al. 1999).

Summer low flows in Woodland Creek are a habitat limiting factor. The reach of Woodland Creek from Lake Lois to below Martin Way typically goes dry during the summer months and summer flows elsewhere in the system are low. For Woodland and Woodard creeks, the largest threat to salmonids is the change in the natural flow regime resulting from the rapid urbanization of the watershed. Increased impervious surface from urban development typically results in increased peak flow storm runoff in the winter and reduced base flows in the summer. Other stream basins in WRIA 13 are also under intense development pressure. Unless the natural flow regime can be restored and maintained in developing basins, salmonid habitat will also be adversely impacted (Haring et al. 1999).

WAC173-513 set minimum instream flows for The Deschutes River, from the confluence of the Deschutes River with Capitol Lake upstream to the Deschutes Falls at river mile 41. This river is closed to new consumptive appropriates between April 15th – November 1st. Several other streams and their tributaries are closed to further consumptive appropriations, including McLane Creek, Woodland Creek, Woodard Creek, Percival Creek, and unnamed tributaries to Puget Sound.

The background of how instream flows and closures were set are described in the Instream Resources Protection Program (IRPP) for WRIA 13 (Ecology 1980). Instream flows were set for streams where continuous flow records existed or correlations of flow to other stream gages

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[32] WRIA 13 Draft Bill Watershed Plan, 2004

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 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 1981). 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 13 every two years with a water quality assessment. Total Maximum Daily Load (TMDL) plans are part of the Federal Clean Water Act; they address water quality concerns by identifying and tracking surface water 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 13 (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, bacteria, and total phosphorus water quality standards. Fine sediment is also listed as impaired in the Deschutes River.

Four TMDLs have been completed in WRIA 13 to address water quality impairments, including the Deschutes River Multi-Parameter TMDL Implementation Plan (Ecology 2015 and EPA 2020), the Henderson Inlet Watershed Multi-Parameter TMDL Implementation Plan (2008), the Nisqually Watershed Bacteria and DO TMDL Implementation Plan (2007), and the Totten, Eld, and the Skookum Inlets Tributaries Bacteria TMDL Implementation Plan (2007).[33] The 2015 Deschutes River TMDL was only partially approved by EPA, resulting in EPA submitting replacement TMDLs for those that were disapproved. While EPA replaced certain TMDLs within the Deschutes Watershed, they did not revise the implementation plan and the original 2015 report should be consulted for implementation elements. A TMDL for dissolved oxygen impairment in the marine waters of Budd Inlet is currently in development.

The Deschutes River Multi-Parameter TMDL Implementation Plan addressed water temperature, dissolved oxygen, pH, bacteria, and fine sediment in the Deschutes River, its tributaries, and tributaries to Budd Inlet (Ecology 2015). The dissolved oxygen and pH components of the associated TMDL for the Deschutes River were disapproved and updated by the USEPA (USEPA 2020). The Budd Inlet portion of the TMDL is currently in the process of being updated by Ecology.

The Henderson Inlet Watershed Multi-Parameter TMDL Implementation Plan addressed water temperature, dissolved oxygen, pH, and bacteria in Woodland Creek and other tributaries to Henderson Inlet (Ecology 2008). The Nisqually River Basin Fecal Coliform Bacteria and Dissolved Oxygen Total Maximum Daily Load Implementation Plan (Ecology 2007) and the Totten, Eld, and the Skookum Inlets Tributaries Bacteria TMDL Implementation Plan (Ecology 2007) addressed bacterial contamination in marine waters from freshwater tributaries.

Additionally, there is an ongoing environmental review under SEPA being led by WA Department of Enterprise Services (DES) to investigate options to address multiple water quality and habitat issues in the Deschutes Estuary and Capital Lake.[34] The draft EIS is expected to be completed in the summer of 2021, and a final EIS issued in 2022 after a public comment period.

Reduced stream flow can lead to degraded water quality. Reduced flows lead to increased pollutant concentrations with the same pollutant load (e.g. bacteria). Reduced stream flow also

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[33] More information on TMDLs in the Deschutes River can be found here: https://www.epa.gov/tmdl/deschutes-river-tmdls

[34] More information on the Capitol Lake - Deschutes Estuary Long-Term Management Project can be found here: https://capitollakedeschutesestuaryeis.org/

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,[35] the WRIA 13 Committee divided WRIA 13 into subbasins for the purposes of this watershed plan[36]. 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).[37] This chapter is based on the Subbasin Delineation Technical Memorandum (Appendix G).

3.2 Approach to Develop Subbasins

The WRIA 13 Committee divided WRIA 13 into nine subbasins for purposes of assessing projections for new PE wells, consumptive use, and project offsets initially using the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) data as the basis for delineations.[38] [39] The basic considerations of the WRIA 13 Committee in delineating subbasin boundaries for this planning process were:

- Distinguishing areas of anticipated rural growth that would include permit-exempt wells or connections;
- Existing planning efforts that have already delineated subbasins;
- Presence of fish-bearing streams of importance within the watershed;
- Direction of surface drainage to different receiving bodies;
- Current level of residential development; and
- In identifying projects the Committee would strive to provide the highest priority recommendations for offset projects in the same time as the impact and in the same basin or tributary.[40]

Other considerations were:

[35] "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.

[36] The term "subbasin" is used by the WRIA 13 Committee for planning purposes only and to meet the requirements of RCW 90.94.030 (3)(b).

[37] 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.

[38] 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).

[39] HDR, 2019. WRIA 13 Draft Subbasin Delineation. June 26, 2019.

[40] RCW 90.94.030(b)

- Size of the subbasins;
- Development character within the subbasin;
- Distinguishing areas where little rural growth is expected; and
- The location of streams included in the watershed rule (WAC-173-513) with closures or instream flow rule limits.

A more detailed description of the subbasin delineation is in the technical memo available in Appendix F. The WRIA 13 committee acknowledges that surface water drainages were used as a proxy for groundwater basins. While shallow groundwater oftentimes does correspond with surface water drainages, this correspondence does not always occur. For example, groundwater recharge or loss in a given watershed may affect flows in an adjacent watershed or may affect marine seepage instead of stream flows.

3.3 Subbasin Map

The WRIA 13 subbasin delineations are shown on Figure 2 and summarized below in Table 4:

Table 4: WRIA 13 Subbasins

Subbasin Name	Primary Rivers and Tributaries	County
Boston Harbor	Ellis Creek, Indian Creek, Moxlie Creek, Woodard Creek	Thurston
Cooper Point	Simmons Creek, Schneider Creek	Thurston
Deschutes Lower	Deschutes River, Percival Creek	Thurston
Deschutes Middle	Deschutes River	Thurston
Deschutes Upper	Buck Creek, Lincoln Creek, Lewis Creek, Little Deschutes River, Thurston Creek, Johnson Creek, Mitchell Creek, Fall Creek, Pipeline Creek	Thurston and Lewis
Johnson Point	Unnamed tributaries to Henderson inlet and Nisqually Reach	Thurston
McLane	McLane Creek, Swift Creek, Beatty Creek	Thurston
Spurgeon Creek	Spurgeon Creek	Thurston
Woodland Creek	Woodland Creek	Thurston

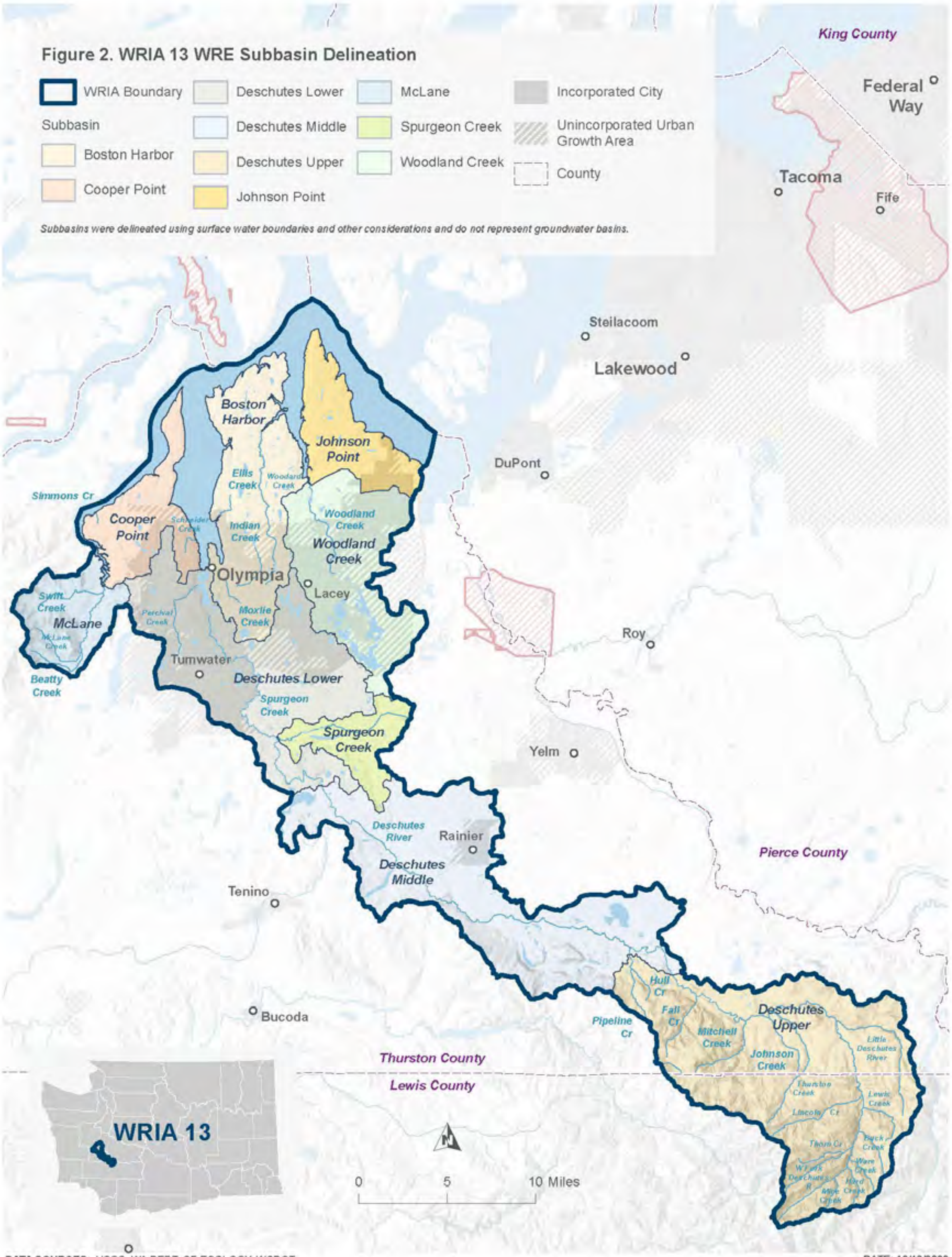

Figure 2: WRIA 13 WRE Subbasin Delineation

Chapter Four: New Consumptive Water Use Impacts

4.1 Introduction to Consumptive Use

The Streamflow Restoration law requires watershed plans to include "estimates of the cumulative consumptive water use impacts over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050" (RCW 94.030(3)(e)). 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" (pg. 7). This chapter provides the WRIA 13 Committee's projections of new domestic permit-exempt well connections (referred to as new PE wells throughout this plan) and their associated consumptive use (CU) [41] for the 20-year planning horizon.[42] This chapter summarizes information from the technical memo (Appendix H) prepared for the Committee.

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

The WRIA 13 Committee projects 2,616 new PE wells over the planning horizon. Note that Thurston County and Lewis County are both within WRIA 13; however, the Lewis County portion of WRIA 13 is entirely comprised of timberland and thus was not included in the projection for new PE wells. No new PE wells are expected to occur in Lewis County over the 20-year planning horizon. New PE well projections are distributed across the WRIA, with the largest numbers in the Middle and Lower Deschutes subbasins, and the three peninsulas. The fewest new PE wells are projected in the Upper Deschutes and Spurgeon Creek subbasins.

The WRIA 13 Committee developed a methodology that it agreed was appropriate to project the number of new PE wells over the planning horizon in WRIA 13, 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 13, the methods used to develop the projections, and the uncertainties associated with the projections.

4.2.2 Methodology

The WRIA 13 Committee developed a methodology in collaboration with Thurston County and the Thurston Regional Planning Council (TRPC) for identifying the most appropriate method of

[41] New consumptive water use in this document is from projected new homes connected to permit-exempt domestic wells associated with building permits issued during the planning horizon. Generally, new homes will be associated with wells drilled during the planning horizon. However, new uses could occur where new homes are added to existing wells serving group systems under RCW 90.44.050. In this document the well use discussed refers to both 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" or "home" refer to any permit-exempt domestic groundwater use, including other ERUs.
[42] See Chapter 6 policy recommendation #12 which describes a recommendation to collect information on 20 years of consumptive water use in addition to PE wells.

projecting new PE wells within their jurisdiction. Population growth projections for Thurston County are produced by the TRPC every 3 to 5 years. Growth projections represent the expected growth based on currently adopted plans and policies. A detailed description of the TRPC methods is provided in Appendix H[43]. Permit-exempt growth was projected using the following steps to project growth of over the planning horizon:

1. Develop 20-year growth projections based on Office of Financial Management (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. Once allocated, estimate the amount of development on permit-exempt connections based on the following criteria provided by Thurston County:
    a) Incorporated cities: no permit-exempt growth
    b) Urban growth areas (UGAs): permit-exempt growth is assumed to occur on parcels with no sewer service
    c) Rural areas outside of water systems: all permit-exempt growth

WRIA 13 Watershed Restoration and Enhancement (WRE) Committee built upon the TRPC methodology by adding permit-exempt growth in rural water systems, assuming that rural water systems may not be able to serve all growth within their service areas. Permit-exempt growth was assumed to be proportional to buildable parcels without water system hookups relative to parcels with water system hookups.

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4.2.3 Distribution of New PE Wells

This WRIA 13 watershed plan compiles Thurston County's growth projection data at both the WRIA scale and by subbasin. As mentioned above, no new PE wells are expected to occur in Lewis County over the 20-year planning horizon.

The TRPC allocated growth throughout Thurston County and WRIA 13. The WRIA 13 Committee summed PE well growth by subbasin, and mapped potential locations of new PE wells in the watershed. The resulting map (Figure 3) shows the most likely area where new residential development dependent on PE wells will occur.

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

The TRPC and the WRIA 13 Committee project approximately 2,616 new PE wells within WRIA 13 over the planning horizon.

PE well growth is distributed through all subbasins, with the largest numbers in the Middle and Lower Deschutes subbasins, and the three peninsulas (Table 5 and Figure 3).

Table 5: Number of new PE Wells Projected between 2018 and 2038 per WRIA 13 Subbasins

Subbasin	**Projected New PE Wells**
Boston Harbor	296
Cooper Point	232
Deschutes Lower	379
Deschutes Middle	734
Deschutes Upper	30
Johnson Point	520
McLane	165
Spurgeon Creek	92
Woodland Creek	168
Total	**2,616**

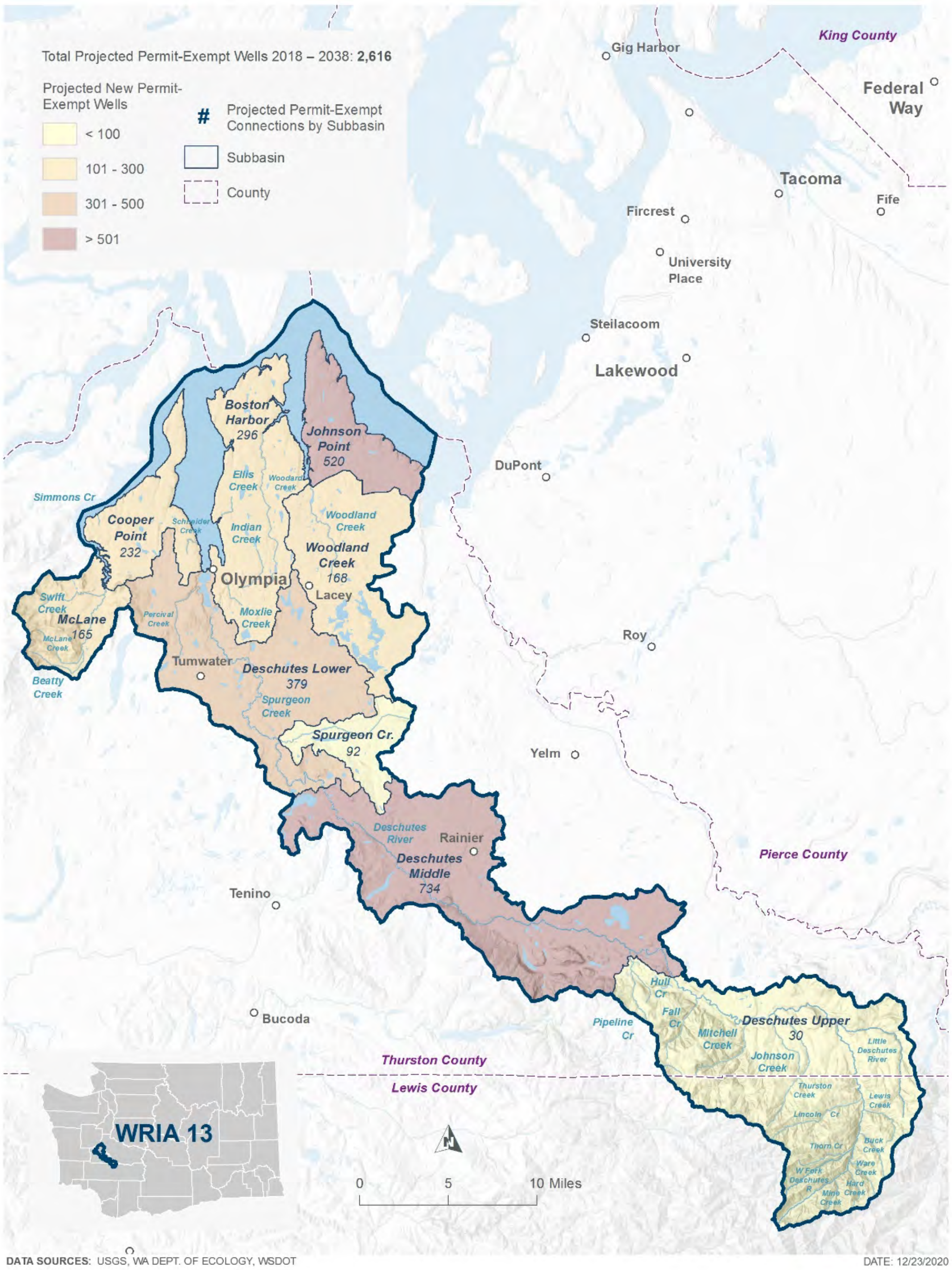

Figure 3: WRIA 13 WRE Distribution of Projected New PE Wells for 2018-2038

4.2.4 Uncertainties and Scenarios

The methods described above for projected new PE wells include several uncertainties. These uncertainties were discussed with the WRIA 13 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.

One limitation is the reliance on historical data. This method 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. To address this uncertainty, the Committee evaluated additional PE well projection scenarios, and agreed to include in the analysis a methodology to account for some growth in rural water systems. This resulted in the PE well estimate which the Committee agreed was the appropriate analysis for WRIA 13.

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, which is simple mortality and migration rate data collection; 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.

This methodology is described in detail in Appendix H

4.3 Impacts of New Consumptive Water Use

The WRIA 13 Committee used a 20-year projection for WRIA 13 of 2,616 new PE wells to estimate the consumptive water use that this watershed plan must address and offset. The WRIA 13 Committee estimates 435 AFY (0.6 cfs) as the "most likely" new consumptive water use in WRIA 13. This watershed plan also includes a higher consumptive use estimate of 513 AFY (0.7 cfs) as a goal to achieve through adaptive management. This section includes an overview of the method used by the WRIA 13 Committee to estimate new consumptive water use (consumptive use), an overview of the anticipated impacts of new consumptive use in WRIA 13 over the planning horizon, and other considerations by the WRIA 13 Committee, such as assumptions and uncertainties. The WRIA 13 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 that annual 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 uses. 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 13 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, which is available in Appendix H.

To develop consumptive use estimates, the WRIA 13 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 Appendix H. Additionally, to provide context for how the regulatory limits of water use in WRIA 13 compare to that of the irrigated area analysis, the Committee agreed that information should be provided regarding the maximum legal limit of 0.5 acres for outdoor watering for non-commercial lawn or garden[44], and the maximum annual average PE well withdrawal limit of 950 gallons per day (gpd)[45]. This information is provided in Appendix H. Information referenced from other methodologies is intended to provide context, and is not intended to be used as a comparison for offsets from projects.

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 into a septic system (Kenny et al., 2012). Based on Ecology's NEB Guidance (Ecology 2019) , the WRIA 13 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 (CUF) to estimate new indoor consumptive water use:

- 60 gallons per day (gpd) per person, as recommended by Ecology.
- 2.5 persons per household assumed for rural portions of WRIA 13[46]
- 10 percent of indoor use is consumptively used (or a CUF of 0.10), based on the assumption that homes on new PE wells are served by onsite sewage systems. Onsite 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.

[44] As defined in RCW 90.44.050
[45] As defined in RCW 90.94.030
[46] Thurston County OFM information can be found here: https://www.ofm.wa.gov/washington-data-research/county-and-city-data/thurston-county

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

$$60 \text{ gpd per person} \times 2.5 \text{ people per house} \times 0.10 \text{ CUF}$$

This results in an indoor consumptive water use of 15 gallons per day per PE well. This equates to an annual average of 5,475 gallons per year (0.017 AFY[47]) (0.00023 cfs[48]) of indoor consumptive water use per PE well.

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 (Ecology 2019).

Average outdoor irrigated area in WRIA 13 was estimated using aerial imagery to measure the irrigated areas of 80 randomly selected parcels of a stratified sample served by new PE wells. The average irrigated area for the 80 parcels was 0.06 acres. This analysis returned a large portion of parcels with no visible irrigation, which were given irrigated area values of zero. To account for undetected irrigation or potential outdoor water use other than irrigation, the WRIA 13 Committee replaced the zero values with 0.05 acres. This value of 0.05 acres was used, because that was the lower end (i.e. <10th percentile) of measurable irrigated areas in WRIA 13. When using 0.05 acres for parcels with no visible irrigation, the average irrigated area was 0.10 acres. This analysis was determined to result in the most likely outdoor consumptive use estimate for WRIA 13, and will be used as the target offset to compare to offsets from projects. Additionally, the WRIA 13 Committee then conducted a statistical confidence level analysis on the results. The 95 percent upper confidence limit (UCL) yielded an irrigated area of 0.12 acre, representing a conservative estimate of the average irrigation area. This method is further summarized in Appendix H, and is included in the plan as a goal to achieve through adaptive management. The Committee considers this analysis as a way to account for uncertainties such as future growth, and climate change.

The WRIA 13 Committee used the following assumptions, recommended in Appendix A of the Final NEB Guidance, to estimate outdoor consumptive water use:

- Crop irrigation requirements (IR) for turf grass according to the Washington Irrigation Guide (WAIG, Appendix B) (NRCS-USDA 1997): 16.8 inches for the Olympia, Packwood, and Centralia WAIG stations, which is a weighted average used to estimate the amount of water needed to maintain a lawn.

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[47] 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. One acre-foot per year is equal to 893 gallons per day.

[48] 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. One cubic foot per second is equal to 646,317 gallons per day.

- 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 IR by 25 percent.
- Consumptive use factor (CUF) of 0.8, reflecting 80 percent consumption for outdoor use. This means that 20 percent of outdoor water is returned to the immediate water environment.
- Outdoor irrigated area based on existing homes using PE wells: 0.10 acre (0.12 acres was used for the higher consumptive use estimate as a goal to achieve through adaptive management)

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

$$\frac{1.4\ feet\ per\ year * 0.10\ acres * 0.80\ CUF}{0.75\ AE}$$

First, the crop IR is multiplied by the average irrigated area to yield acre feet. Next, that volume of water was multiplied by 80 percent to produce the outdoor consumptive water use. Finally, that consumptive use is divided by seventy five percent to adjust for irrigation application efficiency (effectively increasing water use or consumptive use).

This results in 0.15 AFY (133 gallons per day) (48,629 gallons per year) (0.00021 cfs) outdoor consumptive water use per PE well for the WRIA based on 0.10 acres used for the most likely consumptive use estimate. Using 0.12 acres used in the higher adaptive management consumptive use estimate, this results in 0.18 AF per year (58,653 gallons per year) (0.00025 cfs). Multiplying the AFY and cfs per PE well by the new PE well projection of 2,616 PE will arrive at AFY and cfs for outdoor consumption by all PE wells. This will provide the contribution of outdoor consumption to the range provided in Section 4.3. This is an average for the year; however, the committee expects that more water will be used in the summer than in other months. The outdoor consumptive use varies by subbasin because of varying temperature and precipitation across the watershed.

4.3.2 Uncertainties and Limitations

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. The WRIA 13 Committee addressed uncertainty in PE well growth projections with a single growth scenario by incorporating TRPC methods and assuming some PE well growth in rural water systems.

Indoor consumptive use estimates 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, the committee recognized that each value in the calculation has uncertainty, and that the method assumes that future indoor water use will not deviate from current water use trends.

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 use. 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. Uncertainty associated with method detection of irrigated areas in aerial photos was ameliorated by assigning a minimum value of 0.05 acre 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. Also, the Committee directed the technical consultant to calculate the 95 percent upper confidence of the irrigated area average. The 95 percent upper confidence limit was 0.12 acre. 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 overestimate of irrigated area that would likely result in a more conservative consumptive use estimate).

Potential bias in methodology was addressed in a comparability study with another consultant, GeoEngineers (Attachment C of Appendix H). Methods used by GeoEngineers in WRIAs 9 and 10 were compared to HDR's methods (as used in WRIA 13) for the same parcel images. HDR's results were found to be lower than that of 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 differences between analysts were not large enough to warrant any revisions to the estimates. However, since the HDR estimates 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 estimate to account for uncertainty.

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, but 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.

An additional source of uncertainty identified by the Committee is that RCW 90.94 allows up to 1/2 acre of land to be irrigated by an exempt well, and in the absence of metering or routine observations of outdoor irrigation, there is no way to accurately calculate how much water is being consumed for outdoor water use.

Another source of uncertainty is that climate change is expected to create longer, hotter, drier growing seasons. This will raise evapotranspiration and increase dry season water demands. A calculation using climate projections by a Committee representative found a 6% increase in water use over 20 years.[49,50] The WRIA 13 Committee addressed the uncertainties, assumptions, and limitations in this method by using conservative assumptions. This approach means that if the committee implements the projects to offset the consumptive use estimate, the WRIA 13 Committee expects that the plan will also 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 on two estimates for WRIA 13: a “most likely” estimate and a “higher use” 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 0.12 acres (the 95th percentile value of 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 13 are 435 AFY (0.6 cfs) for the most likely estimate, and 513 AFY (0.7 cfs). The total consumptive use estimates for WRIA 13 are calculated as the number of new 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. The highest consumptive use is expected to occur in the subbasin with the most anticipated new PE wells, as presented in Figure 4.

Information on other methodologies including Water System Data, maximum outdoor watering for non-commercial lawn or garden (0.5 acres), and the maximum annual average PE well withdrawal limit (950 gpd) is provided in Table 6 for context.

[49] This analysis is provided in the Compendium

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

Table 6: WRIA 13 Estimated PE Well Projections and Indoor and Outdoor Consumptive Use Estimates[51] by Subbasin[52], 2018-2038

			Assumed Irrigated Acreage of 0.10 Acre ("Most Likely" Estimate)		Assumed Irrigated Acreage of 0.12 Acre (Higher Adaptive Management Estimate)		Water System Data	Maximum Outdoor Watering Limit (0.5 acres)	Maximum Withdrawal Limit (950 gpd)
Subbasin	**Projected new PE Wells**	**Indoor CU (AFY)**	**Outdoor CU (AFY)**	**Total CU/year (AFY)**	**Outdoor CU (AFY)**	**Total CU/year (AFY)**	**Total CU/year (AFY)**	**Total CU/year (AFY)**	**Total CU/year (AFY)**
Boston Harbor	296	5	44	49	53	58	52	226	217
Cooper Point	232	4	35	39	42	45	41	177	170
Deschutes Lower	379	6	57	63	68	74	67	289	278
Deschutes Middle	734	12	110	122	132	144	129	560	539
Deschutes Upper	30	1	4	5	5	6	5	23	22
Johnson Point	520	9	78	86	93	102	92	397	382
McLane	165	3	25	27	30	32	29	126	121
Spurgeon Creek	92	2	14	15	16	18	16	70	68
Woodland Creek	168	3	25	28	30	33	30	128	123
Total	**2,616**	**44**	**391**	**435**	**469**	**513**	**461**	**1,997**	**1,921**

[51] Results are shown in acre feet per year (AFY). 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

[52] The WRIA 13 Committee has determined that an area of 0.10 irrigated acres result in the most likely outdoor consumptive use estimate for WRIA 13, and will be used as the target offset to compare to offsets from projects. The analysis based on an area of 0.12 irrigated acres is included in the plan as a goal to achieve through adaptive management. Results for consumptive use were rounded to the nearest whole number.

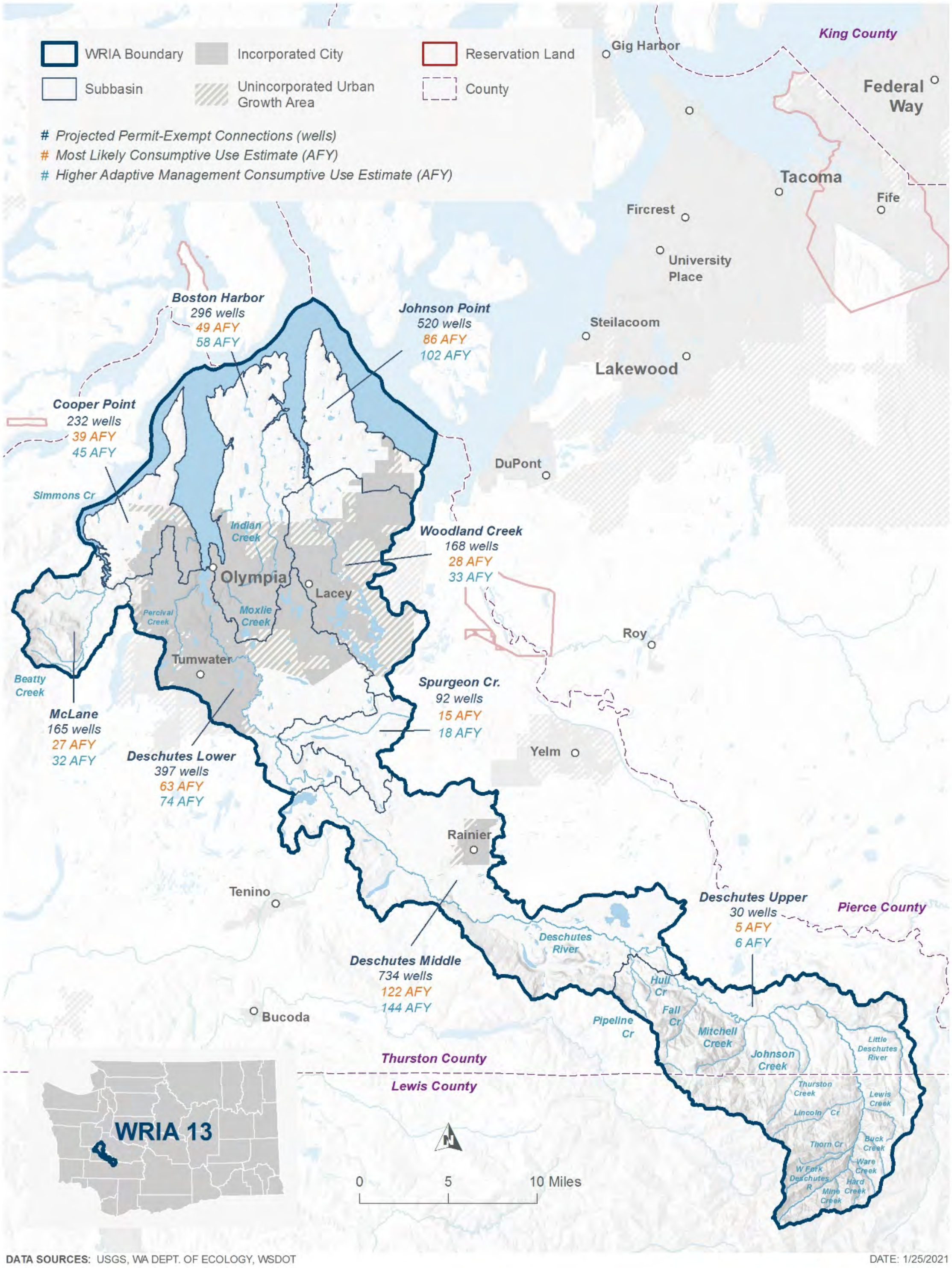

Figure 4: WRIA 13 Estimated Consumptive Use by Subbasin 2018-2038

Chapter Five: Projects and Actions

5.1 Description and Assessment

Watershed plans must identify projects and actions that offset the potential impacts future PE wells will have on streamflows and provide a net ecological benefit to the WRIA.[53] This chapter provides recommendations from the WRIA 13 Committee for projects to offset consumptive use and meet NEB[54]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 are 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 13 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 in alignment with other planning processes and identify any projects of concern for inclusion in the WRE Plan, the WRIA 13 Committee engaged the salmon recovery lead entity in WRIA 13. At any point in the process, Committee members or WRIA 13 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.

[53] 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.

[54] 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 Yelm 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 further developed the analysis on the subset of projects, and the committee determined the offset value to attribute to each project. This chapter presents summaries of those projects.

In a separate effort, Ecology contracted with Pacific Groundwater Group (PGG) to support identification of water right acquisition opportunities for WRIA 13. In coordination with the Committee, PGG narrowed down the list of opportunities. The Committee provided input on the revised list of projects for PGG to develop a focused list of water rights for future project opportunities; however no specific water rights were identified for acquisition and no offset is being claimed by the Committee.

For projects that did not provide a quantifiable streamflow benefit, the WRIA 13 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 13 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 and include detailed project descriptions from the technical consultants in Appendix I. All other projects are presented in the project inventory in Appendix J. The WRIA 13 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 13.

The Committee recognizes the importance of developing projects with climate resiliency in mind, and the need to assess how climate change may affect project effectiveness. Restoring floodplain connectivity and streamflow regimes, and re-aggrading incised channels are most likely to ameliorate streamflow and temperature changes and increase habitat diversity and population resilience (Beechie et al. 2013).

