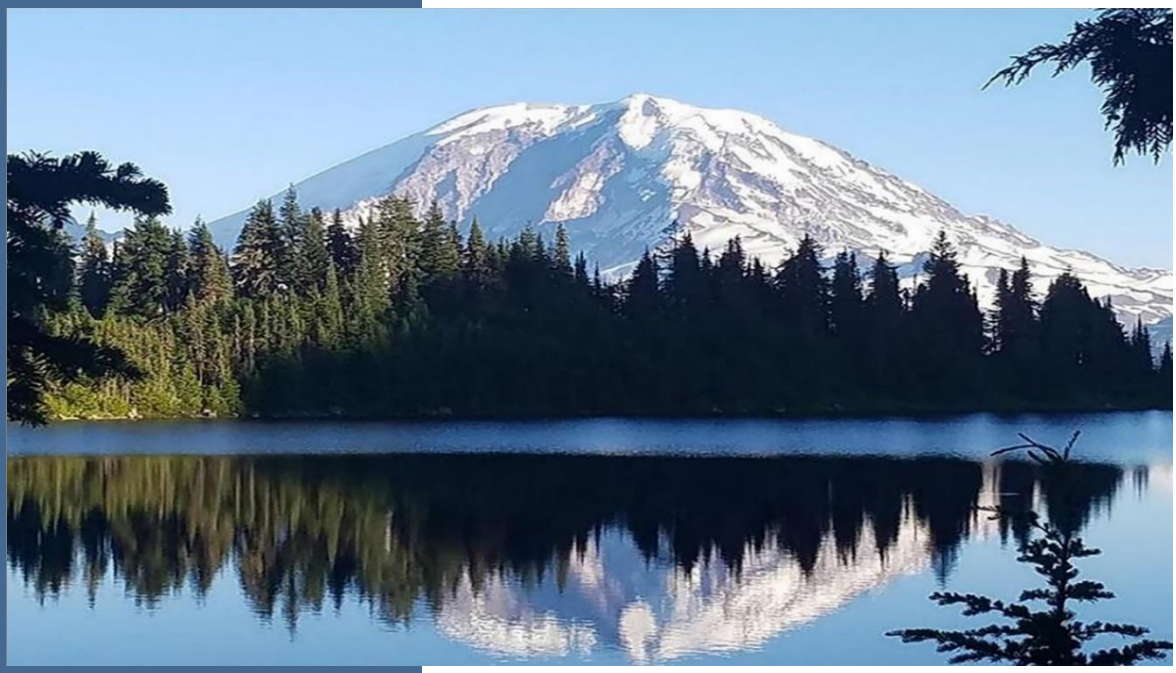

Watershed Restoration and Enhancement Plan
WRIA 10 - Puyallup-White Watershed

FINAL DRAFT
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Executive Summary

In January 2018, the Washington State Legislature passed the Streamflow Restoration law (chapter 90.94 RCW) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. The law directs the Department of Ecology to lead local planning Committees to develop Watershed Restoration and Enhancement Plans that identify projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over the planning horizon (2018 – 2038), and provide a net ecological benefit to the watershed. This Watershed Restoration and Enhancement Plan meets the requirements of the law.

The Department of Ecology (Ecology) established the Watershed Restoration and Enhancement Committee to collaborate with tribes, counties, cities, state agencies, and special interest groups in the Puyallup-White watershed, also known as Water Resource Inventory Area (WRIA) 10. The WRIA 10 Committee met for over 2 years to develop a watershed plan.

This watershed plan projects 688 PE well connections over the 20-year planning horizon. The estimated consumptive water use associated with the new PE well connections is 277.4 acre-feet per year (0.38 cfs); equivalent to 360 gallons per day for each new PE well. The projects and actions in this watershed plan will address and offset the consumptive water use from those PE well connections.

The projects in this watershed plan include water right acquisitions, managed aquifer recharges, stormwater infiltration, and PE well decommissioning that provide an estimated offset of 788.3 acre-feet per year to benefit streamflows and enhance the watershed. Additional projects in the plan include benefits to fish and wildlife habitat, such as levee setbacks, floodplain reconnections, stream improvements, and bank stabilizations.