5.2 Category I Projects with Quantifiable Streamflow Benefit

The WRIA 13 Committee set the goal of meeting the offset target for each subbasin. The projects presented below have quantifiable streamflow benefit or habitat improvement. The committee identified these projects as having the greatest potential for implementation and meeting 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 - 9.

5.2.1 WRIA-wide Projects

5.2.1.1 Managed Aquifer Recharge Projects in WRIA 13

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. MAR potential was estimated in terms of 1) potential locations suitable for MAR projects, 2) flow available for diversion during high flows, and 3) the number of days when diversion is feasible. To ensure that flows would be diverted in quantities that would not reduce habitat suitability for salmonids or reduce habitat forming processes, one of two methods were used to estimates flow rates. If minimum flows have been designated, then the flow rate was estimated as less than two percent of minimum flows. If minimum flows have not been designated, 2% of the average 75th percentile flows during November –April were used. 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 Deschutes River and Green Cove Creek. MAR projects may be considered for Percival Creek, Woodard Creek, and Woodland Creek, but are not being proposed for offset credits in this plan.

MAR projects in WRIA 13 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 811 AFY. Due to uncertainties in the likelihood of projects being built, project performance over time, and the benefits being realized (including the timing of streamflow benefits), the Committee chose to exclude estimates for projects located in basins with instream flow rule closures, and to reduce the estimates for other MAR projects, Consequently, the Committee determined that a reasonable offset estimate to claim for the purposes of this plan is 325 AFY (i.e. forty percent of the estimated 811 AFY total). The Committee supports future feasibility studies within WRIA 13 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.

The WRIA 13 Committee acknowledges that some diversion methods including in-channel structures may pose an impact to fish habitat, and strongly advocates 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 13 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 has indicated that they will be the project sponsor of MAR projects, in coordination with project partners and implementation groups, pending feasibility studies.

5.2.2 Boston Harbor Subbasin

5.2.2.1 Managed Aquifer Recharge Project in Woodard Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Woodard Creek (Appendix I). Woodard Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 –17 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 18 AFY. However, because of the uncertainty associated with being a closed stream, the Committee is not claiming offset credits for this project.

5.2.3 Cooper Point Subbasin

5.2.3.1 Managed Aquifer Recharge Project in Green Cove Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Green Cove Creek (Appendix I).Green Cove Creek is a closed stream (Chapter 173-513 WAC). Measured flows near the potential MAR location are near zero in the summer and range from 7 –11 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 18 AFY. The Committee has conservatively claimed forty percent of this water offset, or 7 AFY (Table 8).

5.2.4 Deschutes Lower Subbasin

5.2.4.1 Schneider's Prairie Off-Channel Storage-and-Release

The Schneider's Prairie Off-Channel Storage-and-Release Project is located on the east bank of the Deschutes River, west of the Keanland Park Lane SE, in north-central Thurston County. This project will restore hydrologic connectivity between the Deschutes River and Schneider's Prairie. Schneider's Prairie is a depressional feature that contains the Ayer Creek drainage (Appendix H). Paleochannels apparent from aerial photos and LiDAR images show that multiple channels historically connected the Deschutes River with Schneider's Prairie. Reconnecting the Deschutes River with Schneider's Prairie and Ayer Creek would provide rearing habitat and flood refugia for juvenile salmonids, stormflow attenuation, and water infiltration for later-season release to augment flow in the lower Deschutes River.

The project concept is to deepen an existing floodplain paleochannel that would hydrologically connect the Deschutes River to Schneider's Prairie (Appendix I). Schneider's Prairie contains Ayers Pond and Ayers Creek. The deepened paleochannel would be connected to the existing Ayers Creek that runs north and back to the Deschutes River. Ayers Creek would be modified near the confluence with the Deschutes River using biotechnical techniques (e.g. buried logs and log jams) to maintain grade control at an elevation that would inundate a portion of the off-channel area during high flow events (152 ft NAVD88).

Inflows from the Deschutes River to the off-channel area were compared to the maximum infiltration capacity of the off-channel area (i.e. 52 acres). The smaller of the two values were used as an assumed infiltration quantity. River inflows that exceeded the infiltration capacity were assumed to be retained as ponded water in the Schneider's Prairie feature. This retained inflow volume was assumed to infiltrate during the late spring, when river inflows were no longer occurring.

The seasonal inundation would result in infiltration and subsequent seepage back to the river on the time scale of days to months. Seepage back to the Deschutes River increases over time, because of the cumulative effect of infiltrating additional water. This cumulative increase reaches an asymptote (i.e. additional benefits are minimal) after about 50 years of infiltration. Seepage back to river does not change substantially with season, but slightly more seepage occurs during the May –October period, relative to the November –April period. Streamflow benefits during the May –October period are predicted to be 285, 681, 958, and 1,310 acre-feet per year during the first, fifth, tenth, and fiftieth year of infiltration, respectively.

The WRIA 13 Committee identified project uncertainties from the modeling analysis was not able to account for or where assumptions were made, including:

1. Evapotranspiration
2. Amount of infiltration
3. Climate change
4. Dropping flow trends of the Deschutes
5. Sediment issues in the Deschutes
6. Modeling assumptions including transmissivity of aquifer, and streambed conductance
7. Modeling represents average conditions, not dry year conditions

To account for project uncertainties the Committee chose to recognize 681 AFY of seepage back to the river during the May – October dry season from this project, which represents less than half of the total estimated based on preliminary hydrologic and hydrogeologic modeling (Tables 7 and 8).

5.2.4.2 Donnelly Drive Infiltration Galleries

Portions of Donnelly Drive SE, and Normandy Drive SE flood during major rainfalls and impacts public property and reduces public safety. Thurston County Roads Maintenance has routinely responded to calls from residents for assistance. It is proposed to install treatment devices and infiltration systems in the Donnelly Drive vicinity to reduce flooding of public streets and promote infiltration to groundwater (Appendix I). There are five locations in the area which see flood issues, and each of these locations are a low point where an existing drywell is located to infiltrate stormwater. These improved infiltration systems has been modeled to increase stormwater infiltration by approximately 14 AFY (Tables 7 and 8). The Committee is claiming 14 AFY for this project, assuming year-round benefits because the stormwater infiltration basin is over 2,500 feet from Chambers Ditch, and the travel time is likely attenuated into the summer season (Ecology 2020; USGS Circular 1376).

5.2.4.3 Managed Aquifer Recharge Project in Percival Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Percival Creek (Appendix I). Percival Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near 3 cfs in the summer and range from 12 –15 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 18 AFY. However, because of the uncertainty associated with being a closed stream, the committee is not claiming offset credits for this project.

5.2.5 Deschutes Middle Subbasin

5.2.5.1 Managed Aquifer Recharge Project in the Deschutes River

MAR projects (as described in the WRIA-wide Projects section) are proposed for the Middle Deschutes River (Appendix I).). Projects would divert water from the Deschutes River, which then would be infiltrated into the ground for subsequent return flow to the river. To estimate the potential benefits from this project, flow data from measured flows are approximated by the Deschutes River at Rainier gage (USGS Station 12079000) and the Deschutes River at E St Bridge at Tumwater, WA (USGS 12080010). The amount of water available for diversion downstream to the control point (in Tumwater) is approximately 8 cfs during at least 50 days of the year, during the November – April wet season. Potential MAR locations have been identified in both the upper and middle Deschutes River subbasins (Appendix I). If all 8 cfs were diverted for several projects for these days and infiltrated for subsequent return flow to the river, which would equate to approximately 792 AFY of offset benefit. Currently, 6 of the 8 cfs is proposed to be applied to MAR projects in the Deschutes Middle subbasin, equaling 594 AFY. The committee has conservatively claimed forty percent of this water offset, or 238 AFY (Table 8).

5.2.6 Deschutes Upper Subbasin

5.2.6.1 Managed Aquifer Recharge Project in the Deschutes River

MAR projects (as described in the WRIA-wide Projects section) are proposed for the Upper Deschutes River (Appendix I). As described above for the Deschutes Middle subbasin, 2 of the 8 cfs is currently proposed to be applied to MAR projects in the Deschutes Upper subbasin, equaling 198 AFY. The committee has conservatively claimed forty percent of this water offset, or 79 AFY (Table 8).

5.2.7 Woodland Creek Subbasin

5.2.7.1 Hicks Lake Stormwater Retrofit

The Ruddell Road Stormwater Facility was constructed by the City of Lacey in 1999, consisting of a pretreatment settling basin that flows to constructed wetlands; ultimately flowing into Hicks Lake. Although the facility is an improvement to the previous, untreated condition, the limited water quality wet pool volume, relatively high inflows, and flow-through design conditions, limit water quality treatment and provides minimal, if any, infiltration benefit. Therefore, the City is investigating the feasibility of an offset infiltration facility as an upgrade to the current system.

The proposed project would provide water offsets and an ecological benefit (per RCW 90.94.030) to the Woodland Creek sub-basin. The improvements are expected to provide a significant shallow groundwater recharge component, and augment base flow to Hicks, Pattison, and Long Lakes, ultimately benefitting Woodland Creek, which is currently impaired by low instream flow (303d listing 6169). Proposed upgrades to the facility include a flow splitting manhole, filtration treatment BMP, infiltration gallery and an overflow structure to the existing wetland.

A range of diversion flows (1cfs, 2cfs, and 3 cfs) were modeled and resulted in a corresponding range of average annual infiltration of 167, 244, and 296 AFY, respectively. All flows, up to 3.5 cfs are expected to be 100% infiltrated, but infiltrating up to 3 cfs accounts for a reduction in infiltration capacity over time (i.e. from clogging of the infiltration basin from fine materials). Therefore, infiltrating up to 3 cfs for an offset benefit of 296AFY is the estimate of stormwater infiltration (Tables 7 and 8). The Committee is claiming 296 AFY for this project, assuming year-round benefits because the stormwater infiltration basin is over 1,000 feet from Hicks Lake, and the travel time is likely attenuated into the summer season (Ecology 2020; USGS Circular 1376). Also, Hicks Lake is the headwaters of the Woodland Creek watershed. Water seeping into Hicks Lake from this project must travel through a wetland into Pattison Lake, and into another wetland into Long Lake, before that water reaches the beginning of Woodland Creek.

5.2.7.2 Managed Aquifer Recharge Project in Woodland Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Woodland Creek (Appendix H). Woodland Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location average 14 cfs in the late summer and range from 24 – 51 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.7 cfs diversion when flows exceed 36 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 62 AFY. However, because of the uncertainty associated with being a closed stream, the committee is not claiming offset credits for this project.

Table 7: Category I Projects in WRIA 13 with Quantifiable Streamflow Benefit

Project Name	Project Type and Description	Subbasin	Estimated Water Offset (AFY)[55]	Estimated Water Offset (AFY) During Critical Flow Period[56]	Offset Claimed by WRIA 13 Committee (AFY)[57]	Timing of Benefits	Project Sponsor	Estimated Project Cost[58]	Readiness to Proceed
Schneider's Prairie Off-Channel Connection	Off-channel reconnection and infiltration	Lower Deschutes	681	681	681	May-Oct	Thurston county	$4.93 M	High
Hicks Lake Stormwater Retrofit	Stormwater infiltration in series with existing stormwater treatment	Woodland	296	148	296	Year-round	City of Lacey	$3.3 M	High
Donnelly Drive Infiltration	Improve neighborhood stormwater infiltration, avoiding surcharge and runoff to Chambers ditch.	Lower Deschutes	14	7	14	Year-round	Thurston County	$6.31 M	High

[55] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day
[56] The WRIA 13 Committee agreed that for the purposes of this watershed plan, the critical flow period will be defined as May-October.
[57] The WRIA 13 Committee agreed to indicate offset claimed for the purposes of the NEB evaluation.

[58] Costs are based on order of magnitude estimates.

Project Name	Project Type and Description	Subbasin	Estimated Water Offset (AFY)[55]	Estimated Water Offset (AFY) During Critical Flow Period[56]	Offset Claimed by WRIA 13 Committee (AFY)[57]	Timing of Benefits	Project Sponsor	Estimated Project Cost[58]	Readiness to Proceed
Deschutes/ Chambers MAR	Several candidate locations for MAR of diverted Deschutes River water from high flow periods, exceeding instream minimum flows or ecological flows.	Upper Deschutes Middle Deschutes Lower Deschutes Woodland Boston Harbor Cooper Point	811	Not calculated	325	Year-round	Thurston County and WRIA 13 Implementation Partners[59]	$2.8 M	High
WRIA 13 Total Water Offset			**1,802**	**836**	**1,316**				
WRIA 13 Consumptive Use Estimate			**435**						
WRIA 13 Higher Adaptive Management Consumptive Use Estimate			**513**						

[59] The WRIA 13 Committee supports the development of an implementation group to further develop projects

Table 8: Water Offsets claimed by the WRIA 13 committee, summed by subbasin. All values are in acre-feet/year.[60]

Subbasin	WRIA 13 Most Likely CU Estimate	WRIA 13 Higher Adaptive Mgmt CU Estimate	MAR	Schneider's Prairie	Hicks Lake SW Retrofit	Donnelly Drive Infiltration	Total
Boston Harbor	49	58	0	0	0	0	0
Cooper Point	39	45	7	0	0	0	7
Deschutes Lower	63	74	0	681	0	14	695
Deschutes Middle	122	144	238	0	0	0	238
Deschutes Upper	5	6	79	0	0	0	79
Johnson Point	86	102	0	0	0	0	0
McLane	27	32	0	0	0	0	0
Spurgeon Creek	15	18	0	0	0	0	0
Woodland Creek	28	33	0	0	296	0	296
Total	**435**	**513**	**325**	**681**	**296**	**14**	**1,316**

[60] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

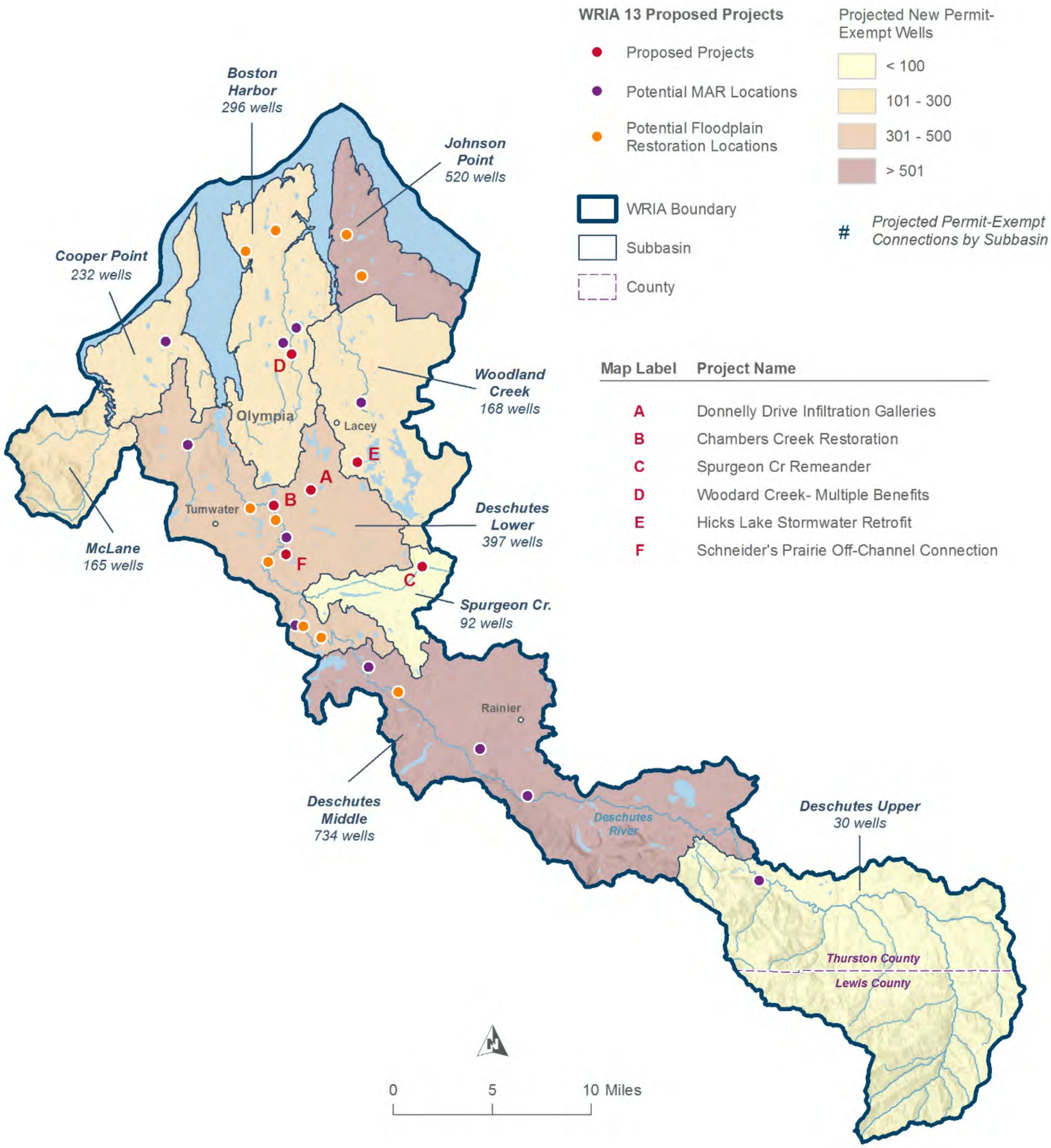

Figure 5: WRIA 13 Projects by Subbasin

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 13. While several of these projects may produce a marginal offset benefit by increasing seasonal storage, the benefits were too small or too complex to estimate. In general, these projects increase stream complexity, reconnect floodplains, promote fish passage, and enhance natural processes that had been lost to the benefit of salmonids and other aquatic species. Projects defined in Table 9 have been developed to the concept or design level. Additional projects identified by the WRIA 13 committee are defined in Appendix J and could be completed during plan implementation. Projects are described in Table 9, and detailed project descriptions are included in Appendix I.

Table 9: Category II Projects in WRIA 13 that Primarily Provide Habitat Improvements

Project Name	Description	Subbasin	Anticipated Ecological Benefit	Sponsor	Estimated Cost[61]	Readiness to Proceed
Spurgeon Creek Re-meander	Channel re-alignment to increase channel length and sinuosity	Spurgeon	Floodplain connectivity; Instream habitat complexity	Thurston County	$<1M	High
Chambers Creek	Channel re-alignment to increase channel length and sinuosity at the confluence with Chambers Ditch.	Lower Deschutes	Floodplain connectivity; Instream habitat complexity	Thurston County	$<1M	Medium
Woodard Creek	Add LWD and riparian vegetation	Boston Harbor	Floodplain connectivity; Instream habitat complexity	Thurston County	$<1M	Low

[61] 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 projects and prospective projects that provide additional streamflow or habitat throughout the WRIA. These categorical projects do not have specific locations, but are supported by the Committee for future development.

5.4.1 Water Right Opportunities

In addition to the projects described in this chapter, the WRIA 13 Committee supports projects and actions that achieve the following goals:

1. Opportunities to address irrigation efficiencies and other conservation measures 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 13 Committee acknowledges that all water rights transactions rely on willing sellers and willing buyers. The WRIA 13 Committee supports acquisition of all types of water rights, including municipal water rights. The WRIA 13 Committee recognizes the importance of water availability for farmers and the limited available water supply. The WRIA 13 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 to the properties at rates no greater than that for the current irrigation occurring, or are otherwise agreeable to the property owner.
4. The WRIA 13 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 13 Committee acknowledges the need for project sponsors, technical assistance to manage complex studies, and future funding to adequately implement projects. Due to the uncertainties regarding the acquisition of water rights, the committee chose not to count the potential offsets from acquisitions during the plan analysis.

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.[62] Due to uncertainties regarding forest management projects, the committee chose not to count the potential offset from this project during the plan analysis.

5.4.3 Floodplain Restoration

The Committee is interested in restoring stream floodplain function, where appropriate. WRIA 13 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).

A detailed project description is included in Appendix I. Due to uncertainties regarding floodplain restoration projects, the Committee chose not to count the potential offset from this project during the plan analysis.

5.4.4 Small-scale LID Project Development

The Committee is interested in a programmatic project to strategically concentrate small-scale LID retrofit work in urbanized settings, partnering with residential and commercial community members to redirect runoff away from stormwater conveyance systems and into green stormwater infiltration facilities. In rural settings, efforts can explore additional opportunities to slow and infiltrate stormwater runoff that would otherwise rapidly discharge into nearby streams.

Thurston Conservation District has taken a leadership role on this project, and is committed to working with partners to identify and implement retrofit projects to benefit groundwater recharge. Project locations will be determined during implementation.

Potential benefits include recharge of shallow groundwater areas where other large-scale projects are not feasible, and water quality benefits to nearby streams which would otherwise receive untreated runoff. Additionally, these projects would directly engage residential and commercial partners to contribute to streamflow preservation. Due to uncertainties regarding these types of projects, the Committee chose not to count the potential offset from this project during the plan analysis.

5.5 Project Implementation Summary

5.5.1 Summary of Projects and Benefits

As specified in Chapter 4, this plan aims to offset 435 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 513 AFY as a goal to achieve through adaptive management. The projects included in Table 7 provide an estimated offset of at least 1,346 acre-feet per year and exceed the consumptive use estimate. The projects included in Table 7 provide an estimated offset of 1,316 AFY and exceed both the “most likely” and higher adaptive management consumptive use estimates.

Out of the 9 subbasins identified by the Committee, 4 subbasins have anticipated project offsets that exceed both the most likely and higher consumptive use estimates; 1 subbasin has anticipated project offsets that do not meet either the most likely or the higher consumptive use estimate; and, 4 subbasins do not have any offset projects identified. However, to address a lack of projects in some subbasins, and to increase the likelihood of plan implementation and tracking progress, this watershed plan includes policy and regulatory recommendations and an adaptive management process (see Chapter 6).

Many habitat projects have been identified by the Committee for habitat benefits (Appendix H). Four of these projects have been described 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 were selected by the Committee for their likelihood to provide 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.

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 consumptive use from new domestic PE wells 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 8.

The total estimated cost for implementing the water offset projects listed and described in this chapter range is $17.34 million, with projects ranging from $2.8 million to $6.31 million.

The total estimated cost for implementing the habitat projects listed and described in this chapter is $3 million.

5.5.3 Certainty of Implementation

The WRIA 13 Committee selected projects a likelihood of implementation and have support from project sponsors. As described in Chapter 6, the WRIA 13 Committee supports the development of an implementation group (see the Deschutes Watershed Council in section 6.1.10) to further develop projects. Additionally, Chapter 6 includes "assurance of implementation" language provided by many entities on the Committee. 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. Additionally, this plan includes other adaptive management and policy recommendations to increase reasonable assurance that the projects and actions in the plan will be implemented.

Chapter Six: Policy Recommendations, Adaptive Management, and Implementation

6.1 Policy and Regulatory Recommendations

RCW 90.94 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 13 Committee included what they have termed "policy and regulatory recommendations" in the plan to show support for projects, 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 13 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 13 Committee intended to count toward the required consumptive use offset or Net Ecological Benefit are included in Chapter 5: Projects and Actions.[63] As recommended by the NEB Guidance, the WRIA 13 Committee prepared this watershed plan with the intention that it be implemented.[64]

The WRIA 13 Committee initially identified a list of potential policy and regulatory recommendations[65]. After iterative rounds of discussion, the Committee narrowed the recommendations in this section to those that both supported the goal of streamflow restoration and had the support of the full Committee. Unless otherwise specified, the proposed implementing entity is not obligated by this plan to implement the recommendation; however, the WRIA 13 Committee supports the recommendations and their implementation by the appropriate entity. Committee members identified as the implementing entity for each recommendation have indicated that they are committed to investigating the feasibility of the recommendation.[66] Additional information on assurance of implementation has been provided by many entities in section 6.3.2.

The Committee recommends that Lewis County be exempt from policy recommendations at this time because of the lack of PE well growth in the Lewis County portion of WRIA 13.

The WRIA 13 Committee supports the following recommendations, which are not listed in order of priority:

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[63] "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

[64] Ecology's interpretation, as articulated in the Streamflow Restoration Policy and Interpretive Statement (POL-2094), is that "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)

[65] Policy and adaptive management proposals provided by Committee members are included in the plan compendium. This chapter represents the recommendations that were agreed to by consensus.

[66] The identification and listing of these policy and regulatory recommendations is directly from the WRIA 13 Committee members and is not endorsed or opposed by the Washington State Department of Ecology.

1. Water Conservation and Drought Adaptation Education and Outreach

Proposed implementing entity:

Thurston Conservation District, potentially with support from WSU Extension and Thurston County.

Recommendations:

- Develop educational materials and workshops for new or existing homeowners.
- Work with local nurseries to stock and label low water use native species for xeriscaping.
- Develop Irrigation Water Management Plans for agricultural producers and gardeners.
- Support development of a program to compensate agriculture producers for not using their full water rights, with conserved water to be temporarily placed into Trust Water Rights program.
- Support development of incentive program to upgrade outdated or inefficient irrigation systems.
- Include drought tolerance/water use efficiency as a factor in recommended tree lists.

Purpose:

Promote water conservation in residential and agricultural sectors. Reduced leaching of nutrients into streams and water bodies due to over watering.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2

2. Drought Response Limits

Proposed implementing entity:

Ecology, Thurston County, and other organizations. Recommendations:

Research the use of water from permit exempt wells during drought periods, and whether upon the issuance of a drought emergency order under RCW 43.83B.405, consider a language change to state that the withdrawal of groundwater exempt from permitting under RCW 90.44.050 “will” be limited to no more than 350 gallons per day per connection for indoor use only, instead of “may”. Consider including new exemptions for growing food, maintaining a fire control buffer, or supporting an environmental restoration project. Engage local stakeholders in considering this change. Consider developing or enhancing a County-wide drought response plan.

Purpose:

Build resilience against climate change impacts (e.g., extreme heat, low precipitation, low flows). Protect Tribal Treaty rights and senior water rights. Support NEB goals for streamflow restoration.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2 Other possible sources of funding include funding allotted to Ecology under RCW 90.94 and potential reassignment of existing or future staff.

3. County Policies to Promote Connections to Group A Systems

Proposed implementing entity:

Thurston County

Recommendations:

Research and review existing plans, policies, and ordinances to determine if there are opportunities to limit PE wells when Group A service is available.

Purpose:

Reduce the number of projected new PE wells, thereby reducing groundwater consumptive use and providing an offset safety factor.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2

4. Revolving Loan & Grant Fund for Small Public Water Systems

Proposed implementing entity:

Ecology and Thurston County

Recommendations:

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 increased cost of connecting to a Group A system (instead of constructing a PE well) creates 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:

Reduce barriers to connecting to Group A systems, thereby reducing the number of projected new PE wells, reducing groundwater consumptive use, and providing an offset safety factor.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

5. South Sound Water Steward

Proposed implementing entity:

Ecology, local governments, and other entities as appropriate.

Recommendations:

Ecology creates a new position of "South Sound Water Steward," whose duties include:

- Monitoring instream flows, wells, and other relevant water bodies to support implementation of the watershed plans and compliance with state rules.
- Conducting ongoing education, outreach, and technical support for permit-exempt wells owners and water rights holders (especially as part of drought response).
- Providing technical advisement to Ecology during water rights decisions in the South Sound.
- Investigating and enforcing illegal water use issues, in accordance with current regulations for enforcement, in accordance with current regulations for enforcement.

As appropriate, the position would include legal authorities consistent with both a Water Master and a Ground Water Supervisor (RCW 90.03.060; 90.03.070; RCW 90.44.200; WAC Chapter 508-12). Duties would not conflict with existing Water Master staff at Department of Ecology Southwest Regional Office, but may build upon them for specific duties at the discretion of the Water Resources Southwest Regional Manager.

Purpose:

Supports compliance with water resources laws/regulations and Tribal Treaty rights. Consistent and effective implementation of watershed plans. Gives Ecology a visible and clear role for supporting plan implementation and compliance with state laws and regulations.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, reassignment of existing or future staff or other means. More funding information is available in Section 6.2.

6. Upgrade Well Reporting

Proposed implementing entity:

Ecology

Recommendations:

- Develop interactive web-based well mapping and reporting tool for drillers.
- Require well coordinates on reports.
- Increase capacity for the Well Construction and Licensing Office at Ecology to vet well reports.

Purpose:

Improve well location data and access to it. Accurate well data is critical for monitoring and management of shared water resources throughout Washington. Streamline data collection process.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

Additional information or resources:

The full policy proposal is included in Appendix K.

7. Instream Flow Rules

Proposed implementing entities:

Ecology; Washington State Legislature; local governments.

Recommendations:

- Investigate the WRIA 13 salmon streams and determine needed revisions to the WRIA 13 Instream Flow (ISF) Rule (WAC 173-513). Streams under review for instream flow revisions will be clearly represented to the public through maps in an accessible manner. Consider need to close streams in WRIA 13 with summer salmonid habitat (which could include: Upper Deschutes River, Middle Deschutes River, Lower Deschutes River, McLane Creek, Green Cove, Woodland Creek, Woodard Creek, Percival Creek, Adams Creek, and other associated tributaries and small coastal streams with salmonid habitat) annually in the low flow season (typically from June through October) and what effect it would have on growth in the watershed. This would apply to water rights that have a priority date after any changes made to the instream flow rule.
- Review other salmon streams without existing ISF between November and May and consider setting ISF levels using current methodology.
- Use the latest ISF assessment methodology to reassess ISF values for the Deschutes River below Deschutes Falls.
- Revise and add any other conditions consistent with the final watershed plan to the ISF rule.

- Ecology to initiate rulemaking to update the 40-year old WRIA 13 rule to reflect changed conditions and new information, and make the rule effective, legally consistent, and enforceable.

Purpose:

Greater protection of aquatic resources, streamflows, Tribal Treaty water rights, and senior water rights from future water demands.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

8. Permit Exempt Well Withdrawal Limits

Proposed implementing entity:

Ecology

Recommendations:

Research water use in WRIA 13 and PE well limits.

- Investigate actual indoor and outdoor domestic water use and compare to current legal limits and determine if a lower limit is appropriate. Consider allowing exceedance of limits if the outdoor water use is for food production, fire protection, or an environmental restoration project.

Purpose:

Benefits: reduces potential impact of new permit-exempt domestic wells. Limitations provide a "safety factor" by setting limits on PE well use based on good water conservation practices. This improves the net benefits of offset projects as they are completed to restore streamflows and protect senior water rights.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

9. Salmon Recovery Portal Project Tracking

Proposed implementing entity:

WDFW in collaboration with Ecology, RCO, University of Washington data stewards, and WRIA 13 Committee.

Recommendations:

Pilot the Salmon Recovery Portal, currently managed by Washington State Recreation and Conservation Office (RCO), for tracking streamflow restoration projects and new PE wells. WDFW would coordinate this effort—in collaboration with Ecology and the WRIA 13 Committee—and consult Lead Entity Coordinators prior to initial data uploads. University of Washington data stewards would perform data entry, quality assurance, and quality control.

Purpose:

- Coordinate streamflow restoration with ongoing salmon recovery efforts.
- Improve capacity to monitor implementation of streamflow restoration projects and actions.
- Build grant funding opportunities and track costs associated with streamflow restoration.
- Provide a template for adaptively managing emergent restoration needs.

Funding source:

WDFW, additional funding may be required.

Additional information or resources:
https://srp.rco.wa.gov/

10. Deschutes Watershed Council (DWC)

Proposed implementing entities:

Deschutes Estuary Restoration Team (DERT); Tribes; local governments; other stakeholders (i.e. agricultural, residential construction, environmental interest representatives).

Interested members of the WRIA 13 Watershed Restoration and Enhancement Committee would reconvene to initiate the DWC, such as DERT, City of Tumwater, City of Olympia, City of Lacey, Thurston County, Thurston Conservation District, and the WRIA 13 Salmon Habitat Recovery Lead Entity Coordinator, and others.

Recommendations:

Convene a collaborative partnership that builds on successful models in other watersheds, uses science-based tools with demonstrated effectiveness, and stresses collaborative solutions that reduce conflict and avoid litigation Responsibilities could include:

- Formally implementing Plan recommendations.
- Identifying and implementing water quantity and quality management solutions on a regional scale that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives.
- Incorporating adaptive management techniques to address climate change and other impacts.

Purpose:

The WRIA 13 Committee recommends creating a Deschutes Watershed Council (DWC) to (1) implement the plan; (2) provide a structure for collaboration on projects; (3) identify, recommend, and implement actions to offset impacts from new water right applications, transfers, and changes, and other water use that impact streamflows; and (4) address water quality issues.

Funding sources:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

Additional information or resources:

Ecology – Deschutes River, Percival Creek, & Budd Inlet Tributaries TMDL Improvement Projects

11. County Planning Study – Streamflow Restoration Effectiveness

Proposed implementing entity:

Ecology or other department would contract a consultant to perform work.

Recommendations:

Conduct a study to compare planning and permitting policies/programs among Kitsap County, Pierce County, Thurston County, Mason County, and King County. Determine how effectively these policies/programs support protection and enhancement of streamflow restoration (e.g., through protection and enhancement of groundwater recharge). Evaluate (1) how and why county programs have been effective, and (2) gaps or areas where planning has been less effective. Propose strategies for improving rules to promote recharge enhancement and streamflow restoration.

Purpose:

Inform decision-making and improve planning/permitting to promote streamflow restoration.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

12. Water Supply Data for Comprehensive Water Planning

Proposed implementing entity:

Ecology with support from counties, Department of Health, and potentially consultants.

Recommendations:

Collect, estimate, and/or project the following data and include in a future update of WRIA 13's Watershed Plan:

- Number of existing permit exempt domestic water wells and their water use
- All projected water usage for the next 20 years (i.e., PE wells, inchoate rights, new water rights).
- Number of municipal water supply connections expected in the next 20 years, by subbasin.
- Total number of existing PE wells by county.

Within the first five years of WRIA 13's Watershed Plan implementation, collect, estimate, and/or project the following for each subbasin:

- Total existing (2018 and earlier) connections in service using (1) unmitigated inchoate water rights; (2) mitigated inchoate water rights; or (3) PE 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) PE wells.

Purpose:

Provide robust information base for comprehensive water planning. Provide context for the Watershed Plan and its goals.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

13. Rainwater Collection - Education & Incentives

Proposed implementing entity:

Thurston Conservation District

Recommendations:

- Assurance from regulatory entities at all levels that rainwater collection is allowed under current DOE policy (Policy #1017).
- Rainwater collection design support at multiple scales of capacity, but only at scales allowed under current DOE policy. Design support through this policy is intended for PE well users only.*
- Financial assistance for rainwater harvesting infrastructure, intended for PE well users only.*

** The proposed limitations regarding eligible assisted community members would only apply to work performed as part of this policy and would not restrict the work of individual partners to provide support for rainwater collection across WRIA 13.*

Purpose:

Education and support around allowed uses of rainwater collection. Could help minimize flashy flows in some locations. Could reduce PE well usage, although reduction volumes are likely minimal. Encourages a shift towards viewing water as a finite resource. Provides community members with a tangible—and practical—action to support water conservation efforts in their communities.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

Additional information or resources:

Ecology's clarification of rainwater collection with basic planning resources:

https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-recovery-solutions/Rainwater-collection

14. Water Conservation Statewide Policy

Proposed implementing entities:

Ecology, Conservation Commission, Conservation Districts, and counties, with direction from legislature.

Recommendations:

The legislature consider authorizing and funding a statewide program of WRIA-based water conservation measures for domestic PE wells in unincorporated areas of the state during drought events. Measures would focus on Voluntary methods for efficient outdoor water use.

Purpose:

Reduce domestic PE well water usage across the state, and especially during drought declarations in affected WRIAs. Reduce impacts on stream flows. Increase climate change resilience. Provide offset safety factor. Support NEB goals.

Funding source:

Potential funding sources could include: legislative budget line item providing additional allocations to Ecology and the Conservation Commission, to pass through to Conservation Districts and Counties.

15. Revise Thurston County Critical Areas Code Regarding Reclaimed Water Use

Proposed implementing entity:

Thurston County

Recommendations:

- Consider changes to the Thurston County Critical Areas Ordinance, specifically the Critical Aquifer Recharge Areas regulations under TCC 24.10.190, 24.30.085, and 24.25.080, to allow for additional uses of reclaimed water. Thurston County's Critical Areas Ordinance currently does not permit large-scale infiltration of reclaimed water (defined as "application to the land's surface above agronomic rates").
- Review additional information from the Regional Groundwater Recharge Scientific Study (now known as LOTT's Reclaimed Water Infiltration Study) and other sources. Thurston County could reconsider this limitation in light of new state-level guidance and information from LOTT's pending study, which will be completed in 2021.

Purpose:

Allowing additional uses of reclaimed water would increase options for mitigating streamflows in unincorporated Thurston County, along with other potential benefits, by replenishing groundwater, augmenting streamflows, enhancing wetlands and other habitat, and offsetting the quantity of water that is withdrawn for other purposes.

Funding:

Funding is undetermined and needed through either grants, committee resources, Thurston County general funds, or other potential funding methods.

6.2 Plan Implementation and Adaptive Management

The WRIA 13 Committee supports an adaptive management process for implementation of the WRIA 13 Watershed Plan. Adaptive management will help address uncertainty and provide more reasonable assurance for plan implementation.

The WRIA 13 Committee recommends tracking the growth of new PE wells and the total number of new building permits requiring a water connection 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.

The WRIA 13 Committee makes the following recommendations:

6.2.1 Oversight

The WRIA 13 Committee recommends creating a **Deschutes Watershed Council (DWC)** to (1) implement the watershed plan; (2) provide a structure for collaboration on projects; and (3) identify, recommend, and implement actions to offset impacts from new water right applications, transfers, and changes, and other water use that impact streamflows. The DWC would comprise of representatives interested in protecting, conserving, and restoring the Deschutes Watershed. For example, this would include the Squaxin Island Tribe; local governments; special purpose districts (taxing authority); businesses; non-profit conservation, land trust organizations, agricultural representatives, environmental interests, residential construction industry; and other entities that participated in the WRIA 13]Committee; and key involvement from a diverse range of community members from across WRIA 13.".

The DWC could address water quality and quantity issues by:

- Providing a **structure for collaboration** on projects to offset impacts to streamflow and changes in water quality.
- **Inventorying** existing (1) water quantity and quality regulations and (2) incentive-based and/or voluntary water protection and conservation programs.
- Identifying and implementing **regional water management solutions** that increase self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives.
- Evaluating and pursuing legislation for the development of **mitigation banks** to be used to offset impacts of future development of either permit-exempt wells or permit-required wells.
- Partner with Stream Team, or engage **community-based volunteer and education programs** to initiate a sense of place, ownership, and responsibility for the future of the Deschutes watershed.

- Specific tasks for DWC could include:
    - Support for review, revision, and prioritization for grant applications, to ensure consistency with the overall approach of the Plan
    - Tracking of offsets and the number of exempt well developments authorized by the counties, both by WRIA and by subbasin.
    - Reporting of Plan progress to Ecology, Committee members and the public.
    - Identification and development of long-term stable funding. The Plan proposes funding to provide capacity to the Lead Organization or Committee. The funding strategy is described in a separate proposal.
    - Development of a multi-party agreement that establishes membership, operating principles, and administration of the DWC.
    - Developing and maintaining the institutional knowledge needed to provide a continuing approach to implement over the long-term.
    - The long-term responsibility for Plan implementation.

6.2.2 Project Tracking

Counties should continue to track permit-exempt well construction. The WRIA 13 Committee also recommends tracking streamflow restoration projects to: (1) track status of implementation, including projects and other recommendations; (2) build grant funding opportunities; (3) track project costs; and () provide a template for adaptively managing emergent restoration needs.

The WRIA 13 Committee recommends piloting the Washington State Recreation and Conservation Office's (RCO) Salmon Recovery Portal **(SRP)** to track Watershed Plan projects through planning and implementation phases. As a statewide tool administered by RCO in partnership with salmon recovery Lead Entities, the SRP provides a dynamic platform to track project offsets. SRP can set goals, create project hierarchy tiers, include supplemental information, and generate automated reports.

To support the implementation of the above pilot program for tracking projects under 90.94.030 RCW, the Washington Department of Fish & Wildlife (WDFW) has initiated pilot projects in two 90.94.020 RCW basins: the Nisqually River Basin (WRIA 11) and the Chehalis River Basin (WRIAs 22/23). These pilots are coordinated by WDFW in conjunction with RCO, Ecology, local Lead Entity Coordinators, and the Planning Units for WRIA 11 and WRIA 22/23. Intended as a proof of concept, these pilots are planned to explore the capacity and effectiveness of the SRP to track streamflow restoration projects.

Tracking of projects will begin with **two primary data entry phases**, shown in Table 9 below.

Table 10: Phases of Project Tracking Data Entry

Tasks:	**Phase 1**: Upload required project information for each project in Watershed Plan.	**Phase 2**: Upload/update all funded projects, project reports, and completed projects annually.
Coordinator	WDFW	WDFW
Funding	WDFW, and other entities TBD.	WDFW, and other entities TBD.
Data entry	University of Washington data stewards in collaboration with RCO and Ecology	University of Washington data stewards in consultation with RCO, Ecology Grant Management staff, and WDFW.
Quality control	University of Washington data stewards	University of Washington data stewards

Local salmon recovery Lead Entity Coordinators will be consulted prior to initial data uploads. At a minimum, the Committee recommends tracking the following **data points for each project**:

- WRIA
- Sub-basin
- Estimated cost
- Funding source
- Project description
- Target implementation date
- Project status (e.g., not started; in progress; completed)
- Project proponent (if applicable)
- Project spatial boundaries or coordinates
- Estimated water offset and/or habitat benefits

6.2.3 Monitoring and Research

In addition to monitoring project implementation as described above, the WRIA 13 Committee proposes the DWC plans and coordinates additional monitoring and research to improve water planning data, reduce uncertainty, and inform decision-making as the Plan is implemented. This additional information will support adjustments to the Watershed Plan to focus limited resources on the most significant problems and best solutions. Additional monitoring and research initiatives could include:

- Developing an overarching **Monitoring and Research Plan** as part of implementation.
- Monitoring all streams with Instream Flow Rule provisions.
- Improving regional groundwater data, maps, and models.
- Developing a program to monitor habitat and net ecological benefit (NEB).
- Monitoring of project implementation and effectiveness.

Existing Monitoring Data

Multiple jurisdictions have operated, and continue to operate, monitoring and data collection programs throughout WRIA 13. The USGS operates gages on the Deschutes River at Rainier (since 1949) and at Tumwater (since 1938). Thurston County operates a weather network (11 stations), groundwater network (10 wells) and stream gaging network (7 gages) in the WRIA, some with continuous data extending back to the 1980s. The County also managed a volunteer lake level monitoring program that was active from 1990 through 2012 on Ward, Hewitt, Chambers, Hicks, Pattison, Long, Offut, Lawrence, and Summit lakes. The Stream Team (a cross-jurisdictional effort between Lacey, Olympia, Tumwater, and Thurston County) has collected volunteer Benthic Index of Biotic Integrity data on streams throughout the region since 1990.
A monitoring and research plan can include these sources of data, as well as any other credible sources of data. Surface water monitoring data in WRIA 13 is available from Thurston County, Ecology, and other entities.

Annual Reporting & Adaptive Management

Using annual reports to identify trends and indicators, the Committee recommends that DWC take an adaptive management approach to implementing the WRIA 13 Watershed Plan.[67] The adaptive management provisions outlined below will also help determine whether projects are functioning as designed under climate change conditions and allow for course corrections as needed.

The Committee recommends requiring the following annual reports:

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[67] Adaptive Management is defined in the Net Ecological Benefit (NEB) Guidance as ‘an interactive and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions.”

- Counties provide reports to Ecology and DWC on PE well construction and connections, as well as the total number of new water connections.
- Project sponsors provide report to DWC on project status and estimated project offset amounts of completed projects.

The WRIA 13 Committee also recommends that Ecology's Streamflow Restoration grant guidance be revised to include a requirement that funded projects provide annual reports to Ecology.

Beginning the fifth year of implementation, DWC will compare the following by subbasin and summarize in a report to Ecology:

- Estimated consumptive use for permit exempt wells constructed during year (using the methodology designated in the WRIA 13 Watershed Plan).
- Estimated annual project offset amounts by subbasin.
- If sufficient project information is not available within the fifth year of implementation, reporting will be adjusted to accommodate project needs.

If the comparison report indicates that total project offset amounts are less than the cumulative total of new permit exempt well consumptive use amounts described in Chapter 4, the Committee recommends:

- DWC identifies opportunities to accelerate completion of offset projects in progress and includes an associated timeline for completion in report to Ecology.
- DWC works with local jurisdictions to consider additional strategies and actions.
- Ecology considers appropriate actions to protect senior water rights and support implementation of the plan

If the comparison report indicates that project offset amounts are exceeding the consumptive use offset targets identified in Chapter 4 as a higher estimate(513 AFY) to achieve through adaptive management (on an annual prorated basis), or if PE well growth is lower than predicted, Ecology could relax restrictions and make reporting cycles less frequent (e.g., every other year).

6.2.4 Funding

Funding is critical to implementing the WRIA 13 Watershed Plan and achieving its goals. Based on funding estimates from other watershed groups, the Committee recommends that an amount not exceeding $200,000 annually could be needed to establish and maintain the Deschutes Watershed Council (which will implement tasks described in sections 1-4 above). Funding described in this section is for oversight, monitoring, and tracking of implementation and does not reflect funding needs for implementation of projects discussed in Chapter 5. Recommended investigation of funding strategies include:

- **Increase permit exempt well fees**. Consider an equitable approach to increasing the existing well fee based on impact to groundwater and needs of plan.
- **Request sustainable funding from the Washington State Legislature**. Funding would be available statewide to WRIAs with a plan or Rule under RCW 90.94. Activities prioritized for funding could include oversight; monitoring and research; education, outreach, and technical assistance; and reporting. The Committee recommends a dedicated fee (e.g., an annual fee on permit exempt wells as part of annual property tax assessments) rather than reliance on the general fund.
- **Other funding methods**. Research additional options for funding to implement the WRIA 13 plan that could include programs, optional mitigation, or other funding methods.

Additional sources of funding could include grants, DWC member cost-sharing or fees, and/or DWC service revenues.

6.3 Other Issues

6.3.1 Summary of Legislative Requests

Legislative funding is requested for all recommendations except 6.1.9.

6.3.2 Assurance of Plan Implementation

WRIA 13 Committee members and participating entities strongly advocate for implementation of the watershed plan. 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 seeking project opportunities
        - Seeking and supporting funding opportunities to achieve implementation
        - Tracking implementation and identifying areas for improvement

- **Lewis County**

    - Lewis County adopts this watershed plan by resolution, formalizing our support of the plan contents.
    - This watershed plan becomes one of the guiding project implementation plans.
    - Lewis 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

- **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

- **Thurston PUD**
    - Thurston PUD supports and participates in implementation activities as staff capacity allows, including:
        - Participating in Implementation meetings
        - Communications with internal and external stakeholders

    - Support project development and management

- **Thurston Conservation District**

    - The Thurston Conservation District 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

- **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 seeking project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement

- **City of Lacey**

    - The City of Lacey 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
    - The City of Lacey adopts this watershed plan by resolution, formalizing our support of the plan contents.

- **City of Olympia**
    - The City of Olympia 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
    - The City of Olympia participates on the Nisqually Watershed Council and intends to participate on the Deschutes Watershed Council when formally established.

- The City of Olympia engages in regional water resource management activities when consistent with the City's authority and regulations, and jurisdictional interests, thereby providing support to other entities' efforts when appropriate.

- **City of Tumwater**
  - The City of Tumwater 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
  - The City of Tumwater intends to participate on the Deschutes Watershed Council when formally established.
  - The City of Tumwater engages in regional water resource management activities when consistent with the City's authority and regulations, and jurisdictional interests, thereby providing support to other entities' efforts when appropriate.

- **Deschutes Estuary Restoration Team (DERT)**
  - DERT supports and participates in implementation activities as staff capacity allows, including:
    - Inform other interested and affected environmental organizations in WRIA 13 of its provisions, and the extent to which the plan conforms to the letter and spirit of the legislation;
    - Advocate at the Legislature for authorization and funding for the Deschutes Watershed Council;
    - Participate in the activities of the Deschutes Watershed Council, including implementation of projects and policies contained in the Plan;
    - Advocate with Ecology for adoption of rule revisions for WRIA 13 if recommended in the Plan;
    - Advocate with Ecology and the Legislature for greater prioritization in Ecology's grant program for priority projects identified in the Plan;
    - Work with the Squaxin Tribe and other representatives to the WREC, to ensure better information and collaborative efforts for restoration of the watershed; and
    - Consistent with DERT's mission for the past ten years, and as a Puget Soundkeeper Affiliate, work for restoration of the Deschutes Estuary, and for improvement of both water quantity and water quality conditions in the Deschutes Watershed.

Chapter Seven: Net Ecological Benefit

7.1 Introduction to NEB

Watershed Restoration and Enhancement Plans must identify projects and actions to offset the potential consumptive impacts of new permit-exempt (PE) domestic groundwater withdrawals on instream flows over 20 years (2018-2038), and provide a net ecological benefit (NEB) to the WRIA. The WRIA 13 Committee chose to include an NEB evaluation to reflect the local expertise of the partners who contributed to developing this watershed plan. Upon approval of a watershed plan, 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.[68]

The Final NEB Guidance establishes Ecology's interpretation of the term "net ecological benefit" as "the outcome that is anticipated to occur through implementation of projects and actions in a [watershed] plan to yield offsets that exceed impacts within: a) the planning horizon; and, b) the relevant WRIA boundary" (Ecology 2019).

The Final NEB Guidance sets Ecology's expectation for the NEB evaluation:

- "Planning groups are expected to include a clearly and systematically articulated NEB evaluation in the watershed plan" (Ecology 2019).
- "A watershed plan that includes a NEB evaluation based on this [Final NEB] guidance significantly contributes to the reasonable assurances that the offsets and NEB within the plan will occur. Ecology will review any such [watershed] plan with considerable deference in light of the knowledge, insights, and expertise of the partners and stakeholders who influenced the preparation of their [watershed] plan. Ecology will make the NEB determination as part of this review" (Ecology 2019).

The WRIA 13 Committee completed a NEB evaluation for this watershed plan; the results of that evaluation are included in this chapter.

7.2 Consumptive Use and Water Offsets

This plan uses medium population growth forecasts for Thurston County to project a total of 2,616 new PE wells installed within WRIA 13 during the planning horizon.

[68] RCW 90.94.030(3)(c) states that "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".

The WRIA 13 Committee has determined that an area of 0.10 irrigated acres result in the most likely outdoor consumptive use estimate of 435 AFY (0.6 cfs) for WRIA 13, and will be used as the target offset to compare to offsets from projects. A higher consumptive use estimate to achieve through adaptive management of 513 AFY (0.7 cfs) was also established by the Committee and was developed assuming an average irrigated area of 0.12 acres per well. More information on methods to estimate the number of new PE wells and consumptive use can be found in Chapter 4 and Appendix H.

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 focus on stormwater infrastructure and infiltration, off-channel reconnection, water right acquisition, and Managed Aquifer Recharge (MAR).

This plan estimates a total potential water offset of 1,900 AFY from four water offset projects or project types (described in Chapter 5 and listed in Table 11). However, to account for uncertainty in the likelihood of projects being built and the estimated benefits being realized (including the timing of streamflow benefits), the Committee chose to exclude estimates of water offsets for some projects, and to reduce the estimates for other projects., resulting in a more conservative potential water offset of 1,316 AFY. This more conservative estimate suggests a WRIA-wide surplus offset of 881 AFY above the consumptive use offset target and a surplus of 803 AFY above the adaptive management goal set by the Committee.

Table 11: Summary of WRIA 13 Water Offset Projects included in NEB analysis

Project Name	Subbasin(s)	Project Short Description	Estimated Offset Benefits (AFY)	Offset Claimed by WRIA 13 Committee (AFY)	Timing of Benefits[69]	Project Stage
Schneiders Prairie Off-Channel Connection	**Deschutes Lower**	Off-channel reconnection and infiltration	681	681	May-October	Conceptual
Donnelly Drive Infiltration Galleries	**Deschutes Lower**	Improve neighborhood stormwater infiltration, avoiding surcharge and runoff to Chambers Ditch.	14	14	Year-round	Conceptual
Deschutes/ Chambers MAR Projects	**Deschutes Lower, Deschutes Middle, Deschutes Upper, Cooper Point, Boston Harbor**	Several candidate locations for MAR by diverting Deschutes River water during high flow periods when minimum instream flows and ecological flows are exceeded.	909	325	Year-round	Conceptual
Hicks Lk Water Stormwater Retrofit	**Woodland Creek**	Retrofit surface water facility for infiltration and additional stormwater treatment - flow attenuation	296	296	Year-round	Conceptual
WRIA 13 Total Water Offset			**1,900**	**1,316**		
WRIA 13 "Most Likely" Consumptive Use Estimate			**435**			
WRIA 13 Higher Adaptive Management Consumptive Use Estimate			**513**			

69 The WRIA 13 Committee agreed that for the purposes of this watershed plan, the critical flow period will be defined as May-October.

Projected future consumptive water use and the estimated project water offset quantities that the Committee agreed to use during the NEB evaluation are compared at the subbasin scale in Table 12. When compared to both the most likely and higher adaptive management consumptive use estimates, a surplus water offset is achieved in four subbasins (Lower, Middle and Upper Deschutes; and Woodland Creek) and a deficit in water offset in the other five subbasins (Boston Harbor, Cooper Point, Johnson Point, McLane, and Spurgeon Creek).

Chapter 90.94 RCW allows for an uneven distribution of the offset project amounts relative to anticipated consumptive water use, provided the plan overall will lead to a NEB. As is evident in Table 12, the benefits associated with offset projects far exceeds the most likely consumptive use in the Deschutes (Upper, Middle, Lower) and Woodland subbasins, and the surplus water offsets are large (between 74 – 632 AFY). Among the subbasins with water offset deficits, Johnson point had the largest predicted water deficit of -86 AFY and no water offset projects have been identified. The remaining subbasins had much smaller deficits than the surpluses in all surplus subbasins.

The subbasins in surplus and deficits are the same when compared to the higher consumptive use estimate described in this watershed plan as a goal to achieve through adaptive management at the WRIA-scale, shown in Table 12. The benefits associated with offset projects far exceeds the anticipated consumptive use in the Deschutes (Upper, Middle, Lower) and Woodland subbasins, and the surplus water offsets are large (between 73 – 621 AFY). Among the subbasins with water offset deficits, Johnson point had the largest predicted water deficit of -102 AFY and no water offset projects have been identified. The remaining subbasins had much smaller deficits than the surpluses in all surplus subbasins

The water offset projects listed in Table 12 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 13, additional benefits could include the following:

- Schneiders Prairie Off-Channel Connection: Off-channel habitat for juvenile salmonids and other aquatic life will be restored and made accessible, with fish ingress and egress. Off-channel habitat will be particularly beneficial to coho salmon. Increased groundwater seepage into the Deschutes River from this project will increase flow and provide cool water during the critical period (i.e. late summer and early fall), benefitting multiple species.
- 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.

Table 12: Subbasin Water Offset Totals Compared to Permit-Exempt Well Consumptive Use Estimate

Subbasin	Offset Project Totals Claimed by the Committee (AFY)[70]	Permit-Exempt Well Most Likely Consumptive Use (AFY)	Surplus/Deficit from Most Likely CU Estimate (AFY)[71]	Higher Adaptive Management Consumptive Use Estimate (AFY)	Surplus/Deficit from Higher Adaptive Management CU Estimate (AFY)
Boston Harbor	0	49	-49	58	-58
Cooper Point	7	39	-32	45	-38
Deschutes Lower	695	63	+632	74	+621
Deschutes Middle	238	122	+116	144	+94
Deschutes Upper	79	5	+74	6	+73
Johnson Point	0	86	-86	102	-102
McLane	0	27	-27	32	-32
Spurgeon Creek	0	15	-15	18	-18
Woodland Creek	296	28	+268	33	+263
WRIA 13 Total	**1,316**	**435**	**+881**	**513**	**+803**

[70] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

[71] 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).

7.3 Habitat Benefits

The WRIA 13 plan includes an inventory of additional projects to meet the offset needs and NEB for the watershed. Table 13 summarizes the benefits of four 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. 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.

WRIA 13 provides an important and productive system for endangered and threatened Puget Sound salmonids. All of the subbasins in the WRIA support some life phase of one or more species. Anadromous salmonid spawning occurs from Tumwater Falls to Deschutes Falls. The habitat projects in Table 13 address many of the salmonid limiting factors described in Chapter 2.1.3, including:

- natural stream ecological processes have been significantly altered due to adjacent land management practices and direct actions within the stream corridor,
- fine sediment (<.85 mm) levels in the stream gravels regularly exceed the <12% level identified as representing suitable spawning habitat,
- lack of adequate large woody debris in streams, particularly larger key pieces that are critical to developing pools, log jams, and other habitat components important to salmonids,
- lack of adequate pool frequency and large, deep pools that are important to rearing juvenile salmonids and adult salmonids on their upstream migration,
- naturally high rates of channel movement in this geologically young basin, but further exacerbated rate of streambank erosion and substrate instability due to loss of streambank and riparian integrity, and alteration of natural hydrology,
- loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, lateral erosion, streambank stability, instream habitat conditions, etc.,
- significant alterations to the natural stream hydrology in streams where the uplands have been heavily developed, and the threat of similar impacts to streams that are experiencing current and future development growth.

The Schneider's Prairie project would provide off-channel rearing habitat during the winter period, when the inlet channel and wetland area is inundated. This habitat would primarily benefit coho salmon. Seepage back to the Deschutes River during the summer and early fall would benefit all fish species by providing cool water and increasing flows.

The Woodard Creek, Chambers Creek, and Spurgeon Creek projects will provide similar ecological benefits. Improvements to riparian condition will increase shade, bank stability, large woody debris loading, and fish cover. Increasing shade will lessen warming of stream water temperatures. 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.

Table 13: Summary of WRIA 13 Habitat Improvement Projects included in NEB Analysis

Project Name and Brief Description	Subbasin	Anticipated Ecological Benefit(s)	Project Stage
Woodard Creek – Additional of large woody debris and riparian vegetation, and floodplain reconnection along middle Woodard Creek.	Boston Harbor	Floodplain connectivity, instream habitat complexity	Conceptual
Spurgeon Creek Remeander Project - Restore wetland conditions to upper Spurgeon Creek by filling ditch, creating microtopography, installing large wood and planting area with native species. Spurgeon Creek is a priority tributary to the Deschutes. Funded by PSAR 2016.	Spurgeon Creek	Floodplain connectivity, instream habitat complexity	Design
Chambers Creek Channel realignment to increase channel length and sinuosity at confluence with Chambers Ditch	Lower Deschutes	Floodplain connectivity, instream habitat complexity	Conceptual
General floodplain reconnection/restoration projects – Identify project opportunities in WRIA 13	All	Increase floodplain function and connectivity and local aquifer storage; increase usable aquatic habitat area; increase fish cover; increase habitat complexity	Conceptual

7.4 Uncertainty and Adaptive Management

The 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 where there is the most need for offsets by subbasin.

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 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.

7.5 NEB Evaluation Findings

This watershed plan provides projects that, if implemented, can offset 435 AFY as the “most likely” estimate of new consumptive water use in WRIA 13, and can offset a higher consumptive use estimate as a goal to achieve through adaptive management of 513 AFY. This watershed plan sets goals of achieving offsets through a total of four projects or project types with estimated offset quantities (one project includes eight quantified MAR offsets) with a cumulative offset projection of 1,316 AFY, WRIA-wide. This projected total water offset yields a surplus offset of 881 AFY above the most likely consumptive use estimate of 435 AFY in WRIA 13, and a surplus of 803 AFY above the higher consumptive use estimate as a goal to achieve through adaptive management.

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 13.

Although the project portfolio will meet offset targets on a WRIA-scale, much of the water offset projects in WRIA 13 will benefit the Deschutes Lower, Deschutes Middle, Deschutes Upper, and Woodland Creek subbasins. Water offsets in the upper and middle subbasins will also benefit the lower subbasin. The Hicks Lake stormwater retrofit project will provide water offsets to Hicks Lake, which is the headwaters to Woodland Creek. This project will benefit the entire tri-lakes and Woodland Creek system. The Johnson Point subbasin has the largest offset deficit of 86 AFY and does not have any offset projects identified for the subbasin. However, there are a very limited number of salmon-bearing streams in the Johnson Point subbasin, and the significant benefits in several of the other subbasins and at the WRIA-scale outweigh the deficit.

At the WRIA-scale, the consumptive use impact has been met with water offsets, with a large surplus. However, additional water offsets are desirable in the Boston Harbor, Cooper Point, Johnson Point, McLane, and Spurgeon Creek subbasins, because there are water offset deficits in these subbasins. These water offsets may be met by projects defined during plan implementation. For example, suitable water right acquisition, MAR, stormwater retrofit, or floodplain restoration projects may be identified and developed to meet these deficits that are currently defined.

Within this plan, water offset projects are complimented by a total of four habitat improvement projects, which provide numerous additional benefits to aquatic habitat. While many of these habitat improvement projects have potential streamflow benefits, the Committee excluded any associated water offset from the plan's accounting. Additional programmatic actions as described in Chapters 5 and 6 are dependent on funding and include exploration of water right opportunities, a Water Conservation and Drought Education and Outreach Program, drought response limits, Thurston County policies to promote connections to Group A Systems, a recommendation to update the Ecology Well Log Database, a new Ecology staff position serving as South Sound Water Steward, instream flow rule revisions, permit-exempt well withdrawal limits, Salmon Recovery Portal project tracking, a collaborative Deschutes Watershed Council, and the potential establishment of a revolving loan and grant fund to offset costs of connecting to Group A public water systems. These programmatic actions could result in some water offsets, if they were developed during plan implementation.

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 13 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 13 Committee developed the WRIA 13 watershed plan to the best of the Committee's ability given the limitations of the timeline and resources. The Committee developed the watershed plan to meet NEB, and as this chapter describes, the watershed plan provides ecological benefits in many ways. The WRIA 13 Committee is leaving the final NEB determination to Ecology.

Appendices

WRIA 13 Deschutes Watershed

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Streamflow: 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	Representative Name	Alternate Representative Name(s)
Lewis County	Lee Napier	John Kliem
Thurston County	Joshua Cummings	Kaitlynn Nelson, Brad Murphy
City of Lacey	Deputy Mayor Cynthia Pratt	Julie Rector
City of Olympia	Donna Buxton	Jesse Barham
City of Tumwater	Councilmember Charlie Schneider	Dan Smith
Squaxin Island Tribe	Jeff Dickison	Paul Pickett
Department of Ecology	Angela Johnson	Mike Noone, Rebecca Brown
Department of Fish and Wildlife	Noll Steinweg	Tristan Weiss, Megan Kernan
Public Utility District 1 of Thurston County	John Weidenfeller	Ruth Clemens, Julie Parker
Deschutes Estuary Restoration Team	Sue Patnude	Dave Monthie, Dave Peeler
Building Industry Association of Washington	Josie Cummings	
Thurston Conservation District	Sarah Moorehead	Adam Peterson, Karin Strelioff
WRIA 13 Salmon Habitat Recovery Lead Entity Coordinator (ex officio)	Amy Hatch-Winecka	
LOTT Clean Water Alliance (ex officio)	Wendy Steffensen	
Nisqually Indian Tribe (ex officio)	George Walter	
City of Tenino (ex officio)	John Millard	
City of Yelm (ex officio)	Grant Beck	Michael Grayum, Chad Bedlington

Appendix D – Operating Principles

Operating Principles and Charter

Watershed Restoration Enhancement
Committee Water Resource Inventory Area
(WRIA) 13

Originally approved March 27, 2019

Revised and Approved September 23, 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 if there is consensus by the full Committee for inclusion.

The chair may revise Appendix A (Committee membership) and Appendix B (timeline) without requiring a decision by the Committee. Any new appendices, or changes to other appendices will be approved by the Committee in advance of the changes being made. The chair will notify the Committee of any changes to Appendices A and B.

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: PARTICIPATION 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. Committee members will, in good faith and using their best professional judgement:

- Actively participate in Committee meetings throughout the planning 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 and will work with committee members to establish reasonable review time for materials prior to calling for a decision.

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, and video conference) 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:

- 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.
- 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.
- Be Productive
- Adhere to the agenda. Respect time constraints and focus on the topic being discussed.
- 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:

Communicate directly with the person or persons whose actions are the cause of the conflict.

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.

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.

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

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 for a minimum of six months leading up to the final decision on the plan.

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.[72] 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.

LATECOMERS

Ecology has invited all governments and organization identified in 90.94.030 to participate on the Committee. Invited entities who originally decided not to participate on the Committee (per written acknowledgement) are allowed to join the Committee at a later date under the following conditions:

- The entity cannot veto, request a new decision, or revisit items previously decided on by the Committee;
- The entity signs an intent to participate, provides a primary and alternate Committee member;

[72] 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.

- 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 1, 2020.

REMOVAL FROM THE COMMITTEE

Entities must participate in the committee process after September 1, 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, 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.

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.[73] 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 Committee 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.

[73] RCW 90.94 (3) states that "the department shall prepare and adopt a watershed restoration and enhancement plan for each watershed listed under subsection (2)(a) of this section, in collaboration with the watershed restoration and enhancement committee. Except as described in (h) of this subsection, all members of a watershed restoration and enhancement committee must approve the plan prior to adoption." Based on input from the Attorney General's office, because Ecology is a member of the Committee and must ultimately decide whether or not to approve the plan, Ecology shall participate in decisions on all items coming before the Committee.

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.

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. [74] 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

[74] Definition of Consensus: Consensus is a group process where the input of everyone is carefully considered and an outcome is crafted that best meets the needs of the group as a whole. The root of consensus is the word consent, which means to give permission to. When members consent to a decision, they are giving permission to the group to go ahead with the decision. Some members may disagree with all or part of the decision, but based on listening to everyone else's input, all members agree to let the decision go forward because the decision is the best one the entire group can achieve at the current time.

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 be described. During in person polling the following protocol will be used:

- Thumbs up – consent
- Thumbs sideways – consent with reservation but can live with and will not block or oppose now or during implementation
- 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."[75]

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. If the Committee decides not to submit a letter of support for a project, individual Committee representatives are not prohibited from submitting letters 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-

[75] If an 'out of office' message is received for the primary representative, the alternate representative(s) will be contacted. The chair and facilitator will make at least 3 points of contact with each Committee member before marking them as an abstention (e.g. phone, email, text).

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 append 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 may only 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:

- Operate a list serve for Committee members and interested parties
- 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 13

Aquifer (DNR Nomenclature in Parentheses)	Description	Typical Thickness
Qvr (Qgo/Qgos)	Often present at land surface, this aquifer primarily consists of stratified silt, sand, and gravel deposits of Vashon recessional outwash of the Frasier glaciation.	10 feet to about 40 feet thick; locally exceeds 150 feet. Where saturated, the unit represents a water-table aquifer and is often in direct continuity with surface-water bodies.
Qva (Qga)	This aquifer is mainly composed of deposits from the Vashon advance outwash. The deposits are poorly- to moderately-well sorted gravel in a sand matrix. This unit is generally confined by the overlying glacial till (Qvt or Qgt).	10 to 45 feet; locally exceeds 100 feet. Thin on northern peninsulas, greater thicknesses in Lacey area.
Qc (Qpg)	Sometimes called the "sea-level aquifer" due its coincident elevation, this unit is usually coarse sand and gravel deposits of pre-Vashon age glacial drift. Confined by the overlying Kitsap formation (Qf or Qpf).	15 to 70 feet thick in most places in the area. Generally absent south of Rainier, though present near Lake Lawrence.
TQu	Composed of unconsolidated and undifferentiated sedimentary deposits from the early Quaternary and late Tertiary period. Mainly consists of deposits of silt, sand, and gravel. Water bearing units are irregularly distributed and local aquitard units are present.	Thickness can exceed 1,000 feet and is poorly constrained. Greater thicknesses in the northern portion of watershed, where it is an important water bearing unit.