This watershed plan recommends an adaptive management process. The adaptive management process includes a mechanism for tracking new PE wells, tracking project implementation, periodic reporting on project status, and recommendations for response if projects implementation lags new PE well connections. These measures, in addition to the surplus water offset and supplemental habitat improvement projects, provide reasonable assurance that the plan will adequately offset new consumptive use from PE wells anticipated during the planning horizon.

Based on the information and analyses summarized in this plan, the WRIA 10 Committee finds that this plan, if implemented, achieves a net ecological benefit, as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019b).

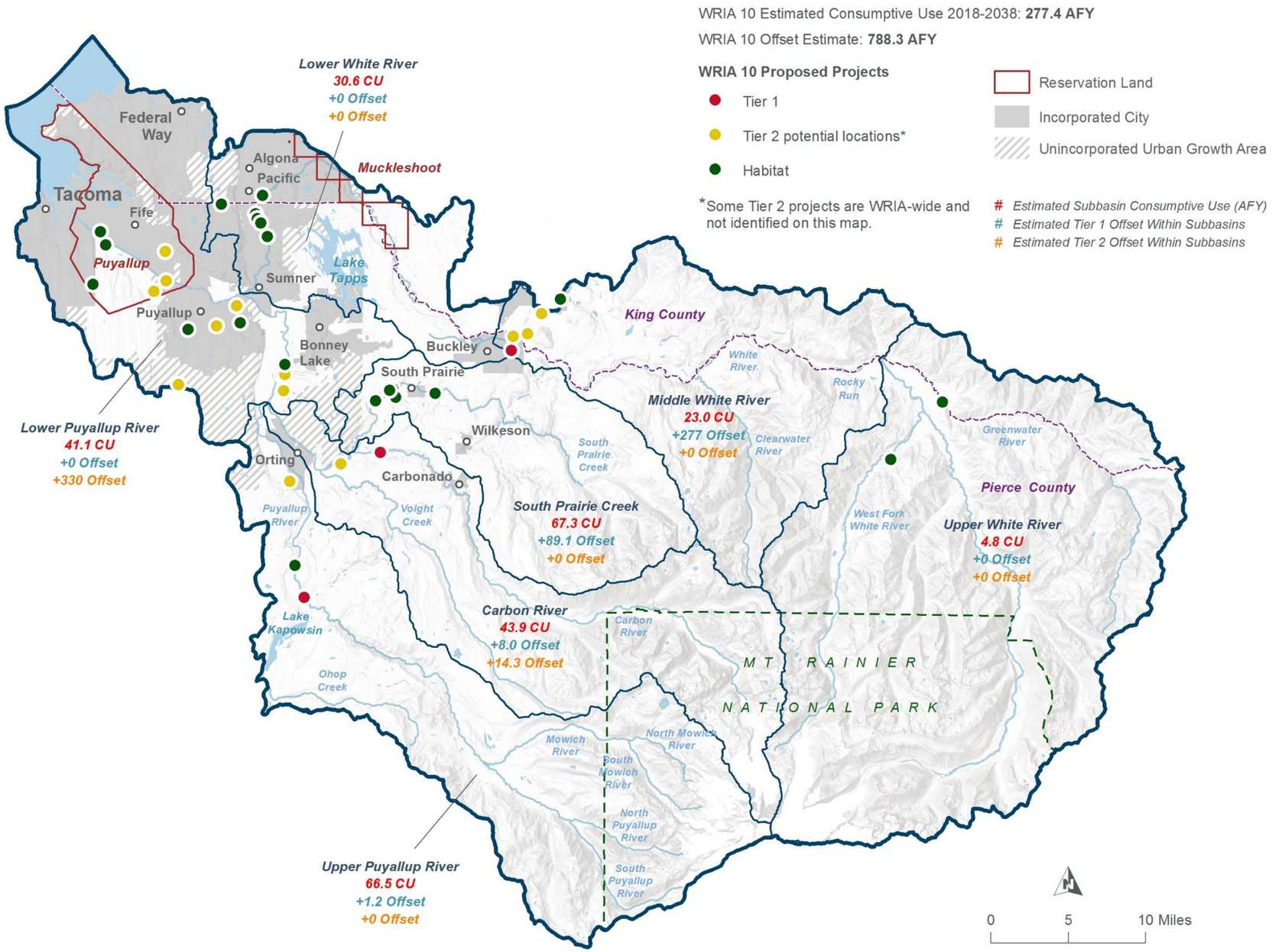

Figure 1 Summary Map of Consumptive Use, Projects, and Offsets by Subbasin.

Chapter One: Plan Overview

1.1 WRIA 10 Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 10 Watershed Restoration and Enhancement Plan is to offset the impacts of domestic permit-exempt wells (referred to as PE wells throughout this plan) to streamflows. The watershed restoration and enhancement plan is one requirement of RCW 90.94.030. Watershed restoration and enhancement plans must identify projects and actions to offset the potential impacts of new PE wells on instream flows over 20 years (2018-2038), and provide a net ecological benefit (NEB) to the WRIA. This WRIA 10 Watershed Restoration and Enhancement Plan (watershed plan or plan) considers priorities for salmon recovery and watershed recovery, while ensuring it meets the intent of the law.

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 and actions that 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 not intended to address all water uses or related issues within the watershed, it may provide a path forward for future water resource planning.

This watershed plan includes seven chapters:

- Plan overview.
- Overview of the watershed.
- Summary of the subbasins.
- Growth projections and consumptive use estimates.
- Description of the recommended projects and actions identified to offset the future permit-exempt domestic water use in WRIA 10.
- Explanation of recommended implementation and adaptive management measures.
- Evaluation and consideration of NEB.

1.1.1 Legal and Regulatory Background for the WRIA 10 Watershed Restoration and Enhancement Plan

In January 2018, the Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 (session law 2018 c 1) 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 chapter 90.94 RCW, clarifies how local governments can issue building permits for homes intending to use a PE well for their domestic water supply. The law also requires local watershed planning in 15 different WRIAs, including WRIA 10.