Appendix F – Surface Water Quality Assessment Category 4 and 5 Listings in WRIA 13

WATERBODY	CURRENT CATEGORY	PARAMETER NAME	TMDL NAME	MEDIUM NAME
ADAMS CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
		pH	Deschutes River Multiparameter TMDL	Water
AYER (ELWANGER) CREEK	5	pH	Deschutes River Multiparameter TMDL	Water
		Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
		Temperature		Water
BARNES LAKE	5	Total Phosphorus		Water
BLACK LAKE DITCH	5	Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
		Temperature		Water
		pH	Deschutes River Multiparameter TMDL	Water
BUDD INLET (INNER)	5	Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
		Bacteria		Water
BUDD INLET (OUTER)	5	Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
		Bacteria		Water
CAPITOL LAKE	4C	Invasive Exotic Species		Habitat
	5	Total Phosphorus		Water
		Bacteria		Water
CASE INLET AND DANA PASSAGE	5	Dissolved Oxygen		Water
COLLEGE CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water

		Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water
		pH	Henderson Inlet Watershed Multiparameter TMDL	Water
DESCHUTES RIVER	4C	Instream Flow		Habitat
		Large Woody Debris		Habitat
	5	Fine Sediment	Deschutes River Multiparameter TMDL	Habitat
		Temperature	Deschutes River Multiparameter TMDL	Water
		pH	Deschutes River Multiparameter TMDL	Water
		Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
		Bacteria		Water
		Temperature		Water
DOBBS CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
EAGLE CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
		Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water
ELLIS CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
ELLIS CREEK, N.F.	5	Bacteria	Deschutes River Multiparameter TMDL	Water
FLEMING CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
		pH	Henderson Inlet Watershed Multiparameter TMDL	Water
FOX CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water

		Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water
HENDERSON INLET	5	Dissolved Oxygen		Water
	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
		Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water
		pH	Henderson Inlet Watershed Multiparameter TMDL	Water
		Temperature	Henderson Inlet Watershed Multiparameter TMDL	Water
HICKS LAKE	4C	Invasive Exotic Species		Habitat
HUCKLEBERRY CREEK	5	Temperature	Deschutes River Multiparameter TMDL	Water
		Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
INDIAN CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
JOHNSON CREEK	5	Temperature	Deschutes River Multiparameter TMDL	Water
JORGENSON CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
LAKE LAWRENCE CREEK	5	Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
LAWRENCE LAKE	5	Total Phosphorus		Water
LOIS LAKE	4C	Invasive Exotic Species		Habitat
LONG LAKE	4C	Invasive Exotic Species		Habitat
	5	Total Phosphorus		Water
MCLANE CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
	5	Dissolved Oxygen		Water
		Temperature		Water
		Bacteria		Water

MISSION CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
MITCHELL CREEK	5	Temperature	Deschutes River Multiparameter TMDL	Water
MOXLIE CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
MUNN LAKE	4C	Invasive Exotic Species		Habitat
MYER CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
NISQUALLY REACH/DRAYTON PASSAGE	4A	Bacteria	Nisqually Watershed Bacteria and DO TMDL	Water
				Water
	5	Dissolved Oxygen		Water
		Bacteria		Water
PALM CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
		Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water
PATTISON LAKE	5	Total Phosphorus		Water
PERCIVAL CREEK	5	Temperature	Deschutes River Multiparameter TMDL	Water
		Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
QUAIL CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
REICHEL CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
		Dissolved Oxygen	Deschutes River Multiparameter TMDL	Water
		Temperature	Deschutes River Multiparameter TMDL	Water
SCHNEIDER CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
SLEEPY CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water

		pH	Henderson Inlet Watershed Multiparameter TMDL	Water
	5	Dissolved Oxygen		Water
SPURGEON CREEK	5	Bacteria	Deschutes River Multiparameter TMDL	Water
SQUAXIN, PEALE, AND PICKERING PASSAGES	5	Dissolved Oxygen		Water
SWIFT CREEK	4A	Bacteria	Totten, Eld, and Skookum Inlets Tributaries Bacteria TMDL	Water
TEMPO LAKE OUTLET	5	Temperature	Deschutes River Multiparameter TMDL	Water
THURSTON CREEK	5	Temperature	Deschutes River Multiparameter TMDL	Water
UNNAMED CREEK (TRIB TO DOBBS CREEK)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO ELD INLET)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO HENDERSON INLET)	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
UNNAMED CREEK (TRIB TO MCLANE CREEK)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO WOODARD CREEK)	5	Dissolved Oxygen		Water
		Temperature		Water
		Bacteria		Water
WOODARD CREEK	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
		Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water

WOODLAND CREEK	4A	Temperature	Henderson Inlet Watershed Multiparameter TMDL	Water
	4C	Instream Flow		Habitat
	4A	Bacteria	Henderson Inlet Watershed Multiparameter TMDL	Water
	5	Temperature	Henderson Inlet Watershed Multiparameter TMDL	Water
	4A	Dissolved Oxygen	Henderson Inlet Watershed Multiparameter TMDL	Water
	5	Dissolved Oxygen		Water

Appendix G – Subbasin Delineation Memo

Technical Memorandum

To:	Angela Johnson (Ecology) Washington State Department of Ecology
From:	Chad Wiseman (HDR)
Copy:	
Date:	June 05, 2019
Subject:	WRIA 13 Subbasin Delineation Alternatives

1.0 Purpose and Background

RCW 90.94.030(3)(b) requires that Watershed Restoration and Enhancement plans (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, the WRIA 13 committee will work to identify projects to offset impacts from new permit-exempt domestic wells within the same subbasin. This memo is intended to summarize the rationale for the two subbasin delineations alternatives currently proposed and to inform the selection of a preferred alternative.

2.0 Initial Delineation

The WRIA 13 WRE committee defined a draft subbasin delineation. The initial data was provided by Thurston County based on Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) data. Members of the workgroup refined the delineations based on fish bearing streams of importance and other factors. The initial delineation had the following characteristics:

- The Deschutes River watershed was trisected into upper, middle, and lower subbasins. The lower subbasin generally corresponds to the cities of Lacey, Olympia, and Tumwater, and their urban growth areas (UGA). The middle subbasin is primarily rural residential areas and the City of Rainier. The upper subbasin is a mix of rural residential and forestland.
- Spurgeon Creek was defined as its own subbasin, because of its unique value to fish and its relatively cold water from groundwater contribution.
- McLane Creek was defined as its own subbasin, because of its unique value to fish. McLane Creek supports multiple salmonid species.
- The land surrounding Puget Sound in the northern portion of WRIA 13 was delineated into subbasins based on 1) direction of surface drainage to different inlets and 2) on the current level of development that is assumed to be correlated with the quality of localized stream health.
    - The Cooper Point peninsula was delineated into the “Eld Inlet” and “Budd Inlet West” subbasins.

- The Boston Harbor peninsula was delineated into the “Budd Inlet East” and “Henderson West” subbasins.
- The Johnson Point peninsula was delineated into the “Henderson East” and “Nisqually Reach” subbasins. The “Henderson East” subbasin includes the Woodland Creek watershed.

3.0 Proposed Alternatives

During the May 21, 2019 WRIA 13 workgroup meeting, the Squaxin Island Tribe proposed two changes to the initial delineation. The proposed changes were to 1) modify the border between the lower and middle Deschutes subbasins, and to 2) delineate the Woodland Creek watershed as a separate subbasin. The workgroup decided not to modify the border between the lower and middle Deschutes subbasins. However, the workgroup agreed to delineate the Woodland Creek watershed as a separate subbasin. The rationale was that Woodland Creek is a relatively large watershed in WRIA 13, and the northern portion has development pressure that includes permit-exempt wells or connections. The workgroup also agreed to combine the remainder of “Henderson East” with “Nisqually Reach” subbasin, and re-name it “Johnson Point” because the development character of the remainder of “Henderson East” was similar to the “Nisqually Reach”. These changes to the initial delineation are reflected in the Alternative #1 delineation (Figure 1).

The workgroup also discussed combining the remaining inlet subbasins for the Boston Harbor and Cooper Point peninsulas, respectively. This potential change is reflected in the Alternative #2 delineation (Figure 1). Alternatives #1 and #2 may be compared in terms of the benefits of splitting (Alternative #1) or combining (Alternative #2) the Cooper Point and Boston Harbor peninsulas.

The benefits can be considered in terms of targeting stream management units with existing low flow limitations and closures for protection, protection of unique aquatic habitat or fish, hydrogeology, residential development potential, and overall WRE planning efficiency. These factors are briefly discussed and summarized in Table 1.

Stream management units under Chapter 173-513 WAC include an unnamed stream draining to Eld Inlet, an unnamed stream draining to Gull Harbor, and Woodward Creek, draining to Woodward Bay. Protection of these stream management units may be more targeted under Alternative #1, because the subbasins that contain them are smaller. On the other hand, offset opportunities may still be targeted to be protective of these streams with larger subbasins under both Alternatives #1 and #2.

Stream and wetland habitat is likely to be similar on each respective peninsula, regardless of whether the waterbodies drain to Eld, Budd, or Henderson Inlets. Streams entering the inlets will have limited fish use and function as pocket estuaries. The stream habitat in the southern portions of each peninsula are more developed and therefore, the stream habitat is generally more degraded.

The hydrogeology of the Cooper Point and Boston Harbor peninsulas is complex and the impact of new permit-exempt domestic well consumptive use will be partly a function of well depth. The delineation of the peninsulas into separate subbasins (as in Alternative #1) does not necessarily reflect the groundwater flow direction divides that would be affected by new permit-exempt domestic well consumptive use.

Residential development potential, as defined by the Thurston Regional Planning Council (TRPC), is similar in the northern portions of the Cooper Point and Boston Harbor peninsulas, but varies in potential in the southern portions. The Cooper Point peninsula has a greater parcel density on the east side. Similarly, the Boston Harbor peninsula has a greater parcel density on the west side. This was part of the rationale for dividing the peninsulas into “east-west” subbasins, as represented by Alternative #1. There may be a benefit to this delineation, in terms of accounting for consumptive use and offsets separately in the more high developed areas. However, if the subbasins were to be combined, as reflected in Alternative #2, the same distribution of offsets could be defined.

WRE planning would be slightly more efficient for Alternative #2, because there would be two fewer subbasins requiring accounting and evaluation, in terms of NEB.

Table 1. Comparison of Alternatives.

Attribute	Alternative #1	Alternative #2
Stream Management Units	More spatially targeted	Less spatially targeted
Habitat/Fish	Similar habitat	Similar habitat
Hydrogeology	No clear benefit	No clear benefit
Development Potential	Some benefit	No clear benefit
WRE Efficiency (i.e. # of subbasins)	11 Subbasins	9 Subbasins

4.0 Final Delineation

Ultimately the WRIA 13 Committee agreed that the approach for Alternative #2 reflected the needs of the Committee, and chose to move forward with that delineation.

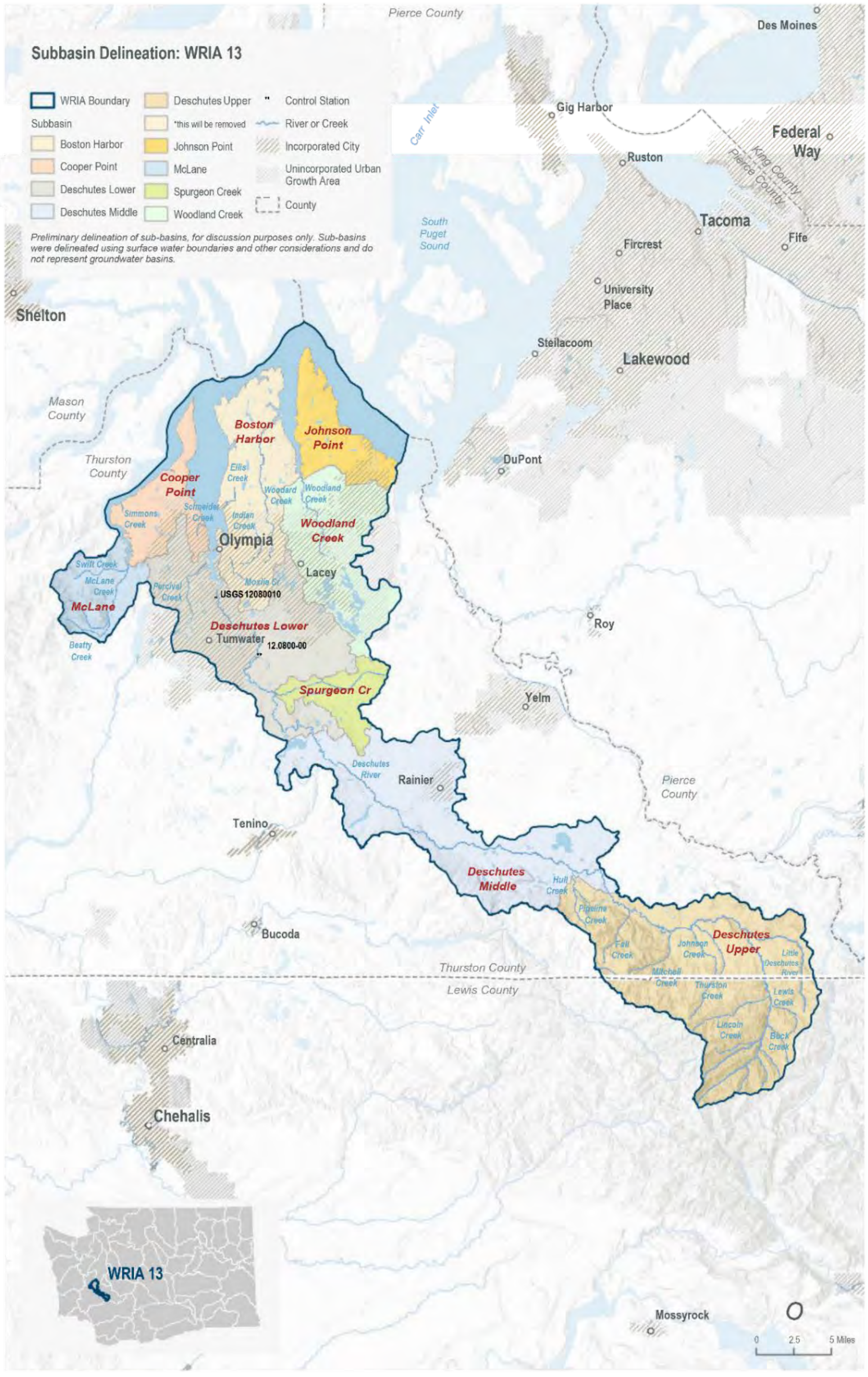

Figure 1 – WRIA 13 Committee Subbasin Delineation

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

Technical Memorandum DRAFT

To:	Angela Johnson, Washington State Department of Ecology
From:	Chad Wiseman, HDR
Copy:	
Date:	July 14, 2020
Subject:	WRIA 13 Permit-Exempt Growth and Consumptive Use Summary (Work Assignment 2, Tasks 2 and 3)

1.0 Introduction

HDR is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) committees for WRIA 13. 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 CU per WRIA.

Under 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 CU of groundwater that is projected to impact WRIA 13 over the planning horizon.

This memorandum includes:

- A summary of WRIA 13 initial permit-exempt growth and an alternative scenario of permit-exempt growth.
- A summary of WRIA 13 initial and alternative scenario consumptive use using two different methods.

2.0 WRIA 13 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. Thurston County (working with the Thurston Regional Planning Council) provided methods and results for Thurston County. Note that Thurston County and Lewis County are both within WRIA 13; however, the Lewis County portion is entirely comprised of timberland and so was not included in the projection for new PE wells.

HDR worked with the WRIA 13 workgroup and WRIA 13 committee (the Committee) to define one alternative growth scenario that allowed for some permit-exempt growth in rural water system boundaries based on the proportion of parcels not currently served by their respective water system.

2.1 Thurston County Methods

The Thurston County initial permit-exempt growth projections were developed by the Thurston Regional Planning Council (TRPC) (Appendix A). The following is a summary of the TRPC 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 (TRPC).
2) Develop residential capacity estimates (TRPC).
3) Allocate growth to parcels based on recent residential development and permit trends, where capacity is available (TRPC).
4) Once allocated, define permit-exempt connections based on the following criteria:
    a) Growth in rural areas, outside of water systems, is assumed to be permit-exempt growth.
    b) Growth in incorporated cities is assumed to connect to a municipal water system
    c) Water systems within UGAs; permit-exempt growth is assumed to occur on parcels with no sewer service.
    d) Rural water systems; assumed no new permit-exempt growth

An alternative permit-exempt growth projection scenario was developed by assuming that some permit-exempt growth will occur in the rural water system areas (i.e. water systems outside of the urban growth areas). 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, which changes the assumption in 4b above.

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 (active + available) and active water system connections 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 projected permit-exempt growth within each water system by dividing the number of buildable parcels without water system hookups by the total number of buildable parcels.
6. Multiply the proportion of permit-exempt growth within each respective water system by total growth projected to occur in that water system.
7. Sum the additional permit-exempt growth by subbasin and add to the initial permit-exempt growth projection.

This alternative permit-exempt growth projection scenario was accepted by the Committee for consumptive use estimation.

The original permit-exempt growth projections were provided to Ecology and the Committee in 2019 (HDR 2019). In 2020, an error in the TRPC results was identified: 116 permit-exempt wells or connections were projected to occur in the Silver Hawk water system service area, when the water system had adequate connections to accommodate all predicted growth. Therefore, these connections were removed from the original projection (Appendix A). These results were organized by subbasin. The WRIA 13 Committee cited this as an example of uncertainty in the assumptions made in the analysis of where new PE wells are expected to occur.

3.0 WRIA 13 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 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 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 (2018 – 2038) (planning horizon).
- 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's Final NEB Guidance defines offset as the anticipated ability of a project or action to counterbalance some amount of the new consumptive water use over the next 20 years (2018-2038). Offsets need to continue beyond the 20-year period for as long as new well pumping continues (Ecology 2019).

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; Ecology 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 impacts from consumptive use on surface water are steady-state, meaning impacts to the stream from pumping groundwater do not change over time. This assumption is based on the wide distribution of future well locations and depths across varying hydrogeological conditions.

Consumptive use of water from projected permit-exempt connection growth was estimated using two different methods; 1) the Irrigated Area Method and 2) the Water System data Method.

3.1 Methods for Indoor and Outdoor Consumptive Use Estimates

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.

3.1.1 Per Capita Indoor Consumptive Use

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

- 60 gallons per day 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 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 (AFY) = 60 gpd x 2.5 people per household x 365 days x 10% CUF

or

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

Where:
HCIWU = Household Consumptive Indoor Water Use (gpd)
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).

3.1.2 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 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 PE domestic wells (Ecology 2018; 2019). HDR estimated the average irrigated lawn area for WRIA 13 by delineating the apparent irrigated area in 80 parcels identified as containing a dwelling unit served by a permit-exempt well in WRIA 13, and averaging them (Appendix B). The irrigated areas were delineated using one technician and a standard method. The average irrigated area per PE connection in WRIA 13 was estimated to be 0.06 acres. The majority of the parcels evaluated did not have an apparent irrigated area (i.e. most parcels had zero irrigated area).

Bias in the irrigated area delineation methods was evaluated by doing a side-by-side comparison study with another consulting form, who was providing similar technical support for the WRIAs 7, 8, and 9 WRE plans (Appendix C). 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 this irrigated area method to specific parcels with meter records (Appendix D). 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 0.06 irrigated acreage average, and because of the large variability in the results (e.g. 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 aces – which would result in a 0.10 acre average irrigated area size.
- HDR completed an irrigated area comparability study (Attachment C) 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 0.09 acre average irrigated area size.
- HDR has completed a statistical analysis of their data, and has determined that using the 95% 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 0.12 acre average irrigated area size.

The Committee decided to move forward with all three of these alternatives as “working numbers”. Consumptive use based on all three acreages were evaluated and compared to the consumptive use calculated from the Water System Data Method. Later, the Committee agreed to include the consumptive use estimate based on the 0.10 acre average irrigated area as the “most likely” estimate, and the consumptive use estimate based on the 0.12 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 CU. An average crop irrigation requirement of 16.8 inches per year was estimated for pasture/turf grass from nearby stations as provided in the Washington Irrigation Guide, Appendix B (NRCS-USDA, 1997). Irrigation application efficiency (i.e. the percent of water used that actually reaches the turf) was assumed to be 75%, 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 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)
A = Irrigated Area (acres)
IR = Irrigation Requirement over one irrigation season (feet)
AE = Application efficiency; assumed to be 75% (factor expressed as 1/0.75)
CUF= Consumptive use factor; assumed to be 80% (factor expressed as 0.80)

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

Conversion Factors:

gpm = AFY * 0.61996

cfs = AFY * 0.00138128

This estimate of outdoor consumptive use per household per day is 0.15 AFY (assuming average irrigated area of 0.09 acres), 0.17 AFY (assuming average irrigated area of 0.10 acres) and 0.20 AFY (assuming average irrigated area of 0.12 acres) and can be annualized and converted to acre-feet per year or 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.

4.0 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 WAC 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 bills 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. In WRIA 13, the Thurston PUD provided data for the Prairie Ridge water system from 2007 – 2010, which billed at a flat rate during that time period.

4.1 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.

4.2 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 that used in the Ecology Irrigated Area Method, an 80 percent consumptive factor was applied to determine the consumptive portion of outdoor use.

4.3 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 13, therefore seasonal outdoor water use was assumed to occur over a period of six 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.

5.0 Results

5.1 Permit-Exempt Connection Growth

Initial permit-exempt connection growth is projected to be 2,309 connections (Table 1). The alternative Revised Permit-Exempt Connection Growth scenario is projected to have 307 additional connections, for a total of 2,616 permit-exempt connections. Permit-exempt connection growth is expected to be greatest in the "Deschutes Middle" subbasin. The Revised Permit-Exempt Connection Growth scenario was selected by the Committee for use in consumptive use estimates.

Table 1. WRIA 13 Alternative Growth Projection Scenarios.

Subbasin	Initial Growth Estimate	Revised Growth Estimate Including Water System Service Areas
Boston Harbor	236	296
Cooper Point	171	232
Deschutes Lower	341	379
Deschutes Middle	715	734
Deschutes Upper	29	30
Johnson Point	412	520
McLane	163	165
Spurgeon Creek	88	92
Woodland Creek	154	168
Totals	2309	2616

5.2 Consumptive Use

The WRIA-wide consumptive use estimates using the Irrigated area method were 0.55 cfs (average irrigated area of 0.09 acres), 0.60 cfs (average irrigated area of 0.10 acres), and 0.71 cfs (average irrigated area of 0.12 acres) (Tables 2- 4).

The water system data analysis for WRIA 13 was conducted using consumption data averaged between years 2007 – 2010 from the Prairie Ridge Water System, managed by the Thurston PUD. Consumptive use was projected to be 0.64 cfs (Tables 2 - 4). The Prairie Ridge Water System charges a flat rate for water service and services homes with large lawns that customers heavily irrigate. While some households on permit-exempt connections may exhibit this type of behavior, several members of the Committee have expressed concern that this may not be representative of the "average" household on a permit-exempt connection.

Estimates of consumptive use using the Irrigated Area method are greater than or less than the water system data estimates, depending on the assumed average irrigated area. The Committee selected the irrigated area method for a consumptive use estimate.

Table 2. Annualized Average Outdoor Consumptive Use Estimates for WRIA 13 (20 year planning horizon) – 0.09 acres average irrigated area (correction factor).[76]

Subbasin	Projected No. Permit-exempt Connection	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS
Boston Harbor	296	52	32	0.07	45	28	0.06
Cooper Point	232	41	25	0.06	35	22	0.05
Deschutes Lower	379	67	41	0.09	57	36	0.08
Deschutes Middle	734	129	80	0.18	111	69	0.15
Deschutes Upper	30	5	3	0.01	5	3	0.01
Johnson Point	520	92	57	0.13	79	49	0.11
McLane	165	29	18	0.04	25	15	0.03
Spurgeon Creek	92	16	10	0.02	14	9	0.02
Woodland Creek	168	30	18	0.04	25	16	0.04
Totals	2616	461	286	0.64	396	245	0.55

Table 3. Annualized Average Outdoor Consumptive Use Estimates for WRIA 13 (20 year planning horizon) – 0.10 acres average irrigated area (minimum detection value of 0.05 irrigated acres).[77]

Subbasin	Projected No. Permit-exempt Connection	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS
Boston Harbor	296	52	32	0.07	49	30	0.07
Cooper Point	232	41	25	0.06	39	24	0.05
Deschutes Lower	379	67	41	0.09	63	39	0.09
Deschutes Middle	734	129	80	0.18	122	76	0.17

[76] Outdoor consumptive water use estimates were rounded to the nearest whole number.
[77] Outdoor consumptive water use estimates were rounded to the nearest whole number.

Deschutes Upper	30	5	3	0.01	5	3	0.01
Johnson Point	520	92	57	0.13	86	54	0.12
McLane	165	29	18	0.04	27	17	0.04
Spurgeon Creek	92	16	10	0.02	15	9	0.02
Woodland Creek	168	30	18	0.04	28	17	0.04
Totals	2616	461	286	0.64	435	269	0.60

Table 4. Annualized Average Outdoor Consumptive Use Estimates for WRIA 13 (20 year planning horizon) – 0.12 acres average irrigated area 95% Upper Confidence Limit).[78]

Subbasin	Projected No. Permit-exempt Connection	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS
Boston Harbor	296	52	32	0.07	58	36	0.08
Cooper Point	232	41	25	0.06	45	28	0.06
Deschutes Lower	379	67	41	0.09	74	46	0.10
Deschutes Middle	734	129	80	0.18	144	89	0.20
Deschutes Upper	30	5	3	0.01	6	4	0.01
Johnson Point	520	92	57	0.13	102	63	0.14
McLane	165	29	18	0.04	32	20	0.04
Spurgeon Creek	92	16	10	0.02	18	11	0.02
Woodland Creek	168	30	18	0.04	33	20	0.05
Totals	2616	461	286	0.64	513	318	0.71

[78] Outdoor consumptive water use estimates were rounded to the nearest whole number.

6.0 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 consumptive use scenario (Table 5 - 7). The month of July has the highest irrigation requirement, resulting in the highest monthly consumptive use impact. This information may be used when evaluating projects designed to offset subbasin- and season-specific impacts.

Table 5: WRIA 13 Monthly Outdoor Consumptive Water Use- 0.09 acres average irrigated area (correction factor)

Subbasin	Projected No. Permit-exempt Connections	Consumptive Use by Month (cfs)											
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Boston Harbor	296	0.0028	0.0028	0.0028	0.0243	0.0956	0.1390	0.1983	0.1385	0.0764	0.0028	0.0028	0.0028
Cooper Point	232	0.0022	0.0022	0.0022	0.0190	0.0749	0.1089	0.1555	0.1086	0.0598	0.0022	0.0022	0.0022
Deschutes Lower	379	0.0035	0.0035	0.0035	0.0311	0.1224	0.1779	0.2539	0.1774	0.0978	0.0035	0.0035	0.0035
Deschutes Middle	734	0.0068	0.0068	0.0068	0.0603	0.2371	0.3446	0.4918	0.3435	0.1893	0.0068	0.0068	0.0068
Deschutes Upper	30	0.0003	0.0003	0.0003	0.0025	0.0097	0.0141	0.0201	0.0140	0.0077	0.0003	0.0003	0.0003
Johnson Point	520	0.0048	0.0048	0.0048	0.0427	0.1680	0.2441	0.3484	0.2433	0.1341	0.0048	0.0048	0.0048
McLane	165	0.0015	0.0015	0.0015	0.0135	0.0533	0.0775	0.1106	0.0772	0.0426	0.0015	0.0015	0.0015
Spurgeon Creek	92	0.0009	0.0009	0.0009	0.0076	0.0297	0.0432	0.0616	0.0431	0.0237	0.0009	0.0009	0.0009
Woodland Creek	168	0.0016	0.0016	0.0016	0.0138	0.0543	0.0789	0.1126	0.0786	0.0433	0.0016	0.0016	0.0016
Totals	**2,616**	**0.02**	**0.02**	**0.02**	**0.21**	**0.85**	**1.23**	**1.75**	**1.22**	**0.67**	**0.02**	**0.02**	**0.02**

Table 6: WRIA 13 Monthly Outdoor Consumptive Water Use – 0.10 acres average irrigated area (minimum detection value of 0.05 irrigated acres)

Subbasin	Projected No. Permit-exempt Connections	Consumptive Use by Month (cfs)											
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Boston Harbor	296	0.0028	0.0028	0.0028	0.0267	0.1059	0.1541	0.2201	0.1536	0.0845	0.0028	0.0028	0.0028
Cooper Point	232	0.0022	0.0022	0.0022	0.0209	0.0830	0.1208	0.1725	0.1204	0.0663	0.0022	0.0022	0.0022
Deschutes Lower	379	0.0035	0.0035	0.0035	0.0342	0.1357	0.1973	0.2818	0.1967	0.1082	0.0035	0.0035	0.0035
Deschutes Middle	734	0.0068	0.0068	0.0068	0.0662	0.2627	0.3822	0.5457	0.3809	0.2096	0.0068	0.0068	0.0068
Deschutes Upper	30	0.0003	0.0003	0.0003	0.0027	0.0107	0.0156	0.0223	0.0156	0.0086	0.0003	0.0003	0.0003
Johnson Point	520	0.0048	0.0048	0.0048	0.0469	0.1861	0.2707	0.3866	0.2698	0.1485	0.0048	0.0048	0.0048
McLane	165	0.0015	0.0015	0.0015	0.0149	0.0591	0.0859	0.1227	0.0856	0.0471	0.0015	0.0015	0.0015
Spurgeon Creek	92	0.0009	0.0009	0.0009	0.0083	0.0329	0.0479	0.0684	0.0477	0.0263	0.0009	0.0009	0.0009
Woodland Creek	168	0.0016	0.0016	0.0016	0.0152	0.0601	0.0875	0.1249	0.0872	0.0480	0.0016	0.0016	0.0016
Totals	**2,616**	**0.02**	**0.02**	**0.02**	**0.24**	**0.94**	**1.36**	**1.94**	**1.36**	**0.75**	**0.02**	**0.02**	**0.02**

Table 7: WRIA 13 Monthly Outdoor Consumptive Water Use - – 0.12 acres average irrigated area 95% Upper Confidence Limit)

Subbasin	Projected No. Permit-exempt Connections	Consumptive Use by Month (cfs)											
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Boston Harbor	296	0.0028	0.0028	0.0028	0.0315	0.1266	0.1844	0.2635	0.1838	0.1009	0.0028	0.0028	0.0028
Cooper Point	232	0.0022	0.0022	0.0022	0.0247	0.0992	0.1445	0.2065	0.1440	0.0791	0.0022	0.0022	0.0022
Deschutes Lower	379	0.0035	0.0035	0.0035	0.0403	0.1621	0.2361	0.3374	0.2353	0.1292	0.0035	0.0035	0.0035
Deschutes Middle	734	0.0068	0.0068	0.0068	0.0781	0.3139	0.4572	0.6535	0.4557	0.2502	0.0068	0.0068	0.0068
Deschutes Upper	30	0.0003	0.0003	0.0003	0.0032	0.0128	0.0187	0.0267	0.0186	0.0102	0.0003	0.0003	0.0003
Johnson Point	520	0.0048	0.0048	0.0048	0.0553	0.2224	0.3239	0.4630	0.3228	0.1772	0.0048	0.0048	0.0048
McLane	165	0.0015	0.0015	0.0015	0.0176	0.0706	0.1028	0.1469	0.1024	0.0562	0.0015	0.0015	0.0015
Spurgeon Creek	92	0.0009	0.0009	0.0009	0.0098	0.0393	0.0573	0.0819	0.0571	0.0314	0.0009	0.0009	0.0009
Woodland Creek	168	0.0016	0.0016	0.0016	0.0179	0.0718	0.1047	0.1496	0.1043	0.0573	0.0016	0.0016	0.0016
Totals	**2,616**	**0.02**	**0.02**	**0.02**	**0.28**	**1.12**	**1.63**	**2.33**	**1.62**	**0.89**	**0.02**	**0.02**	**0.02**

7.0 References

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.

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) over $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 Google Earth .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 Google Earth 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 ADUs under construction in the most recent Google Earth 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 google earth 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 vegetation 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). Average irrigated acreage was 0.15 acres (Table B-1). In all WRIAs evaluated, most of the 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% upper confidence limit of the mean could only be fit with a non-parametric distribution and was about two times the quantity of the calculated arithmetic mean.

Figure B-5. Parcels selected in WRIA 13 with existing PE connections that were delineated for apparent irrigated areas.

Table B-1. Irrigated acreage delineation results.

Statistic	WRIA 13
PE Parcel Sample Pool	7,271
Sample Size	80
Mean (acres)	0.06

Mean with 0.05 minimum acreage (acres)	0.10
Standard Deviation (acres)	0.12
95% UCL (acres)	0.12

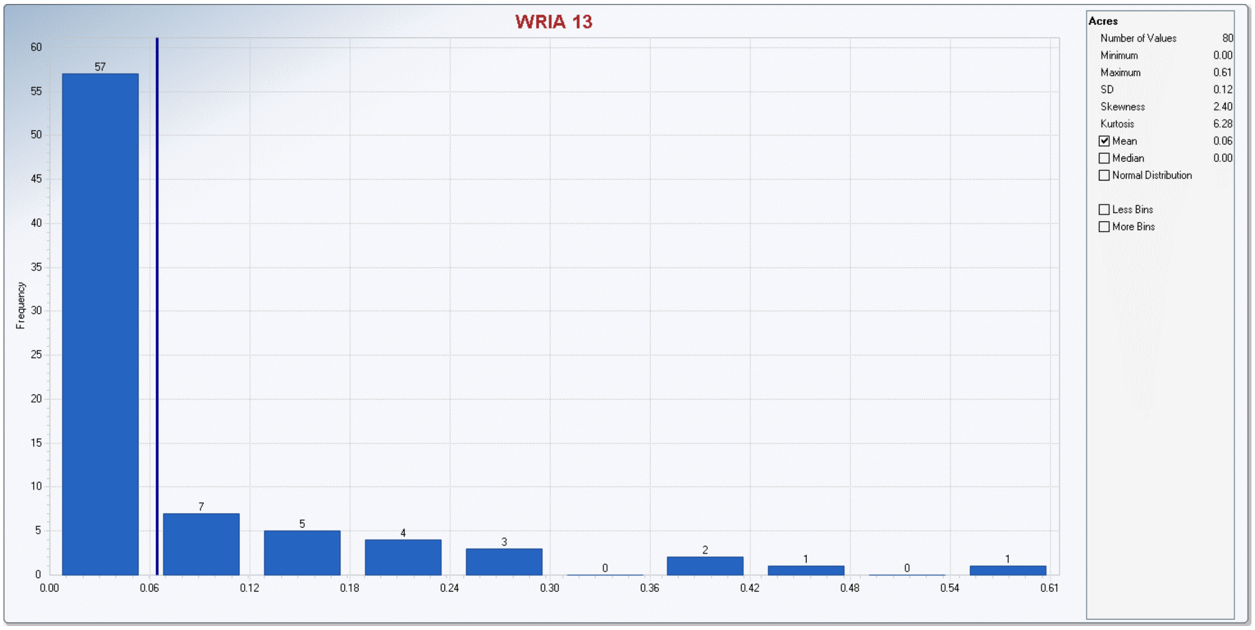

Figure 2. Histogram of WRIA 13 irrigated acreage delineation results

Attachment C

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 13 contains the results of the corroboration analysis.

Table 13: 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 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

1) Chambers Creek Habitat Project
2) Donnelley Drive Infiltration Galleries
3) Floodplain Restoration
4) Forest Stand-Age
5) Hicks Lake SW Retrofit
6) Managed Aquifer Recharge Projects in WRIA 13
7) Schneider's Prairie Off-Channel Storage and Release
8) Small-Scale LID Project Development
9) Spurgeon Creek Remeander Habitat Project
10) Water Right Opportunities
11) Woodard Creek

Chambers Creek Habitat Project

Project Description

Description

Chambers Creek is a tributary of the Deschutes River in Thurston County and is listed as high priority for restoration (SIT 2015). Thurston County is proposing to re-meander a series of ditched channels through the adjacent wet fields south of Yelm Highway and east of Rich Road (Figure 1). The proposed project is intended to improve aquatic and salmonid habitat. The project has the potential to provide a connection to existing Coho Salmon spawning habitat in the lower basin.

The goal of the project is to improve fish productivity and survival within Chambers Creek by enhancing the quality and quantity of instream habitat within the project reach. Habitat within Chambers Creek is currently impaired, by lack of riparian vegetation and large woody debris, simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality.

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

The Chambers Creek restoration project is located at the confluence with Chambers Ditch, in Thurston County. At the project location, Chambers Creek, Chambers Ditch, and an unnamed tributary converge, and are ditched through a wet field (Figure 1). The proposed project area is both in designated wetland and floodplain. Thurston County will work with the landowners to recreate the natural stream sinuosity and the surrounding wetland. Additionally, wood structures will be added that offer refuge from predators and opportunities for salmon to feed, while the wetland offers slower water during high flow events. Native plants will be planted throughout the ¾-acre project area that will recruit wood and provide shade into the future.

Chambers Creek is a lowland tributary to the Deschutes River and a critical contributor of cold water. Overall, the Chambers Creek basin is composed of 8,323 acres that drain to Chambers, Little Chambers, Smith Lake, Chambers Ditch, and Chambers Creek. Chambers/Little Chambers Lake complex is the largest waterbody in the basin. It does not have a feeder system, but Little Chambers Lake does form the headwaters for Chambers Ditch. Smith Lake is a 12-acre, groundwater-fed lake (Thurston County, 1995). Chambers Ditch is a seasonal stream that was ditched for most of its length early in the century. Chambers Ditch flows from Chambers Lake south to its juncture with Chambers Creek and the South Tributary upstream of Rich Road. Chambers Creek is a natural stream with year-round flow through most of its length. Chambers Creek flows into the Deschutes River. The South Tributary is a network of natural channels, artificial ditches, and poorly defined wetlands, which flows intermittently and remains dry most of the year (Thurston County, 1995).

The proposed project is intended to improve water quality and increase salmon rearing habitat for juvenile Coho Salmon. The system is modeled as habitat for Fall Chinook, Coho and Chum Salmon. Specifically, the project will designed to accomplish the following:

- Increase stream length by at least 1/8 miles.
- Restore at least 1/3 mile of creek.
- Increase instream shading.
- Increase instream complexity by adding Large Woody Debris (LWD).
- Increase community involvement.

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

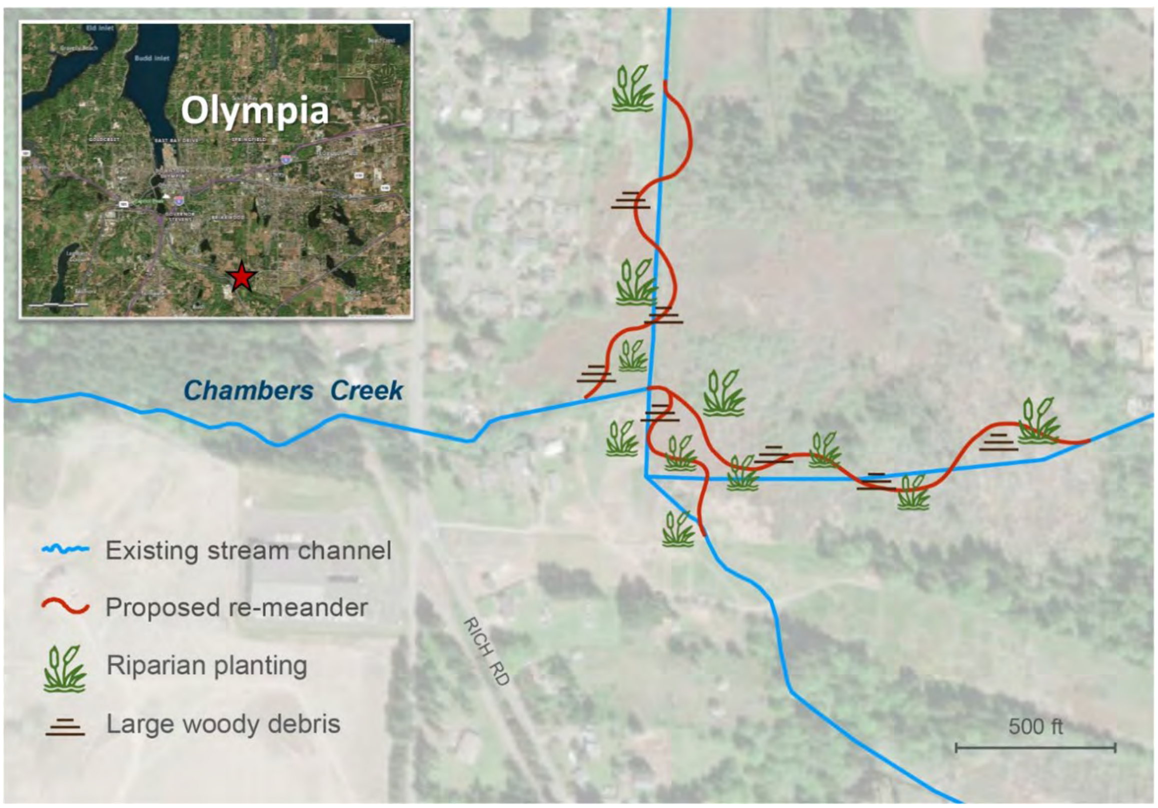

Figure 1. Location of proposed Chambers Creek remeander project in Thurston County.

Description of the anticipated spatial distribution of likely benefits

The proposed project site is approximately 3 acres. Within that footprint, the length of Chambers Creek is expected to be increased by increasing the sinuosity. The new channel alignment will have improved instream habitat, floodplain connectivity (i.e. local flooding from increased sinuosity channel roughness elements), and increased groundwater storage (i.e. in terms of saturated soils from increased local flooding.

Performance goals and measures.

The performance goals are to increase channel sinuosity and length, increase instream habitat complexity, and channel roughness. Specific metrics and measures will be defined when during feasibility and 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 and Fall Chinook are present in Chambers Creek and that Coho Salmon and Fall Chinook have access to Chambers Creek (WDFW Salmonscape 2020). WDFW (2020) documents spawning in Chambers Creek and small areas in the lowermost reaches (WDFW 2020). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook salmon were historically present in Chambers Creek which is identified as an important tributary to the Deschutes River (WDF 1975). Chambers Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

Chambers Creek has inadequate spawning gravel and low summer flows (Haring and Konovsky, 1999). Chambers Creek offers three types of coho habitat. The segment near the mouth contains a few spawning sites. The lower section provides year-round rearing habitat from the springs below Rich Road to the mouth. The portion from the springs below Rich Road up to a point below Yelm Highway provides winter habitat as long as the creek is flowing. The area near the mouth of Chambers Creek is the best remaining habitat for anadromous fish in the basin with relatively clean gravel, large trees, and a well-developed understory near the creek that provides shading. Upstream from the mouth, the habitat quality declines. The riparian cover gives way to open fields south of the creek below Rich Road (Thurston County, 1995). The lower quarter mile of the South Tributary upstream of Rich Road contains viable seasonal habitat for migrating fish, with fair overhanging cover and in-stream woody debris. However, upstream, it has been channelized through agricultural lands, and disappears frequently in the wetlands. There is poor substrate and very little large organic debris in the channel (Thurston County, 1995).

Identification of anticipated support and barriers to completion.

Thurston County has indicated support for this project. The primary barrier to completion is likely to be land acquisition or obtaining conservation easements. The proposed project area includes privately owned parcels.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be <$1 million, based on an order of magnitude estimate (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by Thurston County or their future project partner. The restored stream section would be designed to be compatible with natural ecological processes to be self-sustaining and resilient to perturbations to minimize long-term maintenance costs.

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

The project sponsor is Thurston County and is ready to implement the project. Implementation would require an evaluation of feasibility.

References

Haring,D. and J. Konovsky. 1999. Salmon Habitat Limiting Factors Final Report. Water Resource Inventory Area 13. Washington State Conservation Commission.

Thurston County Storm and Surface Water Program. (1995a). Chambers/Ward/Hewitt Comprehensive Drainage Basin Plan. Prepared for the City of Olympia and Thurston County.

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Donnelly Drive Infiltration Galleries

To: Angela Johnson (Ecology and Kaitlynn Nelson (Thurston County)
From: HDR
Date: May 20, 2020
Subject: Donnelly Drive Infiltration Gallery Analysis

Background

Portions of Donnelly Drive SE, and Normandy Drive SE flood during major rainfalls and impacts public property and reduces public safety. Thurston County Roads Maintenance has routinely responded to calls from residents for assistance. It is proposed to install treatment devices and infiltration systems in the Donnelly Drive vicinity to reduce flooding of public streets and promote infiltration to groundwater. There are five locations in the area which see flood issues as shown on Figure 1. Each of these locations are a low point where an existing drywell is located to infiltrate stormwater.

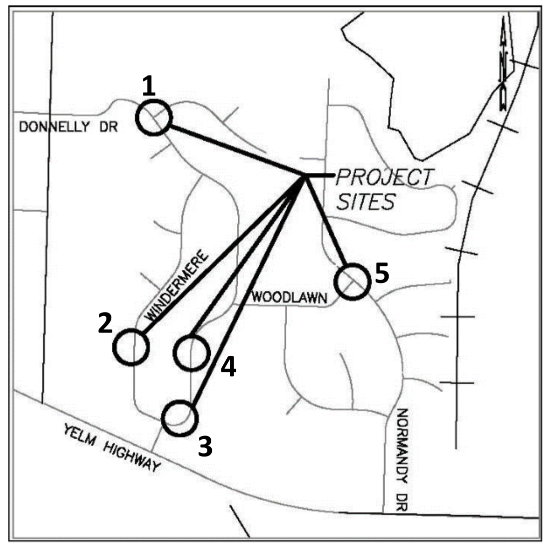


Figure 6. Flooding areas

At Location 1 (at the intersection of Donnelly Drive SE and Glendale Drive SE) is a single drywell installed at some point after the original neighborhood was built.

At location 2 (along Windermere Drive SE) are two drywells installed on either side of the roadway. The drywells are original to the initial construction of the neighborhood.

At location 3 (at the intersection of Donnelly Drive SE and Windemere Drive SE near Yelm Highway), are three drywells installed on all sides of the intersection, all of which were installed at some point after the original neighborhood was built.

At location 4 (along Donnelly Drive SE) are two drywells installed on either side of the roadway. The drywells are original to the initial construction of the neighborhood.

At location 5 (intersection of Woodlawn Drive SE and Normandy Drive SE), are three inlet inlets. Two of these are located on the west side of the intersection and one is located on the south side of the intersection. It is unclear how many of these are drywells.

Analysis and Results

Site Visit

During the rainfall event, it was observed that the drywells at Locations 2 and 4 were fully surcharged and bypassing all flow reaching them with negligible infiltration.

At Location 5, the northern most inlet was surcharged while the inlet on the west side of the intersection had a water surface elevation approximately 2-inches below the rim. The southern inlet was surcharges with flow slightly greater in the curb downstream of the inlet than upstream. A slow rise of particles was seen out of the inlet indicating flow was coming out of the inlet. If this inlet/drywell is connected to the inlet on the other side of the street, this may indicate that the flow to the combined structures exceeded the infiltration capacity and is surcharging. If not connected, this may indicate groundwater coming up out of the inlet.

Locations 1 and 3 were not surcharging during the May 2, 2020 rainfall event and fully infiltrating.

Basin Delineation

The contributing stormwater basins to each flooding area was delineating by using topography data from the 2011 Thurston County LiDAR survey and verified with a site visit during a rainfall event occurring on May 2, 2020. Five basins were delineated and shown on Figure 2 with each basin flowing towards one of the flooding areas.

For determining basin areas for sizing infiltration galleries, only the directed connected impervious area of the roadway and driveways was considered.

Assumed Infiltration Rate

According to the NRCS Web Soil Survey, the soils in the area consist primarily of sandy loams. Table A.1 of the Thurston County Drainage Manual lists the estimated design (long-term) infiltration rate for sandy loam as 0.25 inches per hour. Past project experience in this area also has found infiltration rates similar to 0.25 inches per hour. The analysis looks into sizing assuming a 0.25 inch per hour infiltration rate as well as 0.5 inches per hour.

Infiltration Gallery Sizing

The required infiltration gallery size was determined using the Western Washington Hydrology Model (WWHM). The model assumed an infiltration gallery cross-section similar to what was installed at Husky Way which had a width of 8 feet, height of 4 feet, and a 24-inch diameter perforated pipe.

The required length of infiltration gallery for each basin is given in Table 1 for three different scenarios these include:

- Infiltration rate of 0.25 inches per hour and sized to infiltrate for all but the two largest storms
- Infiltration rate of 0.25 inches per hour and sized for 100 percent infiltration
- Infiltration rate of 0.50 inches per hour and sized to infiltrate for all but the two largest storms

The reason for sizing for all but the two largest storms is that getting to 100 percent infiltration causes the galleries to be unfeasibly large (approximately 67 percent larger). An example of the stage height seen in each infiltration gallery when not sized for 100 percent infiltration is shown on Figure 2.

Figure 2. Drainage basins

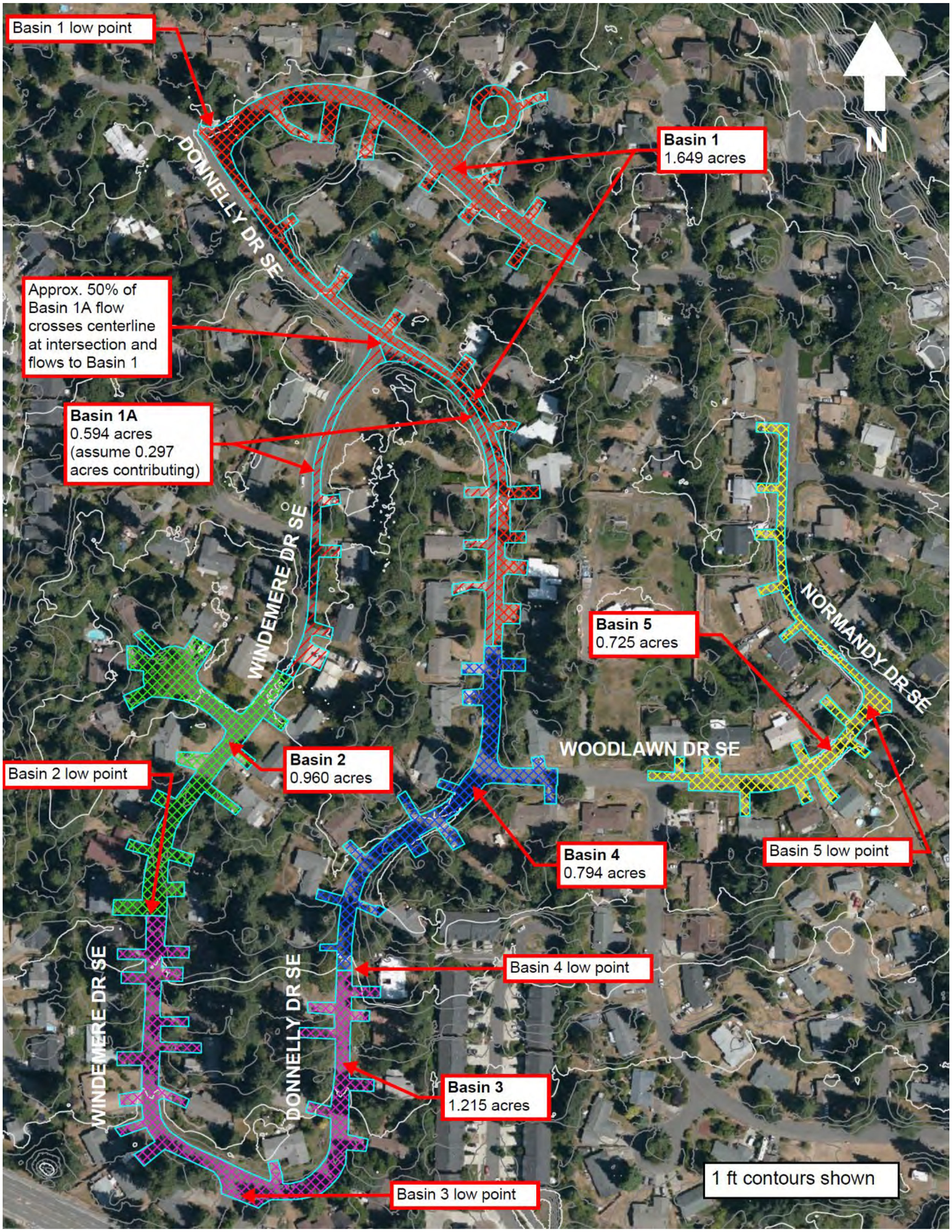


Figure 3.

Table 14. Infiltration gallery length

Basin	Calculated infiltration gallery length (feet)		
	0.25 inch/hour	0.25 inch/hour – 100% infiltration	0.5 inch/hour
1	1,800	3,000	1,450
2	900	1,500	725
3	1,150	1,900	900
4	750	1,250	600
5	675	1,150	550
TOTAL	5,275	8,800	4,225

Figure 7. Drainage basins

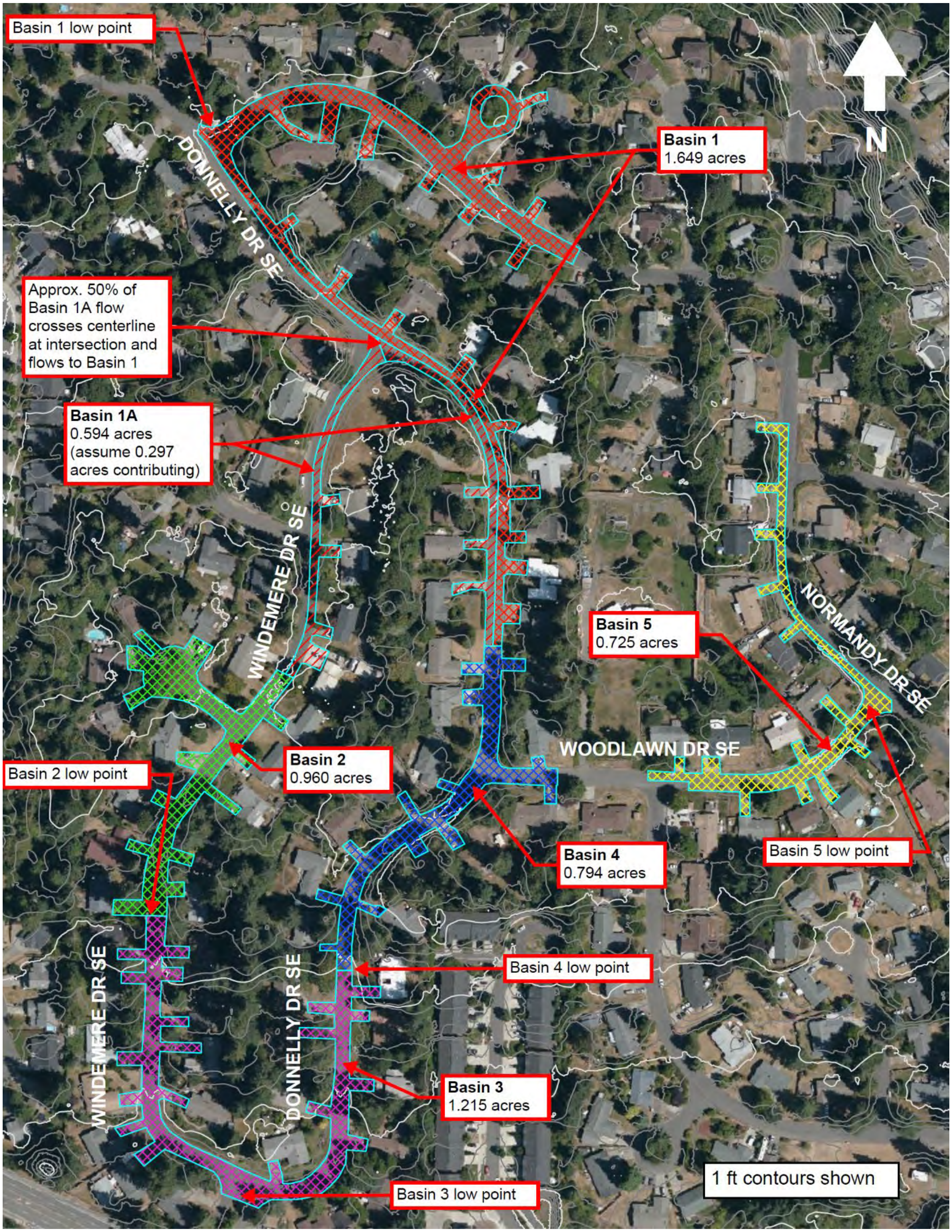
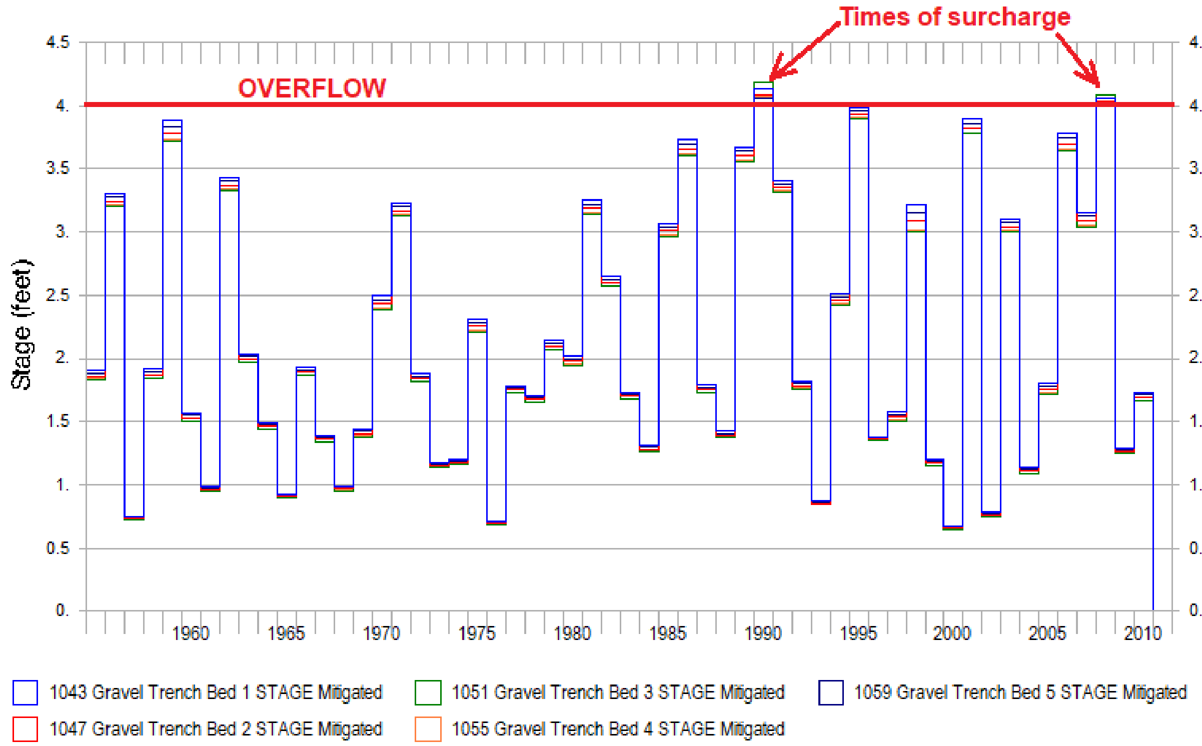


Figure 8. Times of surcharge across WWHM model run



If the infiltration rate were to increase to 0.5 inches per hour from 0.25 inches per hour, the length of infiltration gallery needed would decrease by approximately 20 percent.

Stormwater Infiltration Volume

The Donnelly Drive project is being considered to not only reduce the flood nuisance but to also provide additional groundwater recharge for mitigation purposes. WWHM was used to estimate the increase in volume infiltrated.

Table 15. Stormwater infiltration volume

Scenario	Annual average infiltrated volume (acre-feet)	Increase in annual average infiltrated volume over existing (acre-feet)
Existing	5.53	0
Galleries sized to infiltrate for all but the two largest storms	19.31	13.78
Galleries sized for 100% infiltration	19.35	13.82

Opinion of Probable Construction Cost

The Husky Way infiltration gallery project was used as a basis to estimate the linear foot construction cost of an infiltration gallery. The engineers estimate, done in 2012, for Husky Way had a construction cost of $166,757 to build 335 feet of infiltration gallery, excluding tax. Inflated to today’s dollars and including tax, this corresponds to a cost of approximately $684 per foot of infiltration gallery.

On top of the construction cost the cost estimate also includes the following costs based on a percentage of the construction cost: (1) 30 percent contingency; (2) 15 percent for geotechnical investigation; (3) 15 percent for engineering; (4) 10 percent for administrative costs; (5) 5 percent for permitting.

Due to the low infiltration rates expected in the area, a substantial area is needed for infiltration with infiltration galleries running along the length of most of the streets within the basins. To further design, additional geotechnical investigation should be completed to verify infiltration rates as infiltration rates higher than what is assumed could substantially lower the cost of the project by reducing the length of infiltration gallery needed.

Table 3 provides a summary of opinion of probable construction costs by project scenario.

Table 16. Opinion of probable construction cost

Cost item	Costs by scenario		
	0.25 inch/hour	0.25 inch/hour for 100% infiltration	0.50 inch/hour
Construction Cost	$3,608,043	$6,019,105	$2,889,855
Contingency (30%)	$1,082,413	$1,082,413	$1,082,413
Geotechnical (30%)	$541,206	$541,206	$541,206
Engineering (15%)	$541,206	$541,206	$541,206
Admin (10%)	$360,804	$360,804	$360,804
Permitting (5%)	$180,402	$180,402	$180,402
Total Cost	$6,310,000	$8,730,000	$5,600,000

Floodplain Restoration

General Project Description for Opportunities in WRIA 13

Narrative description, including goals and objectives.

The Deschutes River originates on Cougar Mountain in Lewis County and flows 57 miles, mostly within Thurston County, with several smaller independent tributaries that drain into three saltwater inlets: Henderson, Budd, and Eld. Other principal streams include Woodard and Woodland Creeks which are the largest of the major tributaries to Henderson Inlet. Key limiting factors for salmonid habitat and productivity in Water Resource Inventory Area (WRIA) 13 were identified in Haring & Konovsky (1999), Thurston Conservation District (2004), and Confluence Environmental (2015).

- Natural stream processes have been significantly altered due to adjacent land uses including timber harvest, agricultural uses, and residential and commercial development,
- Fine sediment (<.85 mm) levels are high, reducing spawning habitat quality,
- Lack of large wood in streams, particularly larger key pieces that are stable and most capable in forming pools and other instream habitats and retaining sediment and smaller wood,
- Lack of adequate pool frequency and particularly a lack of large, deep pools that are key habitats for rearing juvenile salmonids and adult salmonids on their upstream migration,
- Naturally high rates of channel migration occur in this geologically young basin with easily erodible glacial outwash soils, but exacerbated rates of streambank erosion and substrate instability due to intermittent bank armoring and removal of forested riparian vegetation and subsequent loss of bank strength and stability,
- Loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, cover, shading, instream habitat conditions, sediment deposition, and wildlife habitat,
- The presence of a significant number of fish passage barriers that inhibit upstream or downstream access to juvenile and adult salmonids,
- Significant alterations to the natural hydrology in streams where the uplands have been heavily developed, which has led to increased peak flows and decreased low flows that cause bed scour, bank erosion, and reduced water quality; and the threat of similar impacts to streams that are experiencing current and future development growth, and
- Estuarine habitat quantity and quality is significantly impacted by physical alteration of the natural estuary, such as by the dam and creation of Capitol Lake that dramatically reduced the area of estuarine habitat, dredging, fill, poor water quality in the estuary, and by significant alteration of nearshore ecological function due to shoreline armoring.

WRIA 13 restoration projects would address functional loss of water storage, low flows and water quality within the Deschutes River and other streams and rivers throughout WRIA 13. 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 lost processes and functions 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 13 floodplain project recommendations from the WRIA 13 committee. The following data and reasoning was used to select candidate sites in WRIA 13:
- 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.

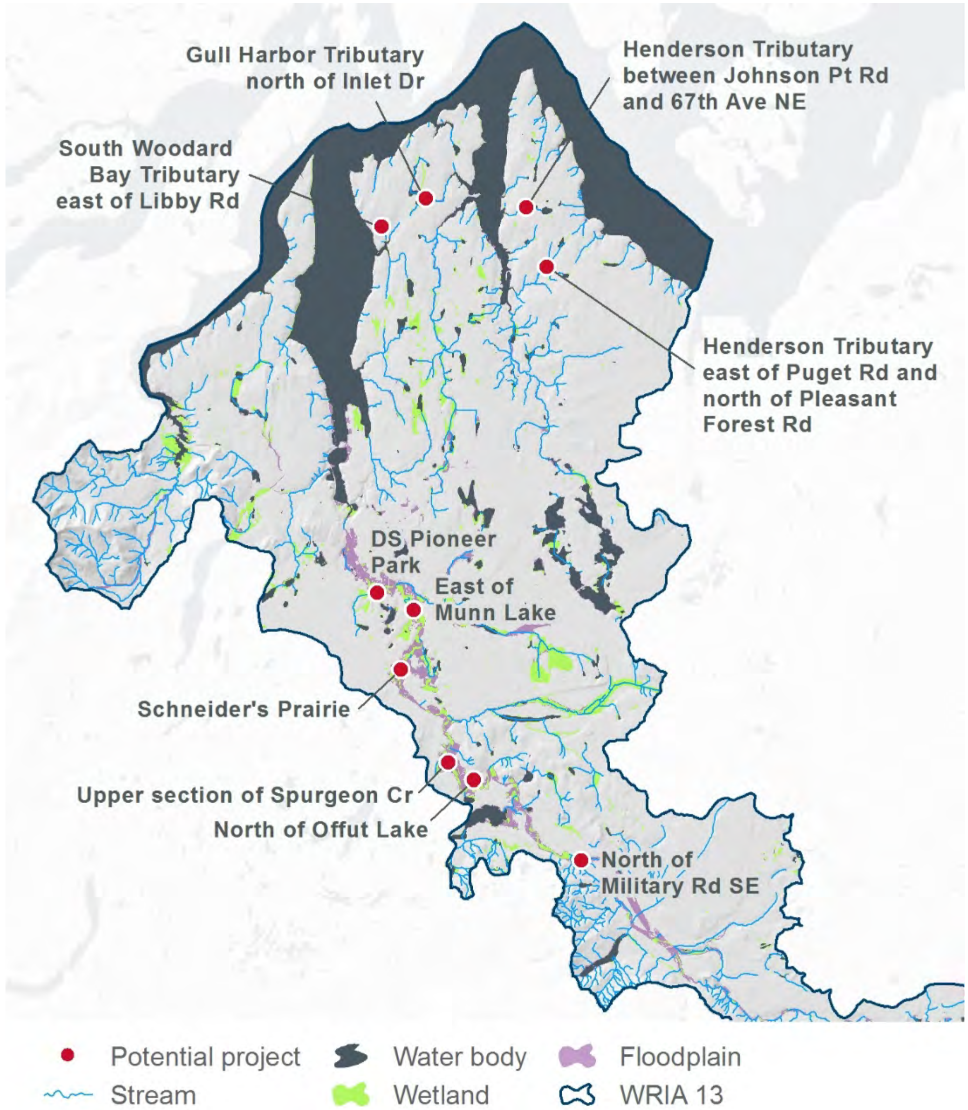


Figure 1. Potential floodplain restoration project locations.

Project locations identified by the committee include the following:

- Tributary to Woodard Bay, east of Libby Road
- Tributary to Gull Harbor, north of Inlet Drive
- Tributary to Henderson Inlet, between Johnson Point Road and 67th Avenue NE
- Tributary to Henderson Inlet, east of Puget Road and north of Pleasant Forest Road

- Deschutes River, downstream of Pioneer Park
- Deschutes River, east of Munn Lake
- Deschutes River, Schneider's Prairie
- Upper Spurgeon Creek
- Deschutes River, north of Offut Lake
- Deschutes River, North of Military Rd SE

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.

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.

The Deschutes River watershed (WRIA 13) contains the Deschutes River and its tributaries, along with 22 independent drainages that enter Henderson, Budd, and Eld inlets. The primary independent drainages are McLane, Woodward, and Woodland creeks.

Potential floodplain restoration projects have been identified in the upper reaches of several small tributaries to Budd and Henderson inlets that historically had more extensive wetlands in their headwaters. Restoring floodplain connectivity, along with riparian and wetland habitats could benefit up to 5 miles of these tributaries and their associated tributaries by storing direct precipitation as well as stormwater runoff in the headwaters and floodplain areas, contributing additional flows during low flow periods.

Potential floodplain restoration projects have been identified in multiple floodplain reaches of the Deschutes River and one potential project in the upper reaches of Spurgeon Creek (primary tributary to the Deschutes River). Restoring floodplain connectivity, along with instream, riparian, and wetland habitats could benefit up to 16 miles of the Deschutes River, plus up to 5 miles in Spurgeon Creek by storing direct precipitation as well as stormwater and flood storage in floodplain areas that could contribute additional flows during low flow periods. The Deschutes River has been noted for low summer/fall flows for decades (WDF 1975) and

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 fall Chinook, coho, and chum salmon, and winter steelhead trout are present in the Deschutes River and the independent drainages in WRIA 13. Chinook salmon are hatchery origin, but the other species are wild or of mixed origin (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. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 13 (Haring & Konovsky 1999; Confluence Environmental 2015) 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, contributing to flood storage, groundwater recharge, recruitment of large wood, and creation of habitats. Floodplain reconnection projects that provide the river with more room to meander and more ways to hold water in the hyporheic zone and porous floodplain soils are important solutions 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.