1.1.2 The Local Building Permit Process and Permit-Exempt Wells

This watershed restoration and enhancement plan, the Streamflow Restoration law, and the Hirst decision are all concerned with the effects of new PE wells on streamflows. Several laws pertain to the management of PE wells in WRIA 10 and this section summarizes them to provide context for the WRIA 10 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. 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, for an applicant to receive a building permit from their local government for a new home, the applicant must satisfy the provisions of RCW 19.27.097 for what constitutes evidence of an adequate water supply.

RCW 90.94.030 adds to the management regime for new homes using domestic PE well withdrawals in WRIA 10 and elsewhere. For example, local governments must, among other responsibilities relating to new PE 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 PE wells in WRIA 10 to a maximum annual average of 950 gallons per day per connection, subject to the 5,000 gallons per day and ½-acre outdoor irrigation of non-commercial lawn/garden limits established in RCW 90.44.050. The Washington Department of Ecology (Ecology) has published its interpretation and implementation of RCW 19.27.097 and chapter 90.94 RCW in Water Resources POL-2094 (Ecology 2019a). The WRIA 10 Committee directs readers to those laws and policy for comprehensive details and agency interpretations.

1.1.3 RCW 90.94.030's Planning Requirements

While supplementing the local building permit requirements, RCW 90.94.030(3) goes on to establish the planning criteria for WRIA 10. In doing so, it sets the minimum standard of Ecology's collaboration with the WRIA 10 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 10 Committee's adopted operating principles that are further discussed in Section 1.4.

Additionally, the Streamflow Restoration law requires this watershed plan to identify projects and actions that offset the anticipated impacts from new permit-exempt domestic groundwater withdrawals over the next 20 years and provide a net ecological benefit. 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 10 Committee's approach to selecting projects and actions, the law also speaks to "high and lower priority projects." The WRIA 10 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". It is

the perspective of the WRIA 10 Committee that this watershed plan satisfies the requirements of RCW 90.94.030.