References

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Forest stand age and flow restoration

Concept paper Paul J. Pickett

For the Squaxin Island Tribe
January 21, 2021

Background

Technical appendix G of the Nisqually Watershed Plan Addendum (Nisqually Indian Tribe, 2019) provided a detailed technical analysis of a Community forest project designed to manage forest stand age to improve stream flows. Excerpts from that document describe some of the technical background for this project concept:

A significant body of field evidence, research and important new modeling indicates that large streamflow benefits can accrue from increasing forest stand age through Managed Forestry:

- *Perry and Jones (2016) used paired forest stands comparable to those in the Nisqually River watershed to show that after a forest stand age of 40 years, re-growing forests contribute significantly to streamflow.*
- *Abdelnour et al (2011 and 2013) confirm that the findings of Perry and Jones (2016) can be reproduced using numerical modeling with the VELMA model code.*
- *McKane et al (2018) has modeled the Mashel River sub-basin using the VELMA model. Preliminary results indicate that streamflows increase substantially when forest stand ages increase.*
- *Managed Forest practices are already being implemented in the Nisqually Community Forest, which include over 1,900 acres already purchased and under protection. This ongoing program (limited only by funding) indicates the viability of the long-term managed forest concept.*

The work of Perry and Jones (2016) is critical to the understanding of the streamflow benefits of Managed Forests. Figure 6b is extracted below for reference from their paper, Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA:

In this figure, streamflows are compared between pairs of test basins: one cut and the other uncut. Their streamflows are expressed as the percent difference between the reference (uncut) streamflow and the clear-cut basin streamflow – over a test period of 35 to 45 years.

- *Initially, streamflows rise rapidly in the cut basin, relative to the uncut partner basin.*
- *Streamflows then decline rapidly as vegetation re-growth uses more water relative to the uncut partner basin.*
- *In forests older than 35-40 years, streamflows then stabilize at 50% to 70% lower than in the uncut partner basin.*

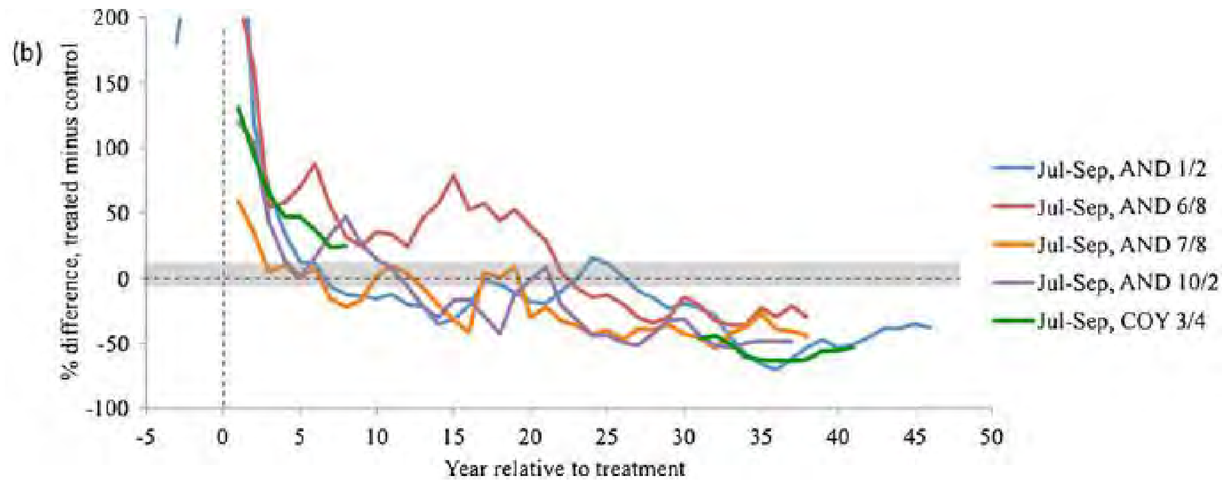

Figure 6b, (excerpted from Perry and Jones (2016).

Computer modeling using the VELMA modeling software (McKane et al) was able to reproduce this sequence – both the hydrology and forest cover changes – for the Mashel River sub-shed (McKane et al, 2018) – at 10 reach locations. Reach 0 at the west end of the model domain represents the simulation of USGS gage 12087000:

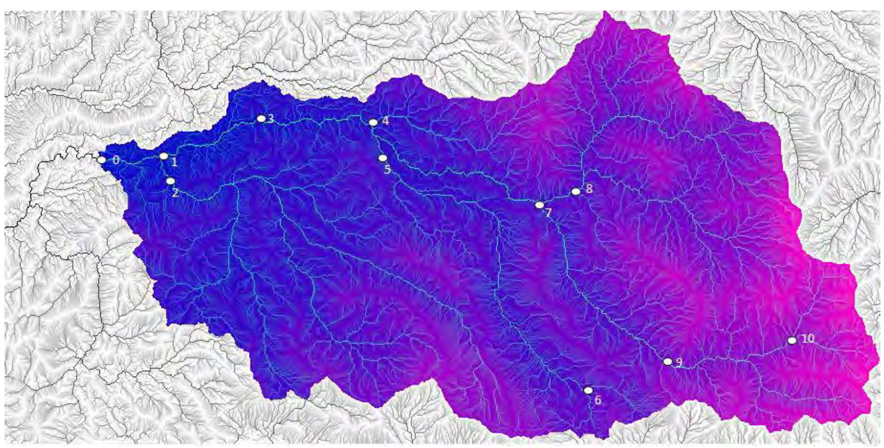

Figure: VELMA model domain for the Mashel Sub-basin showing the stream network, simulated gages at key reaches and boundary view (reproduced from McKane et al, 2018).

The VELMA modeling made a good approximation of the actual discharge in the Mashel River. Three other scenarios were simulated in the modeling: 1 year after clear-cut, 40 years after clear-cut and 240 years after clear-cut. The streamflow from the 240-year old forest stand is reported to be nearly indistinguishable at the streamflow from a 100-year-old forest stand (McKane, 2018; Abdelnour 2011; Abdelnour 2013). Lowest modeled streamflows were found at 40 years after clear-cut, while from 40 to 100 years, streamflows returned, approaching un-cut old-growth streamflows in the 100-year-old stand age modeling.

A recent study by Coble et al. (2020)[1] describes studies of the effect of forest stand age on stream low flows. A summary of effects from Coble et al (2020) and others describes a general pattern observed in response to clearcut:

1. Initial response: increased stream flow compared to pre-harvest (mature forest)
2. Regenerating stands: small, mixed, or variable responses (modern cutting programs may provide some improved recharge compared to historic clearcut methods)
3. Continued growth: decline in low flows
4. Mature forest: low flows return to pre-harvest conditions

The graph in Figure 1 summarizes the results from 19 catchments from a variety of studies. Flow reductions in Hydrologic period 3 were found in 17 of 19 studies.

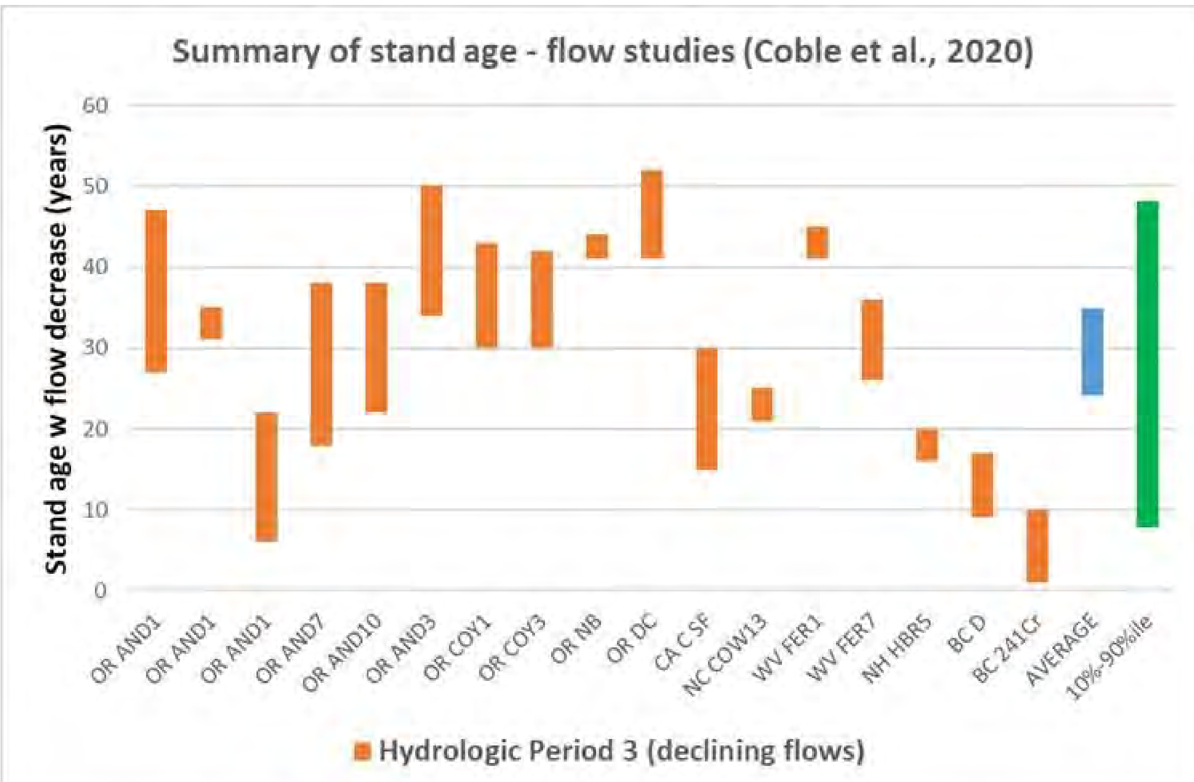

Figure 1. Summary of stand age studies (Coble et al., 2020)

This graph illustrates the effect of stand age. Study results indicate that stream flows decrease with stand ages from 10 to 50 years (10^{th} percentile of onset year to 90^{th} percentile of final year), and on the average between 25 and 35 years (average onset year to average final year). Commercial cut rotations tend to occur between 40 and 60 years.). In most cases, stream flows rebound to pre-harvest conditions at 35 to 50 years.

[1] Long-term hydrological response to forest harvest during seasonal low flow: Potential implications for current forest practices. Science of the Total Environment 730 (2020) 138926

Bob McKane from the EPA Corvallis Laboratory has developed a method to model the flow effects of stand age using the VELMA model. He applied this model to a study of the Nisqually Community Forest.[2] Figure 2 compares streamflows at 40- and 100-year forest stand ages.

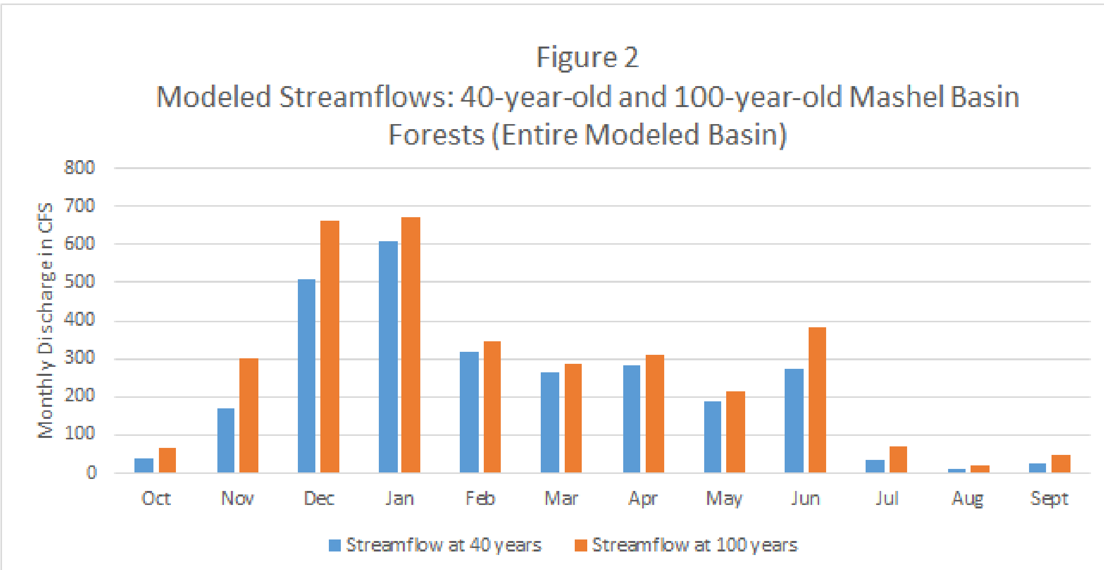

Figure 2. Modeled streamflows in the Mashel River basin (Nisqually Indian Tribe, 2019)

Using these assumptions, differences between monthly flows in the 40-year-old and 100-year-old VELMA simulations can be used to determine a unit acre of per-year streamflow increase that can be reasonably achieved for new Managed Forestry lands added to the potentially protected forest.

The uncertainties in this analysis must be acknowledged. Forest stand age affects hydrology through a complex variety of factors, which include:

- Geophysical and climate factors across any specific watershed, such as: latitude, climate, local weather patterns; watershed elevation, slope, and aspect; soils; and underlying geology.
- Average stand age, tree species composition, and parcel-scale cut patterns across the watershed.
- Patterns of forest harvest, such as the extent of clear-cut, patchy cutting strategies, riparian areas left intact, and management of debris.
- Other factors such as soil compaction and roads.

There are also possible differences between the effects in research study areas and effects in working forests subject to regional regulation, such Washington's Forests & Fish program and Habitat Conservation Plans.

[2] https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=CPHEA&dirEntryId=348155

Project concept

To meet the requirement of a project under RCW 90.94, a project just provide benefits indefinitely. From the research cited above, this suggests that protecting a forest stand so that it either: 1) remains uncut; or 2) is cut in a rotation of 80 years or more, could provide baseflow benefits. EPA's VELMA modeling tool could help to quantify those benefits.

Funding is limited for streamflow restoration, so directly funding fee-simple forest land acquisition is possible, but difficult. However, there may be opportunities to leverage acquisition for multiple purposes using a combination of Streamflow Restoration grants and other funding sources. Note that the focus of this proposal is projects with the voluntary cooperation of a landowner, and is not intended to address legal or regulatory issues.

Several kinds of forest protection projects appear to be viable for this kind of synergy: setting aside an area as conservation or community forest; habitat protection; and carbon sequestration. A project such as these that provides permanent protection for forest lands might meet Ecology criteria for a water offset if the benefits could be quantified. Another window of opportunity could be a project that would protect forest with low timber value, and where a project is on the borderline for water offset – but might be a candidate for funding with habitat or carbon sequestration funding. By adding in Streamflow Restoration grant funding, a project may be realized that would otherwise not reach financial viability.

With this in mind, a forest stand age project might include these elements:

- Project would need to be an area currently managed for timber harvest.
- Stand age management for streamflow protection can be either forest protection (total elimination of harvest), or management to an average stand age of 80 years or more.
- A project could access supplemental Streamflow Restoration funding to support permanent forest protection or stand age management, and also conduct the offset analysis to quantify benefits.
- If a project is funded through other sources and provides permanent forest protection or stand age management, only an offset analysis would be needed to quantify baseflow enhancement benefits.

Several factors would need to be evaluated as part of a feasibility study:

- Whether the project is in a basin with baseflow enhancement needs, including tributaries where perennial flows are threatened.
- Whether the project is large enough to provide significant baseflow enhancement downstream. Specific project areas could be of any size, but the greater the coverage of a tributary watershed, the more the presumed benefits.
- The ability to selectively harvest trees for a longer cut rotation. The literature suggests other methods could enhance streamflow, such as selective patchy cutting.
- Evaluation of the effect of site-specific factors through a spatial and modeling analysis.
- The economic implications for lengthening harvest or taking timber out of production, including

reduced employment and local revenues.

- There are corollary environmental and economic benefits from longer cut rotations that could be evaluated and quantified.

Next steps

- Include a categorical project that would allow for future specific projects, or support further research into this type of project to more clearly define the availability, structure, and suitability of potential projects, including assessing the potential social, economic, and environmental positive and negative impacts to the watershed and local communities.
- Identify specific opportunities that could be put forward for a suitable project.

References

Abdelnour, A., Stieglitz, M., Pan, F., & McKane, R. (2011). Catchment hydrological responses to forest harvest amount and spatial pattern. Water Resources Research, 47(9).

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Hicks Lake stormwater retrofit

Description

The Ruddell Road Stormwater Facility was constructed by the City of Lacey in 1999, consisting of a pretreatment settling basin that flows to constructed wetlands; ultimately flowing into Hicks Lake. Although the facility is an improvement to the previous, untreated condition, the limited water quality wet pool volume, relatively high inflows, and flow-through design conditions, limit water quality treatment and provides minimal, if any, infiltration benefit. Therefore, the City is investigating the feasibility of an offset infiltration facility as an upgrade to the current system.

The proposed project would provide water offsets and ecological benefit (per RCW 90.94.030) to the Woodland Creek sub-basin. The improvements are expected to provide a significant shallow groundwater recharge component, and augment base flow to Hicks, Pattison, and Long Lakes, ultimately benefitting Woodland Creek, which is currently impaired by low instream flow (303d listing 6169). Proposed upgrades to the facility include a flow splitting manhole, filtration treatment BMP, infiltration gallery and an overflow structure to the existing wetland.

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

The delineated basin contributing to the existing stormwater system has an approximate total area of 346.46 acres. Stormwater runoff was modeled for the catchment by characterizing precipitation, soils, impervious surfaces, and land use composition. The proposed infiltration facility was sized according to potential stormwater flows, an assumed soil infiltration rate, and soil characteristics. A range of diversion flows were modeled (1cfs, 2cfs, and 3 cfs) were modeled and resulted in a corresponding range of average annual infiltration of 167, 244, and 296 afy, respectively. All flows, up to 3.5 cfs are expected to be 100% infiltrated, but infiltrating up to 3cfs accounts for reduction in infiltration capacity over time. Therefore, infiltrating up to 3 cfs for an offset benefit of 296 cfs is reasonable.

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

Figure 1 shows the general layout of the proposed infiltration facility, in series with the existing stormwater (water quality) treatment facility. Up to 3 cfs in stormwater flow would be directed to and infiltrated in the proposed facility. Any stormwater not infiltrated would still over into the existing facility, and flow into Hicks Lake.

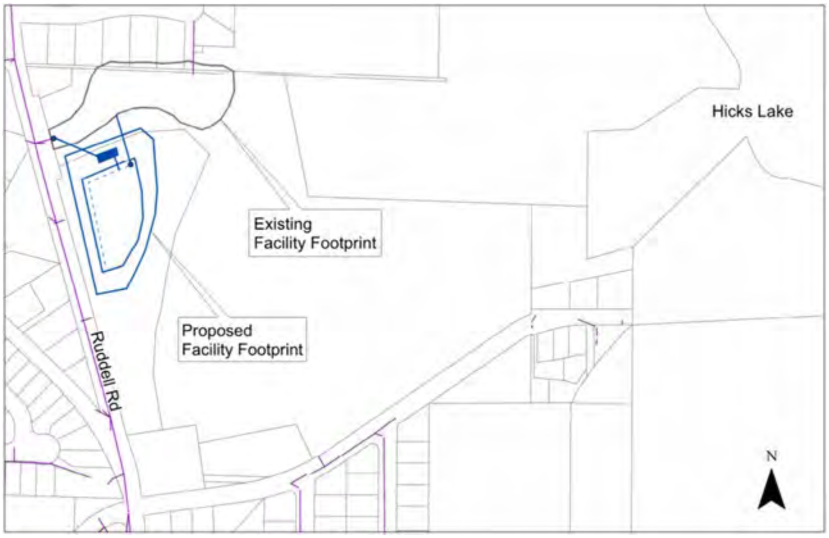

Figure 1. Layout of Proposed Infiltration Facility

Description of the anticipated spatial distribution of likely benefits

The infiltrated stormwater would seep into Hicks Lake. Hicks Lake is the headwaters of the Woodland Creek watershed. Water in Hicks Lake flows through Pattison Lake, Long Lake, and then into Woodland Creek. Infiltrated stormwater would reduce flood flows and presumably increase base flows in the entire system during non-storm periods.

Performance goals and measures.

Performance will be measured in terms of infiltration. Stormwater flows and infiltration capacity (or bypass to the water quality BMP) will be measured or observed, for effectiveness.

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

Woodland Creek supports spawning populations of coho, chum, and Chinook salmon (WDF 1975; WDFW 2020). Steelhead trout has documented presence. These salmonids are present from Henderson Inlet to Long Lake. Within this reach, the creek is seasonally dry from Lake Lois to Beatty Springs, north of Martin Way. The watershed is heavily urbanized in the headwaters, contributing to reduced summer flows. This project will contribute to moderating the effects of urban stormwater impacts.

Identification of anticipated support and barriers to completion.

The City supports this project. The project will be on property the City is planning to purchase, and the City does not anticipate any barriers to completion.

Potential budget and O&M costs.

The preliminary OPCC totals approximately $3.3 million for the proposed facilities as currently envisioned (Attachment A).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by City.

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

The project sponsor is the City of Lacey. The City is ready to implement this stormwater retrofit project, commensurate with funding.

References

WDF (Washington Department of Fisheries), 1975. "A Catalog of Washington Streams and Salmon Utilization, WRIA 13."

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

Attachment A - Opinion of Probable Costs of Construction (OPCC) - Concept Plan Level

Note: Preliminary OPCC does not include sales tax, design, CM, property acquisition, legal, and other administrative/legal costs

Total OPCC:	**$3,295,000**

Item	Description	Unit	Unit Cost	Qty	Cost	Comments
	General Requirements - Stormwater Facilities					
1	Mob/Demob, Survey, Temp Facilities, Utilities Protection, Traffic Control, etc.	ls	331,000	1	$331,000	15% of Items below
	Flow Splitter at Connection to Existing SD					
2	Flow Splitter Vault with Adjustable High Flow Bypass Weir	ls	$60,000	1	$60,000	Precast vault with interior lateral weir wall with alluminum adjustable weir plate - assume 8'X16' vault size
	Water Quality Pre-Treatment					
3	Pre-treatment Facilities Prior to Groundwater Discharge	cfs	$80,000	3	$240,000	Pre-settling vault and/or hydrodynamic separator(s) - allowance for 3 cfs capacity
	Drainage Conveyance System					
4	12" Dia. Storm Drain (Polypropylene)	lf	$60	700	$42,000	Collective 12" conveyance SD; 4' - 6' Depth
5	Catch Basin Type 1	ea	$4,000	4	$16,000	Collective Type 1 CBs, 5' Std Depth
6	Catch Basin Type 2	ea	$7,000	2	$14,000	Collective Type 2 CBs, 6' - 10' Depth

7	Catch Basin Type 2 Emergency Overflow w/Debris Rack	ea	$10,000	1	$10,000	Overflow spillway from infiltration gallery to existing constructed wetland; debris cage
8	Trench Excavation Safety Systems	ls	$7,000	1	$7,000	All conveyance facilities
	Earthwork					
9	Construction TESC Control and Compliance	ls	$70,000	1	$70,000	CSWPPP, TESC, SPCC, Temp Treatment, Discharge, CSGP Monitoring/Compliance
10	Clearing, Grubbing, Disposal	ac	$14,000	3.0	$42,000	Forrested parcel; on-site processing with grinder assumed
11	Infiltration Facility Pad Excavation Incl Haul, Disposal	cy	$20	32,000	$640,000	Assumes excess material disposal within 5 mi
12	Infiltration Gallery Footprint Excavation, Haul, Disposal	cy	$24	6,500	$156,000	Assumes excess material disposal within 5 mi
13	Shoring or Extra Excavation	ls	$15,000	1	$15,000	Temporary shoring for gallery excavation
	Infiltration Gallery					
14	Storm HDPE Arch Infiltration Chambers	lf	$40	12,000	$480,000	16" high HDPE arch infiltration chambers
15	Crushed Stone - 1.5" Fractured/Washed	cy	$55	4,500	$247,500	Infiltration chambers zone backfill
16	Geotextile	sy	$4	5,500	$22,000	Separation geotextile from overlying soils
17	Topsoil	cy	$40	1,100	$44,000	Topsoil above gallery and in disturbed fringe areas
18	Access Road Restoration - AC Pavement	sy	$36	1,200	$43,200	Perimeter 1,100' X 10'W access road and connection to Ruddell Rd
19	Gallery Footprint Restoration Seeding	ls	$5,000	1	$5,000	Grass surface restoration above infiltration gallery
20	Perimeter landscape Plantings and Irrigation	ls	$50,000	1	$50,000	Landscaping allowance

Subtotal	**$2,534,700**
Construction Contingency (Planning Level, 30%)	**$760,410**

Managed Aquifer Recharge Projects in WRIA 13

Description

The WRIA 13 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.

The total potential offset from all project locations is 909 acre-feet/year (AFY); however ,the Committee acknowledged that potential projects located in streams with year-round closures (Chapter 173-513 WAC) should be removed from the overall total, resulting in a potential offset of 811 AFY.

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

Potential MAR locations were determined based on a screening process (Attachment A). Areas in WRIA 13 with the following features were considered for candidate locations:

- Favorable soils and surficial geology-
    - Soils mapped in hydrologic groups A and B with all soil layers having a permeability greater than 2 inches per hour.
    - Surficial geology primarily composed of sand and/or gravel.
    - Exclude areas with low permeability surficial geology (i.e. silt, clay, bedrock).
    - Exclude wetlands, lakes, and high groundwater areas.

- Depth and thickness of aquifer
    - Depth to water of 8 feet or greater.
    - Surficial aquifer saturated thickness of 10 feet or greater.
- Distance to potential water source
    - Favorable MAR locations were defined as those within 0.25 and 0.5 miles from a potential donor stream or river.

This screening resulted in favorable areas and specific locations for consideration during WRE Plan implementation (Figure 1; Table 1). Tier 1 locations are favorable in terms of land ownership, property size, and relative net ecological benefit (i.e. significant use by anadromous salmonids). Tier 2 locations are either located farther than 0.5 miles from a stream or are near a source water closed to further appropriation. At the WRIA 13 committee's request, potential locations were identified on the Cooper Point, Boston Harbor, and Johnson Point, and Woodland Creek subbasins with less restrictive criteria (Appendix A). Many tier 2 locations were identified that do not have nearby source waters. These sites may be considered for future stormwater infiltration projects.

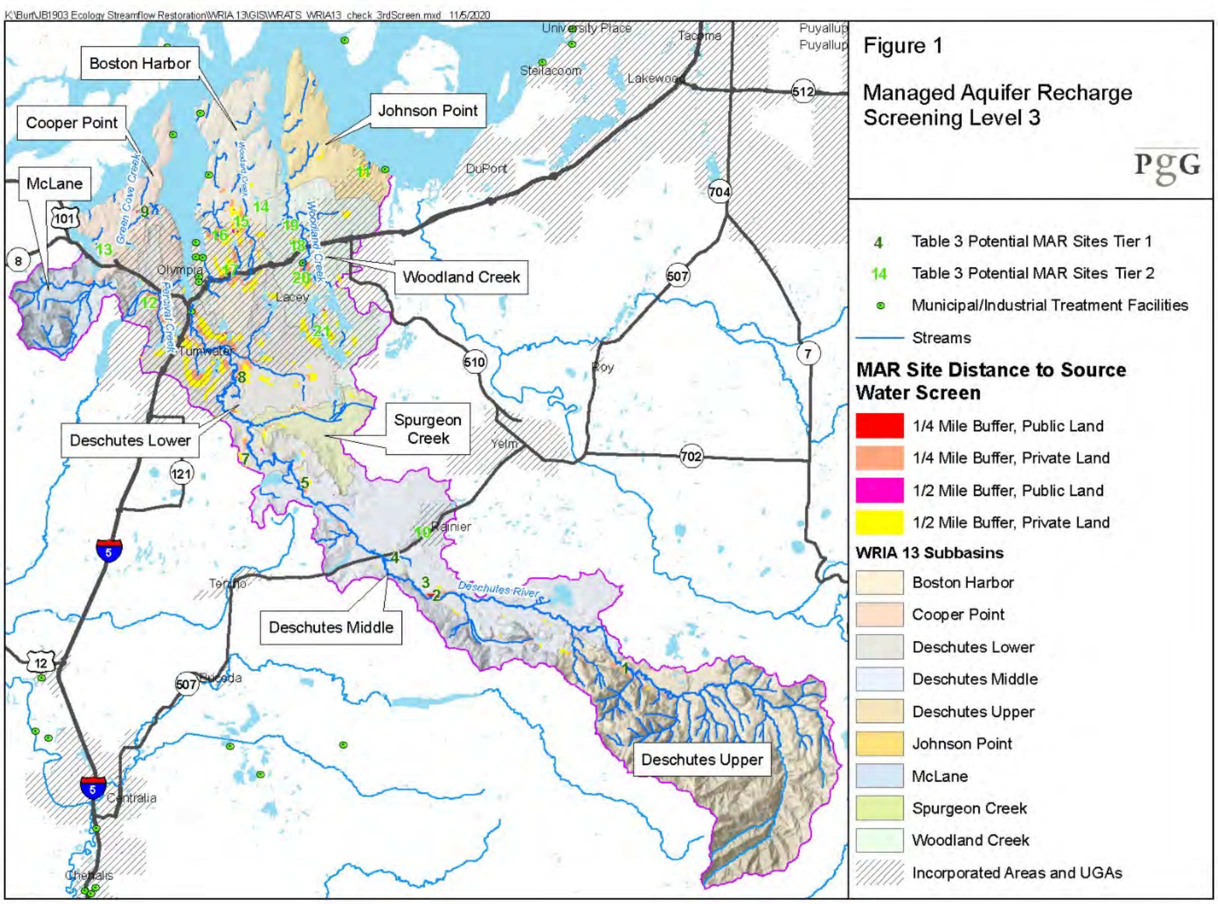

Figure 1. Areas favorable for MAR locations and potential MAR sites.

Table 1. Potential managed aquifer recharge locations.

Tier	Site #	Subbasin	Location	Source Stream
1	1	Deschutes Upper	South of Clear Lake	Deschutes River
1	2	Deschutes Middle	Rainier View Park	Deschutes River
1	3	Deschutes Middle	North of Rainier View Park	Deschutes River
1	4	Deschutes Middle	Route 507, SW of Raymond	Deschutes River
1	5	Deschutes Middle	East of Offut Lake	Deschutes River
1	6	Deschutes Lower	Thurston County Roads Gravel Pit, Waldrick Rd SE	Deschutes River
1	7	Deschutes Lower	Middle Deschutes Property	Deschutes River
1	8	Deschutes Lower	Alpine Sand and Gravel, Rixie Road	Deschutes River
1	9	Cooper Point	Cooper Point	Green Cove Creek
2	12	Deschutes Lower	Lower Percival Creek, SPSCC	Percival Creek
2	14	Boston Harbor	Former borrow pit	Woodard Creek
2	15	Boston Harbor	Private	Woodard Creek
2	16	Boston Harbor	Mission creek	Mission creek
2	17	Boston Harbor	Near 4th Avenue E and Interstate 5	Indian Creek
2	18	Woodland Creek	Property with kettle pond on 15th Avenue NE	Woodland Creek
2	19	Woodland Creek	Near Pleasant Glade Road	Woodland Creek
2	20	Woodland Creek	Near Dept. of Ecology Headquarters	Woodland Creek

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.

Source Water Availability and MAR Facility Sizing

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 and the number of days when flows may be diverted were determine in two different ways, depending on whether the stream has minimum instream flows or not.

Diversion flows were proposed based on maintaining minimum instream flows and habitat forming processes (i.e. ecological flows). Diversion flows in streams and rivers with minimum instream flows (i.e. the Deschutes River) were set at 2 percent of wet season (November – April) minimum flows (e.g. 2% of 400 cfs equals 8 cfs for the Deschutes River). 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. These "diversion days" were summed across the wet season (November – April) for each water year in the flow record. The average and minimum number of diversion days were calculated across all water years in the flow record.

When a stream or river does not have minimum instream flows, the 75th percentile flows for each month across the entire flow period of record was calculated. Diversion flows were proposed based on 2% of the average 75% percentile flows during November – April. Diversion of flow to an MAR facility could occur during days when flows exceed 75th percentile flows. Flows would exceed 75% percentile flows 25% of the time (i.e. 45 days during the November – April wet season).

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.

Deschutes Upper and Middle

Water availability in the upper to middle Deschutes may be approximated by flows the USGS 12079000 gage near Rainier, WA (Figure 2). The Deschutes River is closed to consumptive appropriations between April 15 – October 15 (Chapter 173-513 WAC). From October 16 – April 14, there are variable minimum flows, with the greatest minimum flow of 400 cfs, as measured at the downstream control point, the USGS 12080010 gage at Tumwater, WA.

The capacity and appropriateness of potential MAR projects in the Upper and Middle Deschutes should be guided by local flows, but the maximum quantity of potential MAR diversion flows is based on meeting minimum instream flows at the downstream control point, the USGS 12080010 gage at Tumwater, WA (see Deschutes Lower Section).

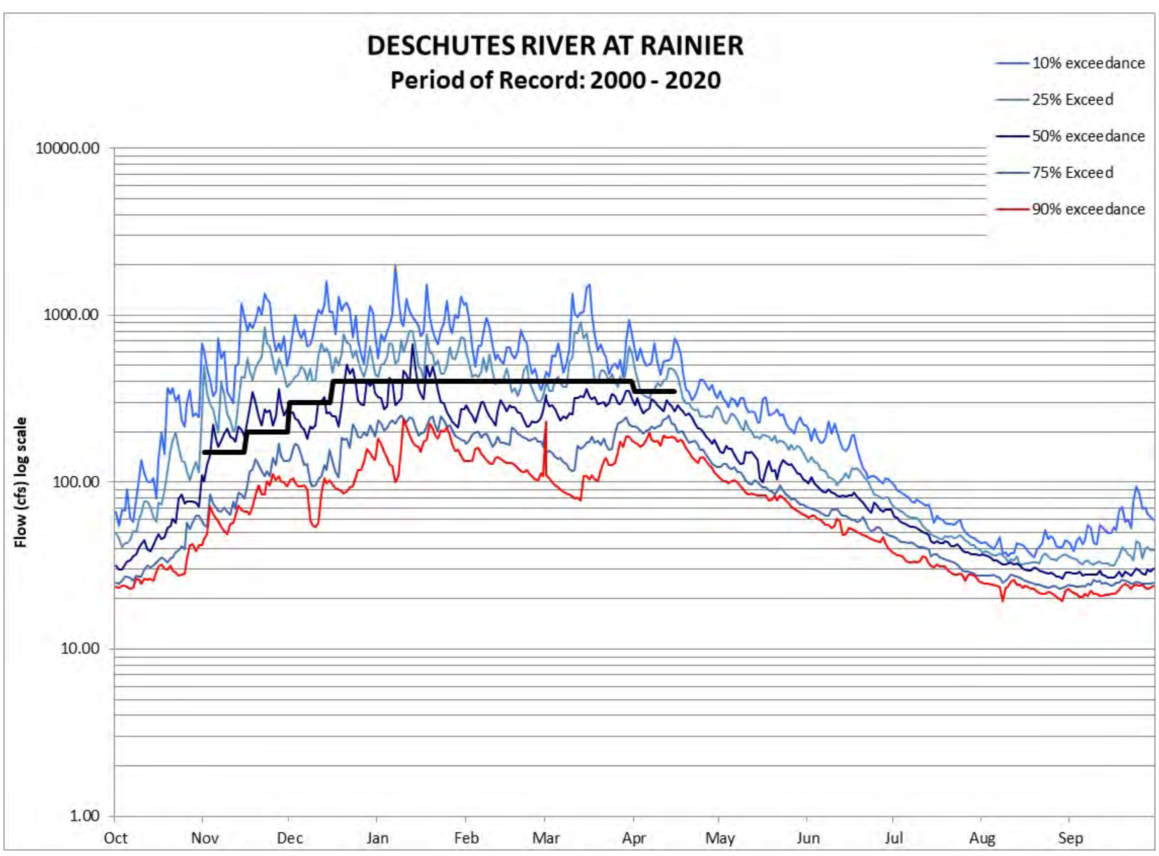

Figure 2. Deschutes River at Rainier (USGS Station 12079000) daily flow exceedances, from 2000 – 2020.

Deschutes Lower

Water availability in the Lower Deschutes may be approximated by flows the USGS 12080010 gage at Tumwater, WA (Figure 3). The Deschutes River is closed to consumptive appropriations between April 15 – October 15 (Chapter 173-513 WAC). From October 16 – April 14, there are variable minimum flows, with the greatest minimum flow of 400 cfs.

Potential diversion flows for the Deschutes River is two percent of maximum wet season minimum flows (400 cfs), or approximately 8 cfs. Potential diversion days range from 50 – 108 days per year (Table 2). Diverting 8 cfs for 50 – 108 days, would equal 792 – 1,712 afy of water diverted and infiltrated for subsequent seepage into the river throughout the year. These flows could be diverted and conveyed to one or more MAR facilities. A scenario of splitting the 8 cfs among four MAR sites is depicted in Table 5.

In the Lower Deschutes subbasin, a potential MAR location was also identified near Percival Creek (Figure 1; Table 1). Percival Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 11 - 15 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs (Table 5). The diversion period is likely around 45 days per year. This would result in an offset of around 18 afy (Table 5).

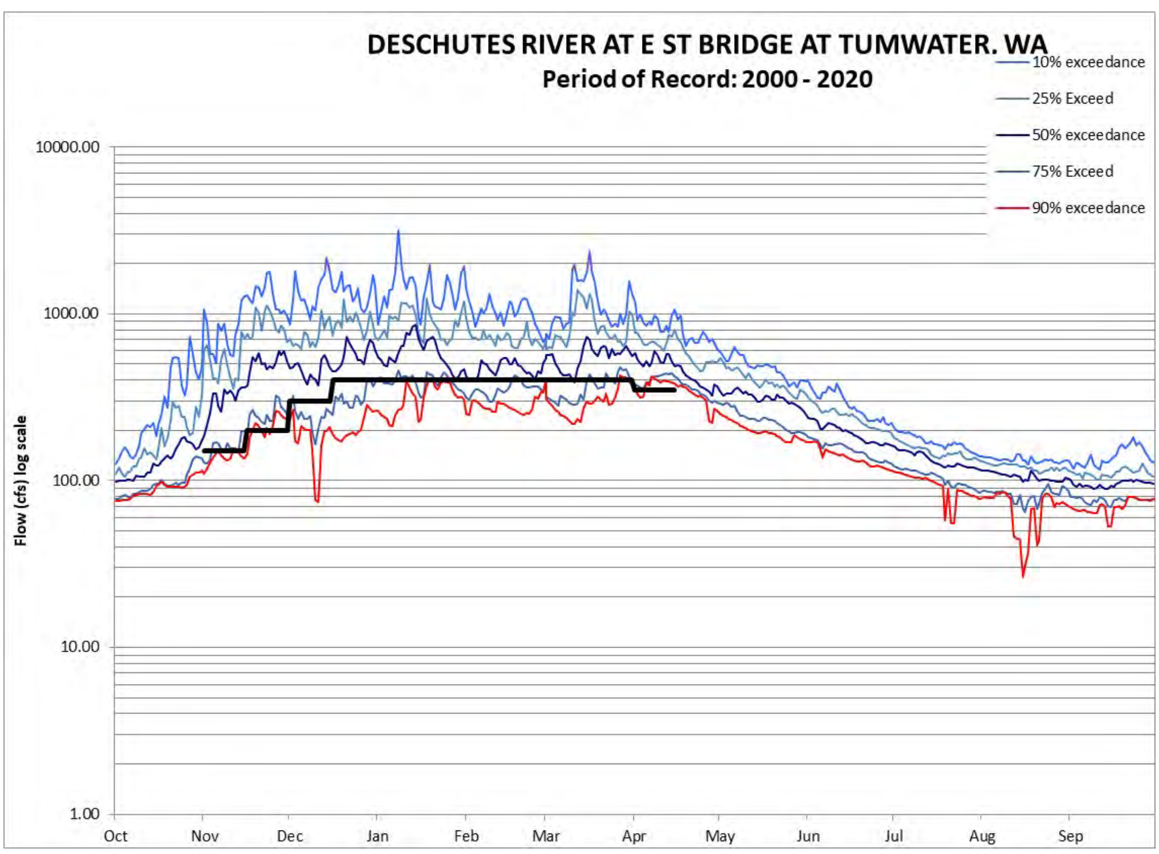

Figure 3. Deschutes River at Tumwater (USGS Station XXX) daily flow exceedances, from 2000 – 2020.

Table 2. Number of days when flows are at least five percent greater than minimum flows during the wet season (November – April). Deschutes River At E St Bridge at Tumwater, WA (USGS 12080010).

Month	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
January	25	0	31	17	21	8	31	29	25	25	26	29	22	20	11	22	31	12	31	16	30
February	27	2	28	16	20	0	21	13	22	1	10	11	29	15	19	12	27	24	26	13	21
March	30	0	29	24	6	5	0	31	25	16	9	31	31	24	31	17	31	31	20	3	2
April	6	3	9	15	0	15	0	15	15	15	15	15	15	12	14	15	15	15	10	9	6
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	6	22	1	15	17	26	27	19	22	30	30	26	30	29	30	30	30	26	19	0	7
December	2	31	10	26	10	13	31	30	4	13	31	8	29	7	24	30	29	21	22	9	0
Sum	**96**	**58**	**108**	**113**	**74**	**67**	**110**	**137**	**113**	**100**	**121**	**120**	**156**	**107**	**129**	**126**	**163**	**129**	**128**	**50**	**66**
Min	**50**																				
Avg	**108**																				

Cooper Point

In the Cooper Point subbasin, a potential MAR location was identified near Green Cove Creek (Figure 1; Table 1). Green Cove Creek does not have any instream flow closures or minimum flows (Chapter 173-513 WAC). Measured flows near the potential MAR location are near zero in the summer and range from 7 – 11 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs (Table 5). The diversion period is likely around 45 days per year. This would result in an offset of around 18 afy (Table 5).

Boston Harbor

In the Boston Harbor subbasin, potential MAR locations were identified near Woodard Creek (Figure 1; Table 1). Woodard Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 – 17 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs (Table 4). The diversion period is likely around 45 days per year. This would result in an offset of around 18 afy (Table 5).

Potential MAR locations were also identified near Mission Creek and Indian Creek (Figure 1; Table 1). However, flow in these streams are very small during all seasons (Table 3) and also have very little value for anadromous salmonids. Therefore, diverting water from these streams for MAR infiltration may not be feasible.

Woodland Creek

In the Woodland Creek subbasin, potential MAR locations were identified near Woodland Creek (Figure 1; Table 1). Woodland Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 – 17 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.7 cfs diversion when flows exceed 48 cfs (Table 4). The diversion period is likely around 45 days per year. This would result in an offset of around 62 afy (Table 5).

If fully implemented, the total quantity of water potentially diverted and infiltrated at MAR sites in WRIA 13 range from 909 – 1,830 afy (Table 5).

Table 3. Average measured monthly flow at Green Cove, Indian, Mission, Percival, Woodard, and Woodland Creeks.

Month	Green Cove Creek @ 36th Avenue NW	Indian Creek Mouth @ Quince Street SE	Mission Creek @ Boston Harbor Road	Percival Creek @ Pedestrian Footbridge	Woodard Creek @ 36th Ave NE	Woodland Creek @ Pleasant Glade Road	Woodland Creek @ Desmond Drive Ecology HQ
January	10.9	6.0	2.2	11.8	13.9	44.8	12.8
February	7.2	5.2	1.2	15.1	12.9	45.7	9.4
March	10.1	7.1	1.6	11.9	16.6	51.2	8.0
April	4.7	3.3	0.8	9.0	12.7	44.3	17.9
May	2.5	2.9	0.6	8.7	10.0	34.1	8.6
June	1.0	2.0	0.4	6.7	7.3	24.4	4.1
July	0.3	1.4	0.5	3.3	5.4	17.8	2.0
August	0.2	1.2	0.3	2.7	4.4	14.6	1.4
September	0.6	1.1	0.3	3.3	4.7	14.3	0.5
October	2.1	2.4	0.9	6.4	6.2	16.0	0.1
November	7.6	4.5	0.4	14.1	10.2	24.5	1.0
December	11.2	5.8	1.9	11.6	12.4	35.3	5.5

Table 4. Seventy-Fifth percentile of monthly flows during the period of record at Green Cove, Woodland, and Woodard Creek and monthly average flows for Percival Creek.

Month	**Green Cove Creek at Bulter Cove FS**	**Woodland Creek at Pleasant Glade Rd.**	**Woodard Creek at 36th Ave NE**	**Percival Creek at SPSCC**
Period of Record	2009 - 2020	2008 - 2020	2008 - 2020	2009 - 2015
January	15.9	51.9	14.9	11.8
February	9.0	52.3	14.9	15.1
March	12.4	56.7	18.7	11.9
April	5.5	53.8	14.7	9.0
May	3.1	40.8	11.1	8.7
June	1.8	28.6	8.2	6.7
July	0.6	21.1	6.0	3.3
August	0.2	16.2	4.4	2.7
September	0.3	16.3	4.7	3.3
October	1.5	19.1	5.8	6.4

November	8.1	30.8	10.8	14.1
December	11.6	44.3	13.8	11.6
Average	**10.4**	**48.3**	**14.6**	**12.3**
Diversion	**0.2**	**0.7**	**0.2**	**0.2**
Diversion Days	**45**	**45**	**45**	**45**

Table 5. Potential MAR site locations, facility sizes, and water offsets.

Subbasin	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)
Deschutes Upper	Deschutes River	South of Clear Lake	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	Rainier View Park	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	North of Rainier View Park	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	Route 507, SW of Raymond	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	East of Offut Lake	Reserve		Reserve			Reserve		
Deschutes Lower	Deschutes River	TC Roads Gravel Pit, Waldrick Rd SE	Reserve		Reserve			Reserve		
Deschutes Lower	Deschutes River	Middle Deschutes Property	Reserve		Reserve			Reserve		
Deschutes Lower	Deschutes River	Alpine Sand and Gravel, Rixie Road	Reserve		Reserve			Reserve		
Cooper Point	Green Cove Creek	Cooper Point	1,240	0.2	45	777,600	18	45	777,600	18
Deschutes Lower	Percival Creek	Lower Percival Creek, SPSCC	1,240	0.2	45	777,600	18	45	777,600	18

Boston Harbor	Woodard Creek	Former borrow pit	1,240	0.2	45	777,600	18	45	777,600	18
Boston Harbor	Woodard Creek	Private	Reserve		Reserve			Reserve		
Boston Harbor	Mission creek	Mission creek	Inadequate Flow		Inadequate Flow			Inadequate Flow		
Boston Harbor	Indian Creek	Near 4th Avenue E and Interstate 5	Inadequate Flow		Inadequate Flow			Inadequate Flow		
Woodland Creek	Woodland Creek	Property with kettle pond on 15th Avenue NE		0.7	45	2,721,600	62	45	2,721,600	62
Woodland Creek	Woodland Creek	Near Pleasant Glade Road	Reserve		Reserve			Reserve		
Woodland Creek	Woodland Creek	Near Dept. of Ecology Headquarters	Reserve		Reserve			Reserve		
						Total	909		Total	1,830

Diversion

Capture and recovery methods would vary by water source but would likely 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 13 Committee acknowledges that some diversion methods including in-channel structures may pose an impact to fish habitat, and strongly advocates 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 13 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.

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.

Thurston County will likely support and implement these projects, with potential support from other partners and an implementation group.

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 811 AFY estimated as potential offset for WRIA 13 (does not include streams closed year-round this would equate to ~$2.8 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 has indicated that they will take a lead role in implementing these projects. However, other project partners and sponsors may occur and would benefit implementation.

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

Favorable MAR Areas and Potential Locations

Technical Memorandum

To: Department of Ecology WRIA 13 Watershed Restoration and Enhancement Committee

From: Glenn Mutti-Driscoll, LHG Pacific Groundwater Group

Re: 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 Water Resources Inventory Area (WRIA) 13, Deschutes. MAR project sites potentially can support watershed restoration and enhancement projects within the WRIA. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 13 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 13, PGG used regional data to assist the Committee in selecting properties within WRIA 13 that appear to have favorable infiltration characteristics and a close enough proximity to water so that MAR may occur. MAR projects could potentially offset the impacts of permit exempt wells on WRIA 13 streams. This memorandum outlines the methodology used to identify potentially favorable MAR project sites.

PROCEDURE

Regional soils, geologic, and hydrologic data coverages were compiled for WRIA 13 using Geographic Information System (GIS) software. A series of screening criteria were then applied to identify sites that appear most favorable.

Screening Level 1- Soils and Surficial Geology

The initial screen focused on areas where regionally mapped soil and geologic units appear favorable for infiltration. The following criteria were applied:

- Soils types mapped on the County level by NRCS (Pringle, 1990) were reviewed and only soils in hydrologic groups A and B where all layers within the mapped soil type had a permeability greater than or equal to 2 inches per hour were retained as favorable for infiltration. **Table 1** lists these soils.

- 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. 1:24,000 geologic maps by the Washington State Department of Natural Resources (DNR) exist for most of WRIA 13 (including Logan and others (2003); Logan and others (2009); Walsh and others (2003); and Walsh and others (2005)), in areas of the upper watershed where 1:24,000 geologic mapping does not exist a regional 1:100,000 map by DNR was used (Schasse, 1987). **Table 2** lists geologic units identified as favorable for MAR.
- Wetlands, lakes, and high groundwater areas as mapped by Thurston County were excluded from favorable infiltration areas.

Areas that meet the Level 1 screening criteria are shown in **Figure 1**.

Screening Level 2 – Depth and Thickness of Aquifer

The second screen focused on removing areas with potentially shallow groundwater or a thin aquifer that may prevent it from transmitting infiltrated water away from a MAR facility. Thurston County provided output from its county-wide groundwater flow model[79] for use in assessing the water-table depth and the surficial aquifer saturated thickness. No regional-scale piezometric surface map exists for the surficial aquifer, and therefore output from Thurston County's groundwater model is considered the best available data source[80]. The following screening criteria were applied to areas identified as having favorable infiltration characteristics from the first level screen:

- A depth-to-water in the surficial aquifer of eight feet or greater was assumed necessary for MAR to be feasible. This depth was selected to allow a groundwater mound of at least five to develop under an infiltration trench or basin, with the uppermost three feet assumed necessary for basin/trench construction and to provide a vadose zone between the base of the infiltration facility and the top of the groundwater mound. This assumed eight foot depth-to-water screening value is somewhat arbitrary (in actuality groundwater mounding beneath a MAR site will be dependent on local soil and aquifer permeabilities), but was applied to screen out areas having marginal vadose zone thickness that most likely could not support long-term concentrated infiltration.
- A surficial aquifer saturated thickness of 10 feet or greater was assumed necessary for MAR to be feasible. The surficial aquifer saturated thickness was calculated using layer thicknesses and

[79] Head data from groundwater flow model version 186 and layer thicknesses from model version 169 were used for this analysis. It should be noted that Thurston County's groundwater flow model continues to be locally improved and calibrated, therefore water level and aquifer thickness values applied for this analysis may differ from values obtained from a later version of the model.

[80] Though the Thurston County groundwater model is the best available data source for county-wide water level data, considerable uncertainty is present in modeled shallow aquifer water levels due to limited calibration data (most water supply wells are installed in deeper aquifers than the water table aquifer).

simulated water table elevations from the Thurston County groundwater flow model. Generally the surficial aquifer saturated thickness equaled the saturated thickness of model Layer 1 (representing Vashon recessional outwash or alluvium), but in areas where the Layer 2 aquitard (Vashon till) was absent, the saturated thickness was calculated using the combined saturated thickness of model Layers 1, 2, and 3 (including representation of Vashon advance outwash). The 10-foot saturated thickness screening criteria applied is also somewhat arbitrary (local hydraulic conductivity values will have a significant impact on aquifer transmissivity), but is intended to remove areas where the aquifer transmissivity may be too low efficiently transmit infiltrated water away from the MAR facility.

Areas that meet the Level 2 screening criteria are shown in **Figure 2**.

Screening Level 3- Distance to Potential Source Water

The third screen focused on identifying areas in close proximity to potential MAR source waters. The following screening criteria were applied to areas identified as having favorable infiltration characteristics from the second level screen:

- Favorable MAR areas were defined as those within ¼ and ½ mile from a potential source water.
- Locations within ¼ and ½ mile from a potential source waters were subdivided into publicly or land-trust owned lands and privately owned lands. Public and land-trust lands potentially are more likely to be developed into MAR sites based on the conservation goals of those entities, and therefore were specifically identified where applicable.
- Potential source water locations included streams and municipal or industrial wastewater treatment plants (WWTPs). In addition to envisioned MAR approaches for stream and water treatment plant source waters, other potential source waters and guiding concepts were considered but not analyzed, as listed below.
    - For stream sources MAR would occur in the wet season (roughly November to mid-April) when instream flow requirements are met on the Deschutes River and its tributaries. Optimally, stream water recharged in the wet season would return to the stream during periods of water scarcity (e.g. summer and fall). Both distance-to-stream and aquifer properties control the timing for seasonal recharge to reach targeted streams.
    - For WWTP sources, treated effluent would be used for infiltration. In practice no potentially favorable sites reliant on treated water were identified, but if a site is identified in the future, a site-specific review of effluent and aquifer water quality criteria would be necessary.
    - Existing and planned reclaimed water pipelines were not included in this analysis as LOTT is not currently producing excess reclaimed water. However, changes in reclaimed water production, demand, and the construction of future conveyance pipelines could make reclaimed water be a more viable MAR source water in the future.

- Stormwater was not included in this analysis as no potential future projects were identified in the areas of interest by the Committee. However, this does not preclude runoff generated from future stormwater projects being used as a source water in areas with favorable soils and geology.
- Source water from wells pumping deeper aquifers was not considered as part of this analysis because water right acquisition would likely be required.
- A MAR approach that was not investigated but could be pursued in the future for glacial till areas is the injection of water through wells into the underlying Vashon advance outwash, which has significantly higher permeability than glacial till. Underground Injection Control regulations and source water quality criteria would need close review as part of this analysis.

Areas meeting the Level 3 screening criteria are shown in **Figure 3**. PGG also identified potential Tier 1 MAR sites based on the above screening criteria along with consideration of land ownership, property size, and relative net ecological benefit (NEB). Potential Tier 1 MAR sites are numbered on **Figure 3** and listed in **Table 3. Table 3** notes whether target receiving streams are salmon-bearing, if gopher soils are present on the site, associated flow restriction periods for the source water, and other relevant observations.

Figure 3 and **Table 3** also identify potential Tier 2 MAR sites. Tier 2 sites are either located farther than ½ mile from a stream or WWTP or are near a source water closed to further appropriation. The relative NEB for these sites will vary from relatively low (for sites located far from streams) to very high (for sites located by streams closed to further appropriation). At the Committee's request PGG reviewed the Deschutes Middle, Johnson Point, Cooper Point, Boston Harbor, and Woodland Creek subbasins to identify potential Tier 2 MAR sites. MAR at Tier 2 sites likely could occur with the identification of other non-stream/WWTP source waters. Tier 2 MAR sites are good potential candidates for future stormwater infiltration projects.

FUTURE STEPS

Site specific feasibility analyses for Tier 1 properties listed on **Table 3** should be pursued, and possibly for Tier 2 sites as well. Initial feasibility considerations will include 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.

Sites listed on **Table 3** are specific properties that have been identified as likely having favorable MAR characteristics. It is likely that favorable MAR sites exist elsewhere in WRIA 13 but were not identified in this analysis based on the regional nature of the available data and the focus of surficial infiltration (and not subsurface injection). Though **Figure 3** is the best approximation of favorable surficial infiltration MAR sites in WRIA 13 using available data, the lack of local water level and geologic data most likely has caused areas with favorable MAR characteristics to not be identified. The set of regional screening maps (**Figures 1 – 3**) can and should be used for the future evaluation of properties, but results from any local or site specific hydrogeologic studies should generally be deferred to over the findings of this regional inventory. Local soil or geologic heterogeneities are generally not reflected in regional data sets, and observed depth to groundwater data will be more accurate than the regionally modeled depths used for this analysis. PGG (2019) presents a more localized infiltration analysis based on observed water levels in portions of the Deschutes Lower and Deschutes Middle subbasins that should also be referred to if future identified sites are within the report study area.

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Schneider's Prairie Off-Channel Storage-and-Release

(Thurston County ID 122)

PROJECT DESCRIPTION

Description

The Schneider's Prairie Off-Channel Storage-and-Release Project (Project) is located on the east (right) bank of the Deschutes River, west of the Keanland Park Lane SE, in north-central Thurston County (Figure 1), Deschutes River (Mainstem Lower) draft management unit. The Project includes Ayers Spring/Pond and Ayer Creek within Schneider's Prairie (Figure 2).

This project will restore hydrologic connectivity between the Deschutes River and Schneider's Prairie. Schneider's Prairie is a depressional feature that contains the Ayer Creek drainage. Paleochannels apparent from aerial photos and LiDAR images show that multiple channels historically connected the Deschutes River with Schneider's Prairie. Reconnecting the Deschutes River with Schneider's Prairie and Ayer Creek would provide rearing habitat and flood refugia for juvenile salmonids, stormflow attenuation, and water infiltration for later-season release to augment flow in the lower Deschutes River.

The project concept is to deepen an existing floodplain paleochannel that would hydrologically connect the Deschutes River to Schneider's Prairie (Figure 2). Schneider's Prairie contains Ayers Pond and Ayers Creek. The deepened paleochannel would be connected to the existing Ayers Creek that runs north and back to the Deschutes River. The paleochannel and Ayers Creek would be roughened with large woody debris (LWD) and beaver dams (analogs and beaver introduction) to flood adjacent floodplain habitat and pond creek flow. Ayers Creek would be realigned with a meander pattern (correcting historical ditching). Ayers Creek would be modified near the mouth using biotechnical techniques (e.g. buried logs and log jams) to maintain grade control at an elevation that would inundate a portion of the off-channel area during high flow events (152 ft NAVD88). The seasonal inundation would result in infiltration and subsequent seepage back to the river on the time scale of days to months.

The existing paleochannel will be deepened to convey water from the Deschutes River to Ayers Creek, within the off-channel feature. The connection point of the paleochannel to the Deschutes River will be through an abandoned oxbow that fills with river water from the downstream end during moderate and high flows. Connecting the paleochannel to the Deschutes River through the oxbow is expected to provide a stable, low-energy connection to the river, and it appears that the paleochannel naturally connects there. The deepened paleochannel could have an invert elevation of 155 ft (NAVD88) that would convey water from the river to the off-channel feature when Deschutes River flows are above 400 cfs. In this design scenario, when the river is flowing above 400 cfs, the channel would begin conveying water to the off-channel feature.

Schneider's Prairie is a broad depressional off-channel feature that contains an extensive wetland, including Ayers Springs and Ayers Creek. Diverted floodwaters would inundate about 52 acres of this feature, below an elevation of 152 ft (NAVD 88 datum), frequently during the months of November – April, and infrequently during the shoulder months of May, June, September, and October. Ponded water will infiltrate and seep back into the Deschutes River over time.

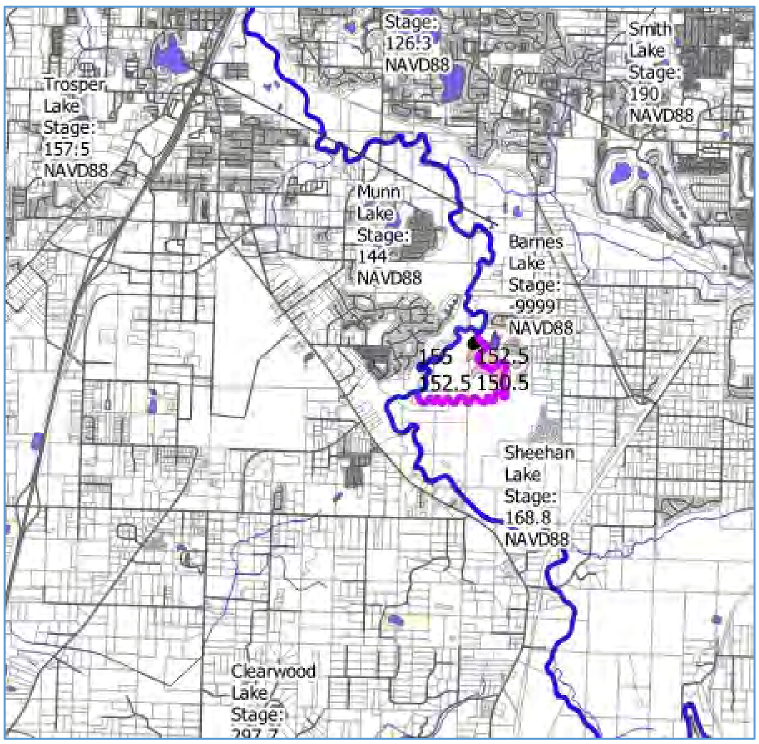

Figure 1. Site Location

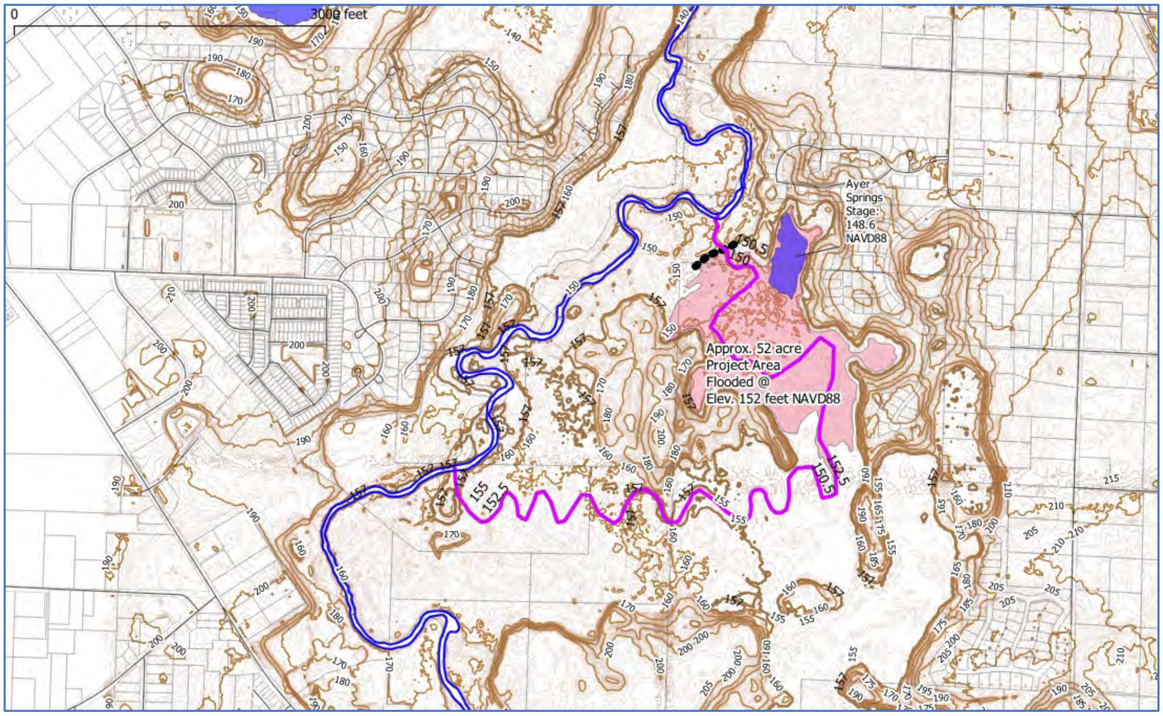

Figure 2. Project Area showing conceptual off-channel storage area and new stream channel.

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

Water offset benefits were calculated by estimating inlet flows into the Schneider's Prairie off-channel feature, inundation extent and depth, and seepage back to the Deschutes River.

Inflows from the Deschutes River to the Schneider's Prairie off-channel area were estimated on a cumulative monthly basis during November – April season (Table 1). Monthly inflows were developed based on assumed inlet channel geometry, daily river flow values river at the USGS E Street Gage in Tumwater, WA (USGS Gage 12080010) and corresponding river elevations derived from the HEC-RAS hydrologic model developed by FEMA for the Deschutes River. Only River flow values greater than 400 cfs caused inflows into the Schneider's Prairie off-channel area, and inflows were restricted to the November – April season.

The inlet channel was added to the existing HEC-RAS model using a standard channel geometry. The surface of the banks and floodplain were built from LiDAR data. Using the 2011 LiDAR terrain contours, a storage area of about 52 acres was considered practical for seasonal inundation – see flooded area polygon (Figure 2). Water depths of 1 to 3 feet were considered potentially obtainable using either surface roughness (natural) or a low dike to retain water, at an elevation of 152 (NAVD88 datum). Modifications to the mouth of Ayers Creek with grade control at 152 feet may be required but would require fish passage for both adult and juvenile salmonids.

Inflows from the Deschutes River were compared to the maximum infiltration capacity of the off-channel area (i.e. 52 acres). Maximum infiltration capacity was estimated using Darcy's Law calculations. The smaller of the two values were used as an assumed infiltration quantity (Table 1). River inflows that exceeded the infiltration capacity were assumed to be retained as ponded water in the Schneider's Prairie feature. This retained inflow volume was assumed to infiltrate during the late spring, when river inflows were no longer occurring.

These monthly infiltration quantities were used to model streamflow benefits (i.e. seepage back to the Deschutes River) over time. Seepage was modeled using STRMDPLT08. Seepage back to the Deschutes River increases over time, because of the cumulative effect of infiltrating additional water. This cumulative increase reaches an asymptote (i.e. additional benefits are minimal) after about 50 years of infiltration (Table 2). Seepage back to river does not change substantially with season, but slightly more seepage occurs during the May – October period, relative to the November – April period. Streamflow benefits during the May – October period are predicted to be 285, 681, 958, and 1,310 acre-feet per year during the first, fifth, tenth, and fiftieth year of infiltration, respectively.

Table 1. Maximum Infiltration and Diversion quantities.

Month	Monthly Deschutes River Inflow (acre-ft)	Maximum Monthly Volume Capacity (acre-ft)	Uninfiltrated Water Remaining (acre-ft)	Remaining Water Infiltrated (Acre-ft)	Monthly Volume Infiltrated (acre-ft)
January	717	435	282		435
February	568	393	175		393
March	505	435	70		435
April	229	421	0	192	421
May	0	435	0	435	435
June	0	421	0	175	175
July	0	435	0		0
August	0	435	0		0
September	0	421	0		0
October	0	435	0		0
November	415	421	0		415
December	709	435	274		435
Total Annual	**3,143**	**4,683**	**802**	**802**	**3,143**

Table 2. Modeled streamflow benefits over time.

Modeled Benefit by Year After Project Start	Total Water Year Benefit acre-feet	Percent of Diversion	May - October Benefit (acre-ft)	Percent of Diversion
Year 1	316	10%	285	9%
Year 5	1,235	39%	681	22%
Year 10	1,824	58%	958	30%
Year 50	2,537	81%	1,310	42%

Notes:

Transmissivity = 1,400 ft^2/d

Streambed Conductance = 1 ft/d

Wetlands Hydraulic Conductivity = 0.20 ft/day

Total Annual Diversion Applied to Groundwater Recharge = 3,143 acre-feet

The attenuation of these high river flows to increased and steady seepage back to the river will increase flow between flooding events, benefitting fish and overall ecological function. Increased base flow during the summer will increase usable aquatic habitat for fish and would also reduce temperatures and effects of euthrophication on dissolved oxygen and pH.

Finally, off-channel fish habitat will be created in the paleochannel and in the inundated floodplain area in Schneider's Prairie. The inlet and outlet will be designed to be low energy with fish cover and habitat complexity. The inlet and outlet channels will allow for fish ingress and egress. It is expected that this would likely improve habitat for Coho salmon and numerous other species, as well as capturing silt and nutrients. Habitat and water offsets may be improved by increasing channel roughness. For example, beaver habitat/ponding, woody structures in the channels/floodplain, or mature forest land cover would slow down and spread out flow entering and flowing through the off-channel feature. These elements would also increase habitat value for juvenile salmonid rearing.

Description of the anticipated spatial distribution of likely benefits

Streamflow benefits would occur in the Deschutes River adjacent to the Project area, to the confluence with Capital Lake. Off-channel rearing benefits would occur within the inlet channel, within the off-channel area, Ayers Creek, and in the Deschutes River, downstream of the confluence with Ayer Creek. The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.

In addition, Ayers Creek currently has TMDLs proposed by the USEPA for water temperature, dissolved oxygen, and pH. Surface water connectivity to the river and increased seepage during the critical period may improve water quality.

Uncertainties and Assumptions

The WRIA 13 Committee identified project uncertainties from the modeling analysis was not able to account for or where assumptions were made, including:

1. Evapotranspiration
2. Amount of infiltration
3. Climate change
4. Dropping flow trend of the Deschutes
5. Sediment issues in the Deschutes
6. Modeling assumptions including transmissivity of aquifer, and streambed conductance
7. Modeling represents average conditions, not dry year conditions

Performance goals and measures.

Streamflow and groundwater level monitoring may be required, subject to the refined concept, feasibility study, and design.

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

This Project would provide off-channel rearing habitat during the winter period, when the inlet channel and wetland area is inundated. This habitat would primarily benefit coho salmon. Seepage back to the Deschutes River during the summer and early fall would benefit all fish species by providing cool water and increasing flows.

Identification of anticipated support and barriers to completion.

Capitol Land Trust owns part of the project area. Other water offset and habitat protection projects have been envisioned nearby, including Allen Creek Restoration Project (Habitat Work Schedule project ID 12-1109) by Wild Fish Conservancy but encountered land development pressures. This project would be an element of a larger "Floodplains by Design" grant proposal and concept design.