1.2 Requirements of the Watershed Restoration and Enhancement Plan

RCW 90.94.030 of the Streamflow Restoration law directs Ecology to establish a Watershed Restoration and Enhancement Committee in the Puyallup - White watershed (referred to in this plan as the Committee) and collaborate with the Committee to develop this watershed plan. Ecology determined that collective development of the watershed plan, using an open and transparent setting and process that builds on local needs would best serve the intent of the law.

At a minimum, the watershed plan must include projects and actions necessary to offset potential impacts of new PE wells on streamflows and provide a NEB to the WRIA. The legislation requires the watershed plan to include the following elements:

- Recommendations for projects and actions that will measure and enhance instream resources and improve watershed functions that support the recovery of threatened and endangered salmonids (RCW 90.94.030(3)(a)).
- Actions the Committee determines necessary to offset potential impacts to instream flows associated with permit-exempt domestic water use (RCW 90.94.030(3)(b)).
- A cost evaluation or estimation (RCW 90.94.030(3)(d)).
- An estimate of the cumulative consumptive use impacts over the twenty year period (2018-2038) (RCW 90.94.030(3)(e)).

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 chapter 90.94 RCW. The Final Guidance on Determining Net Ecological Benefit (referred to as Final NEB Guidance throughout this plan) 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 Streamflow Restoration law requires that all members of the Committee approve the watershed plan prior to submission to Ecology for review. Ecology must then determine that the plan's recommended streamflow restoration projects and actions will result in a NEB to instream resources within the WRIA after accounting for projected use of new PE wells over the 20 year planning horizon from 2018-2038.

1.3 Overview of the WRIA 10 Committee

1.3.1 Formation

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

- Each federally recognized tribal government with reservation land or usual and accustomed harvest area within the WRIA.
- Each county government within the WRIA.
- Each city government within the WRIA.
- Washington State Department of Fish and Wildlife.
- The largest publically-owned water purveyor providing water within the WRIA that is not a municipality.
- The largest irrigation district within the WRIA.

Ecology sent invitation letters to each of the entities named in the law[2] 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 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 Committee.

The entities represented on the WRIA 10 Committee are included in Table 1. This list includes all of the entities identified by the Legislature that agreed to participate on the Committee.[3]

Table 1 WRIA 10 Membership

Entity Name	Representing
Muckleshoot Tribe	Tribal government
Puyallup Tribe	Tribal government
Pierce County	County government
City of Auburn	City government
City of Bonney Lake	City government
City of Edgewood	City government
City of Enumclaw	City government
City of Fife	City government
City of Orting	City government
City of Pacific	City government
City of Puyallup	City government
City of Sumner	City government
City of Tacoma	City government

[2] Except the irrigation district because there are no irrigation districts in WRIA 10.

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

Entity Name	Representing
Washington Department of Fish and Wildlife	State agency
Washington Department of Ecology	State agency
Lakehaven Water and Sewer District	Water utility
Pierce County Conservation District	Agricultural interest
Master Builders Association of Pierce County	Residential building industry
Puyallup River Watershed Council	Environmental interest

Roster with names and alternates is available in Appendix C.

The Committee invited the WRIA 10/12 Salmon Recovery Entity to participate as an "ex-officio" member. 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 Committee. The Tacoma-Pierce County Health Department (TPCHD) participated in select Committee and workgroup meetings as a technical expert on local well permitting.

1.4 Committee Structure and Decision Making

The Committee held its first meeting in October 2018. Between October 2018 and April 2021, the Committee held 27 meetings. All Committee meetings were open to the public. Some meetings were held jointly with the WRIA 12 Committee. The Committee met at least once a month, and as needed to meet deadlines.

The two and a half years of planning consisted of training, research, and developing plan components. Committee members had a range of knowledge about hydrogeology, water law, salmon recovery, and residential development. Ecology technical staff, Committee members, and partners presented on topics to provide context for components of the plan.

In addition to playing the role of Committee chair, Ecology staff provided administrative support and technical assistance, and contracted with consultants to provide facilitation and technical support for the Committee. The facilitator supported the Committee's discussions and decision-making. The technical consultants developed products that informed Committee decisions and development of the plan. The technical consultants developed all of the technical memorandums referenced throughout this plan.

The Committee established two workgroups to support planning activities and to achieve specific tasks, a technical workgroup and a subbasin workgroup. The workgroups were open to all 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 Committee acted on workgroup recommendations, as it deemed appropriate. The technical workgroup met each month between Committee meetings, and the subbasin workgroup met twice.

During the initial Committee meetings, members developed and agreed to operating principles (see Appendix D).[4] The operating principles set forward a process for meeting, participation

[4] Complete and signed operating principles are available on the WRIA 10 Committee webpage.

expectations, procedures for voting, structure of the Committee, communication, and other needs to support the Committee in reaching agreement on a final plan.

This planning process, by statutory design, brought diverse perspectives to the table. As the legislation requires that all members of the Committee approve the final plan prior to Ecology's review,[5] it was important for the Committee to identify a clear process for making decisions. The Committee strived for consensus during foundational votes and decisions on plan development, being the best indicator of the Committee's progress toward an approved plan. When consensus could not be reached, the Committee relied on a two-thirds majority vote. The chair and facilitator documented agreement and dissenting opinions.

The WRIA 10 Committee reviewed draft plan and draft plan chapters on an iterative basis.

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

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 10

WRIAs are large watershed areas formalized under Washington Administrative Code (Water Resources Code of 1971) for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeological regimes, levels of development, and variable natural resources. WRIA 10, also known as the Puyallup-White, is one of the 62 designated WRIAs in Washington State. The 1,000 square mile Puyallup-White Watershed is within Pierce and King counties and includes all of the lands drained by the Puyallup, White, and Carbon rivers. The White and Carbon rivers are tributaries to the Puyallup River. These three river systems originate from glaciers on Mount Rainier.

The Puyallup River flows 46 miles, drains 490 square miles, and discharges into Commencement Bay and Puget Sound in Tacoma (Lead Entity 2018). The mean annual flow in the Puyallup River is 3,332 cubic feet per second (cfs) measured near Puyallup[6] (USGS 2020a). The White River runs 75 miles and has a mean annual flow rate of approximately 1,400 cfs as measured near Buckley[7] (PRWC 2014; USGS 2020b). The Carbon River runs 33 miles and has a mean annual flow of 430 cfs measured at Fairfax[8] (PRWC 2014; USGS 2020c).

2.1.1 Land Use in WRIA 10

The Puyallup-White Watershed is one of the most heavily populated basins in western Washington. The western portion of the Puyallup-White Watershed is predominantly urban, characterized by a combination of residential, industrial, commercial, agricultural, transportation, communication, and utility land uses. The most populated cities in the watershed are Tacoma, Auburn, and Federal Way (OFM 2020). Approximately 14 percent (149.7 square miles) of the watershed is within a city or designated urban growth area, and approximately 86 percent of the WRIA is outside of the urban growth areas. The confluence of the Puyallup River with Commencement Bay occurs in the urbanized and highly industrialized Port of Tacoma.

The eastern or upland portion of the watershed generally consists of commercial forest land, Mount Rainier National Park (19 percent of the WRIA), and the Baker-Snoqualmie and Gifford Pinchot national forests (26 percent of the WRIA). Washington State agencies manage about 3% of the WRIA. Land uses shift to agriculture, suburban developments, and small urban centers in the foothills of the Cascade Mountains. Rural residential development has primarily occurred in the foothills outside of the urban centers (see Figure 2).