This area is already under consideration by other entities water, protection and habitat improvement projects. Capitol Land Trust owns part of the project area. The WRIA 13 Salmon Lead Entity is organizing potential partners for a larger Deschutes River project encompassing this area. Because of these efforts, this water offset project is best conceived as one component of the larger effort to protect this part of the lower Deschutes River, an area of substantial ecological and hydrologic value.

Potential budget and O&M costs.

Potential (Class V, order of magnitude) capital costs, including design, permitting, property acquisition, and construction, are approximately $5,000,000.

Anticipated durability and resiliency.

The project would require regular operation and maintenance.

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

Thurston County and WRIA 13 implementation partners

Sources of Information

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

Small-scale LID Project Development/Implementation for WRIA 13

Sponsor: Thurston Conservation District

Problem:

In undeveloped landscapes, most rainfall typically soaks into the ground, recharging shallow groundwater. As development occurs, stormwater runoff is generated in areas where compacted soils, impervious roofs, driveways and parking lots concentrate surface flow that can no longer infiltrate into the ground. These impervious surfaces concentrate rainfall and it often flows as stormwater runoff into conveyance systems, whether roadside ditches or buried pipes. Recent adoption of Low Impact Development (LID) practices for new development begins to address this issue. However, in all urbanized areas of WRIA 13 a significant legacy of conventional development continues to generate large volumes of runoff flowing untreated into stormwater systems, and this water ends up in treatment facilities or is discharged – untreated - into local streams and into Puget Sound.

Project Description/Solution: By strategically concentrating small-scale LID retrofit work in urbanized settings and by partnering with residential and commercial community members to redirect runoff away from stormwater conveyance systems and into green stormwater infiltration facilities, this work will help to conserve in-stream flow. In rural settings, efforts can explore additional opportunities to slow and infiltrate stormwater runoff that would otherwise rapidly discharge into nearby waterways.

Thurston Conservation District will work with partners to identify and implement retrofit projects to benefit groundwater recharge. Creative partnerships with local jurisdictions could result in incentive programs and a focus on areas of interest that will benefit stormwater programs as well as in-stream flow. Given short-term uncertainties about project development and measurable benefits, small-scale LID retrofit projects won't be counted towards initial offsets in the plan. However, long-term benefits will be quantified and tracked as projects are developed and implemented in regions with appropriate soils, willing partners, and waterways that can benefit from this work. The use of small-scale LID retrofit projects is an important tool to integrate into long-term planning for in-stream flow preservation. Construction of numerous, clustered infiltration facilities including rain gardens and biofiltration swales will eventually result in a measurable impact and benefit.

Project Benefits: Infiltrating stormwater runoff into strategic, well-planned and concentrated clusters of LID retrofit projects offers an important opportunity to recharge shallow groundwater in areas where MARs or other large-scale projects are unlikely or infeasible. Small-scale LID retrofits can also (importantly) directly engage residential and commercial partners to contribute to in-stream flow preservation. This work will also immediately benefit water quality in nearby streams, which would otherwise receive untreated runoff and continue to experience flashy flow events along with the input of concentrated pollution.

Spurgeon Creek Remeander Habitat Project

PROJECT DESCRIPTION

Description

Spurgeon Creek is the largest lowland tributary of the Deschutes River in Thurston County and is listed as high priority for restoration (SIT 2015). The South Puget Sound Salmon Enhancement Group (SPSSEG) is currently proposing to re-meander a ditched channel through the adjacent wet fields just south of a private driveway and north of and below the Fox Hill development (Figure 1). The proposed project is intended to improve water quality as well as salmonid, aquatic, and riparian habitat by increasing habitat area and floodplain activity. The project also has the potential to provide salmon viewing and educational opportunities to local residents and the public at large.

The goal of the project is to improve fish productivity and survival within Spurgeon Creek by enhancing the quality and quantity of instream habitat within the project reach. Habitat within Spurgeon Creek is currently impaired, particularly within the lower portion of the project reach, by lack of riparian vegetation and large woody debris, simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality.

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

The Spurgeon Creek restoration project is located near the head waters of Spurgeon Creek in Thurston County. At the project location, the creek is currently ditched through a field (Figure 1). The South Puget Sound Salmon Enhancement Group has been working with the landowners to recreate the natural stream sinuosity through a wetland. Additionally, wood structures would be added that offer refuge from predators and opportunities for salmon to feed, while the wetland offers slower water during high flow events. Native plants would be planted throughout the ¾-acre project area that will recruit wood and provide shade into the future.

Spurgeon Creek is the largest lowland tributary to the Deschutes River and a critical contributor of cold water. The proposed project is intended to improve water quality and increase salmon rearing habitat for juvenile Coho Salmon. Specifically, the project will designed to accomplish the following:

- Increase stream length by 1/8 miles.
- Restore 1/3 mile of creek.
- Increase instream shading by 20%.
- Increase instream complexity by adding Large Woody Debris (LWD).

- Increase community involvement.

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

Figures 1-2 show the location of the proposed project.

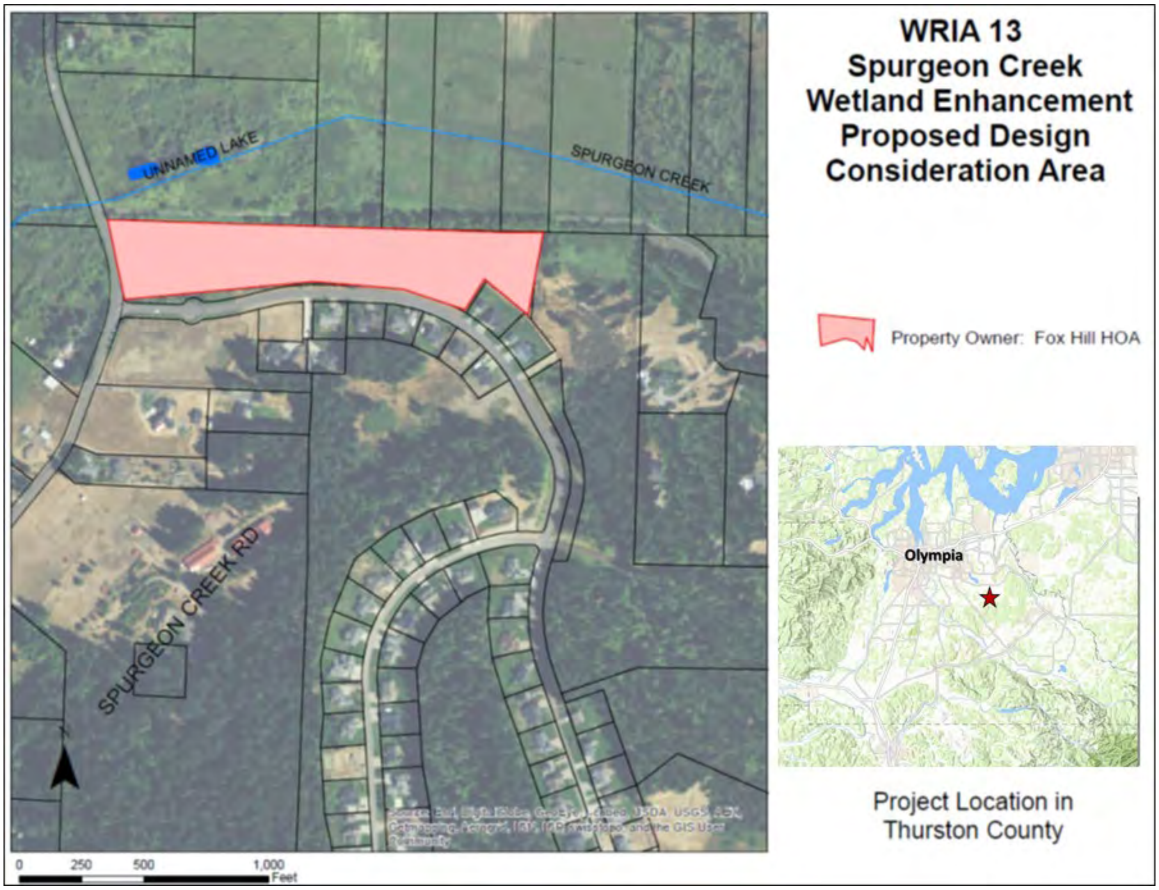

Figure 1. Location of proposed Spurgeon Creek remeander project in Thurston County.

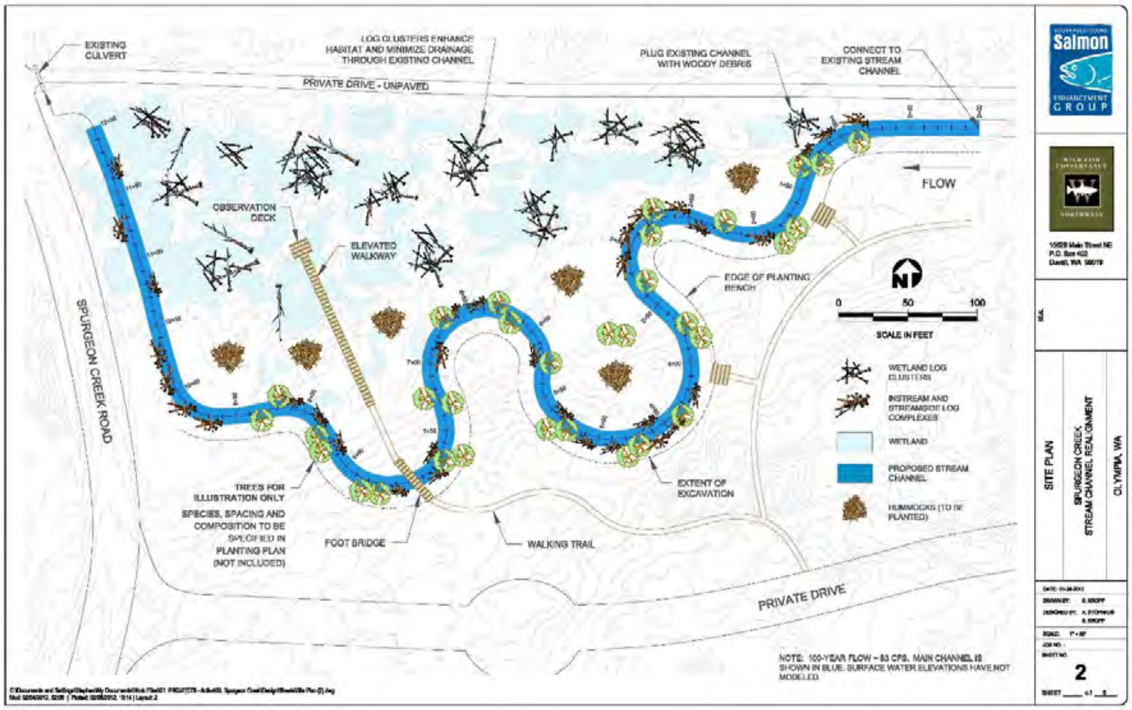

Figure 2. Conceptual drawing of Spurgeon Creek remeander project from 30% site plan (January 2012).

Description of the anticipated spatial distribution of likely benefits

The proposed project site is approximately ¾ of an acre. Within that footprint, Spurgeon Creek is expected to be increased by 1/8 miles, effectively restoring 1/3 of the creek. Water quality benefits will extend 2 miles downstream of the restoration site.

Performance goals and measures.

The performance goals are to increase stream length by 1/8 miles, restore 1/3 mile of creek, increase instream complexity by adding LWD, increase instream shading by 20%, and increase community involvement. Water quality benefits will extend 2 miles downstream of the restoration site.

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 and Fall Chinook are present in Spurgeon Creek and that Chum Salmon and winter steelhead have access to Spurgeon Creek (WDFW Salmonscape 2020). WDFW (2015) documents spawning in Spurgeon Creek and small areas in the lowermost reaches of a limited number of other middle and lower tributaries are shown as supporting spawning (WDFW 2002, cited in Anchor 2008). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook Salmon were historically present in Spurgeon Creek which is identified as an important tributary to the

Deschutes River (WDF 1975). Spurgeon Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

The portion of Spurgeon Creek proposed for restoration has the potential to provide rearing and foraging habitat for the aforementioned salmon and trout populations year round. Increased base streamflow, improved water quality, and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions (NOAA 2007).

Identification of anticipated support and barriers to completion.

The actions included in this project are recommended by the WRIA 13 Four-Year Work Plan and the Squaxin Island Tribe Natural Resources Deschutes Coho study (SIT 2015). This project has support from the Fox Hill Homeowners Association, the Washington Department of Fish and Wildlife, and the Squaxin Island Tribe. Spurgeon Creek is a high a priority for restoration based on the Deschutes River Coho Salmon Biological Recover Plan and would help address water temperature issues for protecting salmonid spawning and rearing.

The proposed project area lies in the transition between wetland soils and glacial till which may limit the ability to create and effectively sustain wetland habitat due to drainage issues. The soils present onsite are adequate for growing coniferous trees, but not for supporting wetland creation and enhancement (Winecka 2019). The project design envisions moving the creek out of its confined channel on the eastern extent of the HOA property, and re-engaging wetlands and expanding Coho rearing opportunities. However, property boundary issues, existing property disputes, and less than full support from neighboring, non-HOA parcels may limit the ability to move Spurgeon Creek out of its confined channel to recreate natural stream sinuosity (Walley 2019).

The main barrier to completion is adjacent landowner concerns at the project site.

Potential budget and O&M costs.

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

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by the South Puget Sound Salmon Enhancement Group. The restored stream section would be designed to mimic natural fluvial and ecological processes to be self-sustaining and resilient to perturbations to minimize long-term maintenance costs.

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

The project sponsor is currently the South Puget Sound Salmon Enhancement Group. A 30% plan set was completed by the South Puget Sound Salmon Enhancement Group and the Wild Fish Conservancy. In addition, stakeholder coordination and public involvement was performed and there is general support for this project. The project team will also engage with watershed partners based on their level of interest and ability to be involved with the study. Potential Project partners who have indicated their interest include: The Fox Hill Homeowners Association, the Washington Department of Fish and Wildlife, and the Squaxin Island Tribe.

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Water Right Opportunities in WRIA 13

Technical Memorandum

To: Department of Ecology WRIA 13 Watershed Restoration and Enhancement Committee

From: Glenn Mutti-Driscoll, LHG Pacific Groundwater Group

Burt Clothier, LHG Pacific Groundwater Group

Re: Water Right Screening Methodology

Date: December 18, 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 Deschutes River Watershed, Water Resources Inventory Area (WRIA) 13. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 13 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 13, 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 13. 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.

WRIA 13 permit exempt (PE) well growth projections were then compared by subbasin in addition to potential mitigation and habitat restoration projects, managed aquifer recharge projects, and the presence of priority salmon streams. From this evaluation, subbasins with the greatest projected PE well growth and consumptive use (Deschutes Middle with 122 acft/yr from 734 wells and Johnson Point with 86 acft/yr from 520 wells) were identified as having relatively few mitigation and restoration projects relative to expected PE well impacts. Therefore, water rights primarily within these subbasins were prioritized to identify potential rights that could be acquired, relinquished to trust, or whose owners could be engaged regarding implementation of water saving or conservation practices.

Over 850 active water right files were identified in the Deschutes Middle and Johnson Point subbasins. Following consultation with the Committee, PGG limited the water rights under consideration to certificates and permits[81] that included commercial and industrial (CI), irrigation (IR), and domestic multiple (DM) uses. DM water rights were included within the query since nearby municipal water systems (Lacey for the Johnson Point subbasin and Raymond for Deschutes Middle subbasin) 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 query based on the expectation that these rights would be unavailable for mitigation or small.

The list of active permits and certificates with CI, IR, and/or DM uses was reduced again based on authorized annual (Qa) quantities. For the Deschutes Middle and Johnson Point subbasin, rights with a Qa of less than 10 acft/yr were removed. This arbitrary cut-off rate was intended to focus on higher-value possibilities and provide a more manageably sized list. In general, larger water rights are considered higher value since they will provide greater flow benefits to a stream. Although not used for filtering, it's worth noting that surface water rights are considered higher value mitigation rights than groundwater rights since they will have an immediate, direct, and easily quantifiable benefit to a stream.

This list was further refined with Committee input regarding the inclusion/exclusion of specific rights, and rights from the neighboring Woodland Creek and Deschutes Lower subbasins were added based on input that they may be acquirable. Rights specifically identified by the Committee did not have the 10 acft/yr general screening criteria applied.

Table 1 lists the identified WRIA 13 water rights that could potentially be converted, purchased, or retired as mitigation water, while **Table 2** is a general summary of the focused water right list. These rights have been identified as having the greatest potential benefit to instream flows in the Johnson Point and Deschutes Middle subbasin vicinities by applying the criteria outlined above. However, this list 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.

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

POTENTIAL FUTURE PROJECTS

Multiple conservation and water-right related offshoot projects were identified through the water right screening process and discussion with the Committee. Potential future opportunities for further study are listed below, all of which could potentially provide Net Ecological Benefit (NEB). Most projects listed provide hydrologic benefit through water offsets (as is noted below) since increases in streamflow generally provide greater NEB than habitat restoration projects.

- Outreach and potential quantification of water saved by implementing Best Management Practices (BMPs) for improving irrigation efficiencies at golf courses and on irrigated lands. Opportunities to improve irrigation efficiencies could be analyzed on a water right or project area scale to assess if hydrologic benefit and/or NEB is likely to occur[82]. Projects that result in NEB would be incentivized as feasible.
- Outreach and potential quantification of water saved through the repair of leaky water system pipes. A review of water system plans for public water systems within the WRIA could be pursued to identify systems with the greatest leakage losses, and if infrastructure repair appears to provide hydrologic benefit and/or NEB[2], incentives could be provided to systems that chose to upgrade.
- Incentivize off channel storage projects during the wet season for agricultural water right holders. Hydrologic benefit potentially can occur if impacts of summer pumping are offset by increases in summer streamflow.
- Create a water bank or other structure to track water quantities voluntarily conserved by agricultural water right holders. Some of the conserved quantities could be leased for other agricultural uses, while some would remain unused or put into temporary trust to provide hydrologic benefit and increase instream flows.
- Connect small water systems to nearby municipal water systems. The transfer of small-system water users to larger municipal water systems would be accommodated by the municipal system as part of its growth projections, while the smaller water system right would be relinquished or permanently donated to trust (providing hydrologic benefit).
- Partial or full relinquishment of water rights into permanent trust for hydrologic benefit.
- Outreach to golf courses, particularly those on salmon bearing streams or in close proximity to Puget Sound, regarding the Salmon Safe Certification program and BMPs. This project would primarily result in habitat benefits.

[82]Projects improving water management efficiencies will need to show how consumptive use is reduced through the upgrade. Upgrades that result in decreased recharge to the shallow aquifer (which would be a decrease in non-consumptive use) are unlikely to result in significant hydrologic benefit.

Woodard Creek Project

PROJECT DESCRIPTION

Description

Woodard Creek basin is located in central Thurston County; it includes a mix of urban and rural areas and is crossed by Interstate-5, a major transportation corridor in the region (Figure 1). Woodard Creek flows into Henderson Inlet. The hydrology of the area has been extensively modified by development in the upstream (southern) portion of the basin, resulting in stormwater impacts.

In 2014, a study done on Woodard Creek basin identified and ranked two potential stormwater retrofit sites that would have a positive impact on the Woodard Creek water quality (AHBL 2014a; 2014b). Since 2014, two sites have been completed, 1 site has been dropped because of issues, and the two remaining sites are in the process of being completed. All of the proposed sites identified in AHBL (2014a; 2014b) address water quality and do not address any flow control issues.

The goal of the Woodard Creek Project (Project) is to address the water quantity impacts of stormwater by attenuating flood flows by increasing stream bed roughness and restoring the channel sinuosity. This would increase floodplain connectivity and overall floodplain storage capacity. Increasing streambed roughness with biotechnical techniques (e.g. large woody debris) would also enhance the quality and quantity of instream habitat within the project reach. Habitat within Woodard Creek is currently impaired, particularly within the northern portion of the project reach, by lack of riparian vegetation and large woody debris, simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality. Therefore, the focus of this project is increase stream length, increase water transit time, and increase habitat complexity by modifying portions of stream in the northern end of the basin.

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

The Project is composed of a number of candidate locations or stream reaches. The Project sponsor will work with the landowners to identify reaches available for restoration. Restoration reaches will have large woody debris added to suitable or reference densities. The LWD will provide fish cover, hydraulic complexity, and will increase pool density and depth. Coho will benefit from increased pool density, in terms of juvenile rearing and adult holding. Riparian vegetation will be planted, as necessary throughout the restoration reaches that will recruit wood and provide shade into the future.

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

Figures 1-2 show the location of the proposed project.

Figure 1. Location of Woodard Creek basin in Thurston County. Potential project locations are outlined by red boxes (A-C).

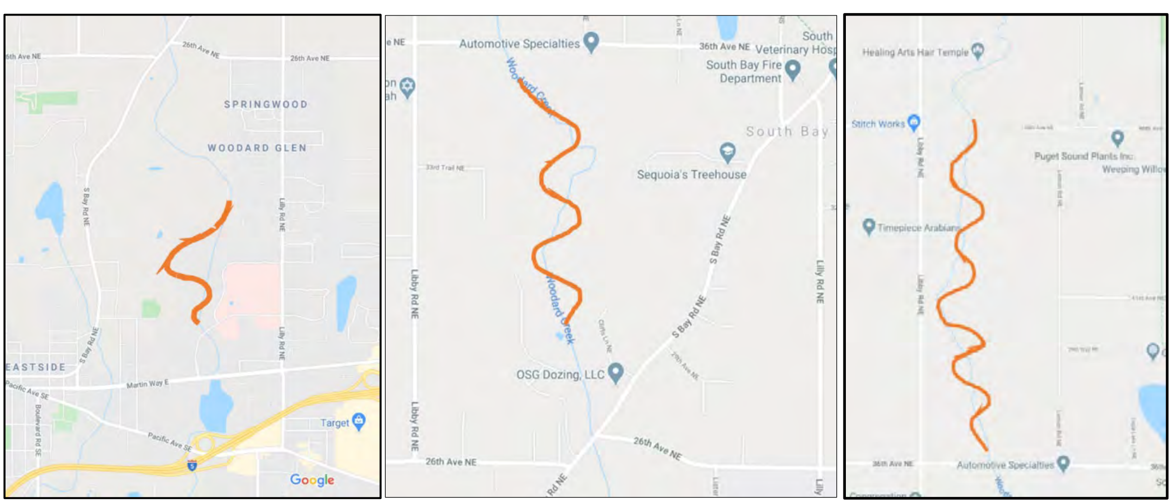

Figure 2. Conceptual drawing of Woodard Creek project locations at sites A, B, and C.

Description of the anticipated spatial distribution of likely benefits

The proposed stream restoration will benefit Woodard Creek. The benefits will be reach-specific..

Performance goals and measures.

The performance goals are to increase channel sinuosity and length, increase instream habitat complexity, and channel roughness. Specific metrics and measures will be defined when during feasibility and design.

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

Although portions of the area have been highly urbanized, Woodard Creek basin supports a variety of wildlife. Many species of fish utilize the creek, including coho, chum, steelhead, and cutthroat trout, and Olympic mudminnow have been noted in the creek near the I-5 interchange, though high winter flows and low summer flows in the river have reduced the usability of this habitat (Thurston County 2015). There are a number of bald eagle nesting sites within the basin, as well as a purple martin breeding area. There are several large wetland areas in the basin, including along Ensign and South Bay Roads.

Woodard Creek has historically supported native runs of coho, chum, cutthroat, and winter steelhead (Thurston County 2015). Limiting factors identified for the creek include alteration of the natural flow regime from increased impervious surfaces, lack of large woody debris (LWD), and barriers to fish passage. The riparian corridor has been impaired by the removal of vegetation in some areas, a lack of conifers in the remaining vegetation, and direct animal access to the stream. Fine sediment may also be a naturally occurring barrier.

The Washington Department of Fish and Wildlife has identified that Coho Salmon, Chum Salmon, Winter steelhead are present in Woodard Creek and that Fall Chinook Salmon have access to Woodard Creek (WDFW Salmonscape 2020). WDFW (2020) documents spawning in Woodard Creek (WDFW 2020). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook Salmon were historically present in Woodard Creek (WDF 1975). Woodard Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

The reaches of Woodard Creek proposed for restoration has the potential to provide rearing and foraging habitat for the aforementioned salmon and trout populations year round.

Identification of anticipated support and barriers to completion.

Thurston County has indicated support for this project. The primary barrier to completion is likely to be land acquisition or obtaining conservation easements. The proposed project area includes privately owned parcels.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be <$1 million, based on an order of magnitude estimate (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by Thurston County or their future project partner. The restored stream section would be designed to be compatible with natural ecological processes to be self-sustaining and resilient to perturbations to minimize long-term maintenance costs.

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

The project sponsor is Thurston County and is ready to implement the project. Implementation would require an evaluation of feasibility.

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Appendix J – Project Inventory

WRIA 13 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.

Appendix K – 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 13 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 13 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:

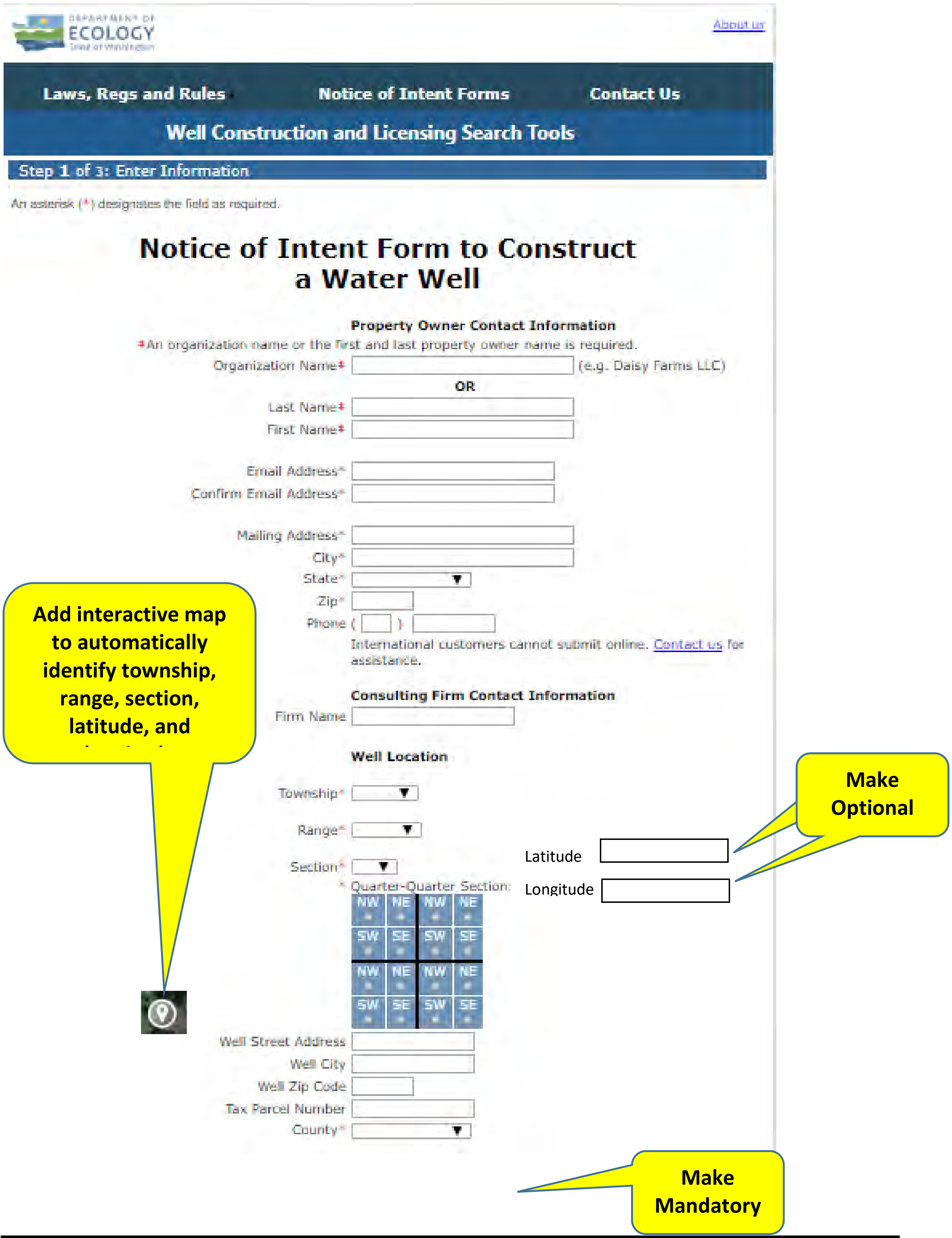
1. **New well location mapping tool for drillers**
   An interactive web-based mapping tool that provides an intuitive means of determining PLS location has been implemented in Oregon recently. Ecology is interested in developing their own web tool which provides the PLS and coordinates location (latitude/longitude) 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.

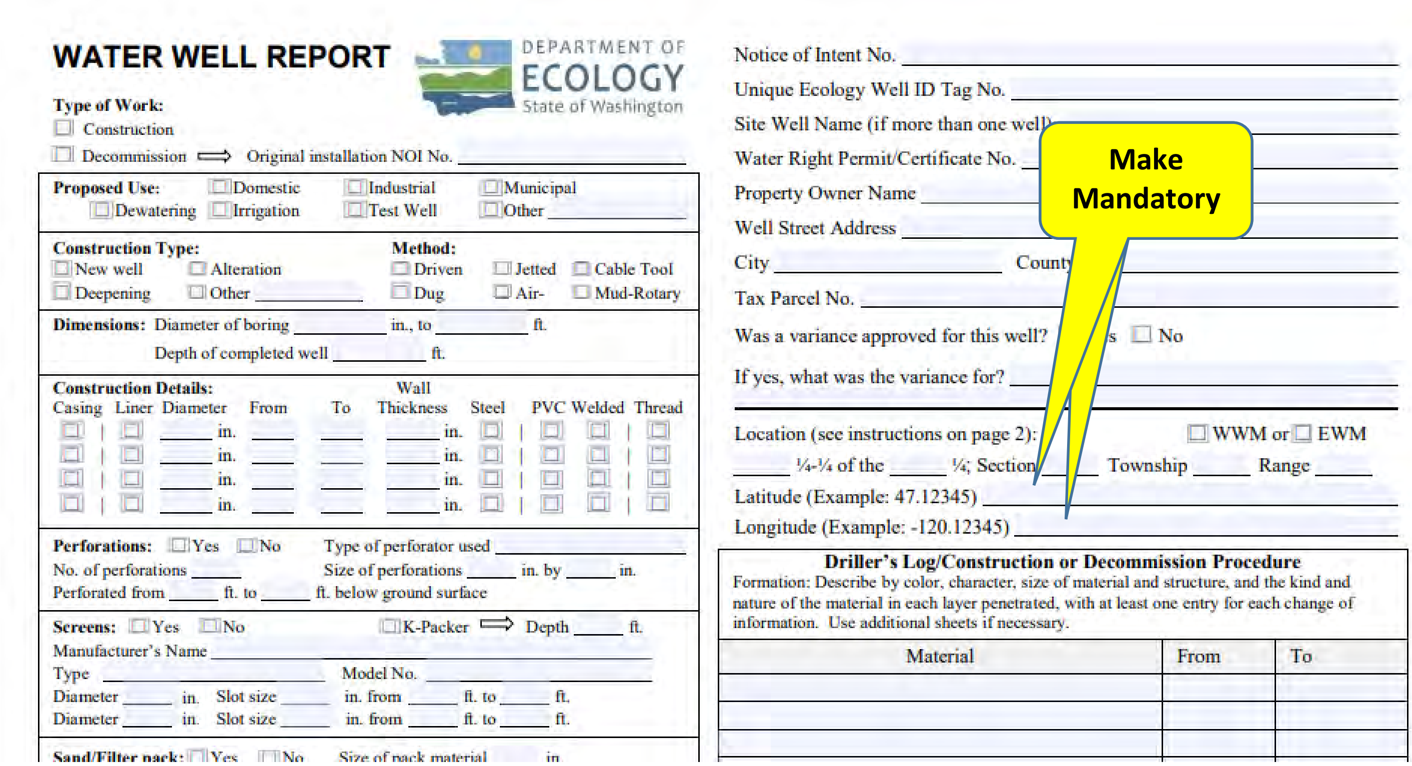
3. **New web-based well reporting application**

- 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:
-
    - 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


DEPARTMENT OF ECOLOGY State of Washington
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
Latitude
Longitude
Well Street Address
Well City
Well Zip Code
Tax Parcel Number
County*
Add interactive map to automatically identify township, range, section, latitude, and
Make Optional
Make Mandatory

https://fortress.wa.gov/ecy/publications/documents/ecy050120.pdf



WATER WELL REPORT

DEPARTMENT OF ECOLOGY State of Washington

Type of Work:
☐ Construction
☐ Decommission ⟹ Original installation NOI No. ______

Proposed Use: ☐ Domestic ☐ Industrial ☐ Municipal ☐ Dewatering ☐ Irrigation ☐ Test Well ☐ Other ______

Construction Type: ☐ New well ☐ Alteration ☐ Deepening ☐ Other ______

Method: ☐ Driven ☐ Jetted ☐ Cable Tool ☐ Dug ☐ Air- ☐ Mud-Rotary

Dimensions: Diameter of boring ______ in., to ______ ft.
Depth of completed well ______ ft.

Construction Details:

Casing	Liner	Diameter	From	To	Wall Thickness	Steel	PVC	Welded	Thread
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐

Perforations: ☐ Yes ☐ No Type of perforator used ______
No. of perforations ______ Size of perforations ______ in. by ______ in.
Perforated from ______ ft. to ______ ft. below ground surface

Screens: ☐ Yes ☐ No ☐ K-Packer ⟹ Depth ______ ft.
Manufacturer's Name ______
Type ______ Model No. ______
Diameter ______ in. Slot size ______ in. from ______ ft. to ______ ft.
Diameter ______ in. Slot size ______ in. from ______ ft. to ______ ft.

Sand/Filter pack: ☐ Yes ☐ No Size of pack material ______ in.

Notice of Intent No. ______
Unique Ecology Well ID Tag No. ______
Site Well Name (if more than one well) ______
Water Right Permit/Certificate No. ______
Property Owner Name ______
Well Street Address ______
City ______ County ______
Tax Parcel No. ______
Was a variance approved for this well? ☐ Yes ☐ No
If yes, what was the variance for? ______

Location (see instructions on page 2): ☐ WWM or ☐ EWM
______ ¼-¼ of the ______ ¼; Section ______ Township ______ Range ______
Latitude (Example: 47.12345) ______
Longitude (Example: -120.12345) ______

Driller's Log/Construction or Decommission Procedure
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information. Use additional sheets if necessary.

Material	From	To

Make Mandatory

Add interactive map to automatically identify township, range, section, latitude, and

Change this water well report into a web form.