[6] USGS stream gage 12101500
[7] USGS stream gage 12099200
[8] USGS stream gage 12094000

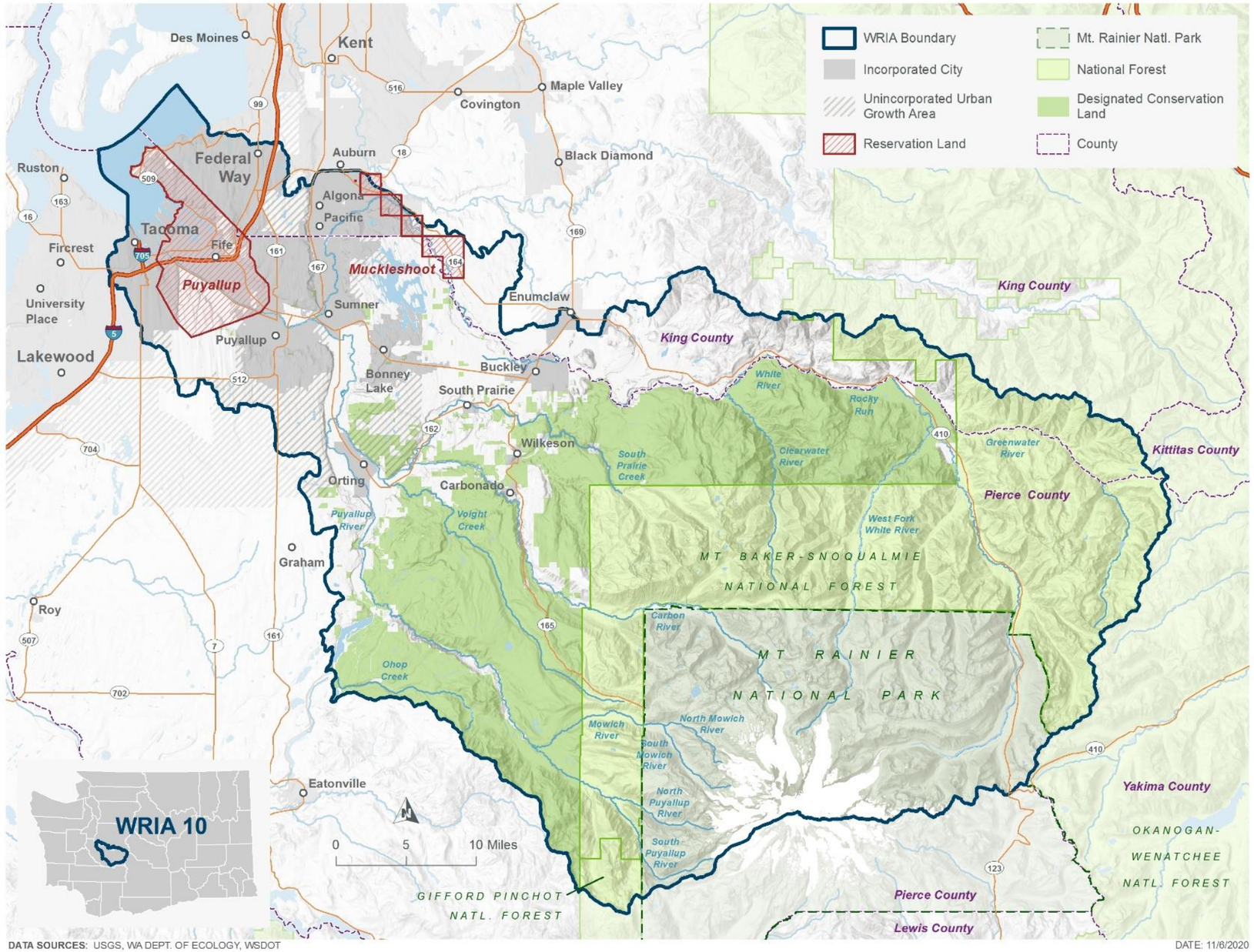

Figure 2 WRIA 10 Vicinity Map with Land Uses

2.1.2 Tribal Reservations and Usual and Accustomed Fishing Areas

The Puyallup Tribe of Indians' Reservation occupies 18,000 acres on the lower Puyallup River and Commencement Bay. The Muckleshoot Indian Reservation occupies 3,600 acres along the lower reaches of the White River. The ancestral lands and use areas of the people of the Muckleshoot Indian Tribe and the lands of the Muckleshoot Indian Reservation are partially located in WRIA 10. The Puyallup and Muckleshoot tribes are sovereign nations with rights over natural resources, including enough water to fulfill the purposes of their reservations.

The Tribes hold Treaty-reserved water rights in WRIA 10 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 10 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.[9]

2.1.3 Salmon in WRIA 10

The Puyallup-White Watershed is an important and productive system for salmonids listed as threatened under the Endangered Species Act (ESA). Several tributaries provide spawning and rearing habitat for Chinook, Coho, Pink, Sockeye, and Chum salmon, as well as steelhead and bull trout. The watershed supports the last spring Chinook salmon run in the South Puget Sound (Salmon Habitat Recovery 2018). Spawning tributaries often experience low streamflows during critical migration and spawning periods (PRWC 2014). Many people depend on the salmon fishery. This includes tribes with usual and accustomed fishing areas that overlap with the Puyallup-White watershed, such as the Puyallup Tribe of Indians and the Muckleshoot Indian Tribe (NWIFC 2014).

2.1.4 Water System Distribution and Impacts in WRIA 10

Communities in WRIA 10 rely on a mix of both groundwater and surface water. Water systems distribute most water in the watershed. The Washington Department of Health classifies water systems by the number of connections and the number people served each day. Group A water systems serve 15 or more connections and 25 or more people per day and require a water right from Ecology. Group B water systems serve fewer than 15 connections and 25 people per day (WA Department of Health 2020). The size of the Group B system determines whether it requires a water right. Usually Group B systems serving fewer than six connections are exempt from permitting because they can meet the requirements of RCW 90.44.050. In Pierce County,

[9] Paragraph provided by WRIA 10 Tribes.

wells serving two connections are considered Group B systems. Most PE wells are located in unincorporated rural areas, where water systems are unavailable.

2.2 Watershed Planning in WRIA 10

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 10 for decades. This section provides a brief summary of broad watershed planning activities as they relate to the past, present, and future water availability and salmon recovery in the Puyallup-White Watershed.

2.2.1 Current Planning Efforts in WRIA 10

This watershed plan is building on many of the past and ongoing activities to further develop comprehensive plans for the entire watershed. For example, the Puyallup White River Local Integrating Organization (PWR-LIO) is developing an Ecosystem Recovery Plan, which will set local priorities and inform the next Action Agenda for Puget Sound Recovery.[10] The planning process to develop an ecosystem recovery plan is community based with engagement by residents, nonprofits, and local, state, and federal agencies. The approach is holistic, addressing everything from salmon and orca recovery, stormwater runoff, equity, climate change, and farmland and forest conservation. The PWR-LIO has engaged the community in a collaborative planning process to develop local priorities and support the health and sustainability of the watershed.

The Salmon Recovery Lead Entity, a collaboration of local governments, state, federal, and tribal partners, and nonprofit organizations, is focused on protecting and enhancing wild salmon populations. In 2018, the Lead Entity updated the Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. [11]

The PWR-LIO and Salmon Recovery Lead Entity include many of the same organizations and individuals that participate in the Committee. This history of collaborative planning and shared priorities has supported the success of the watershed restoration and enhancement plan development in WRIA 10. This history of collaboration will also lead to successful implementation of this plan.

The Pierce County Coordinated Water System Plan (CWSP) was created for water utilities to coordinate planning and construction programs with water utilities and other local jurisdiction programs.[12] The plan, established in 1988, provides the foundation for how to meet public drinking water needs with consideration for future growth. A limited update was completed in

[10] The PWR-LIO boundaries mirror the WRIA 10 boundaries, except for a small area in Tacoma. More information on local integrating organizations and their efforts to recovery Puget Sound is available here: https://www.psp.wa.gov/LIO-overview.php.

[11] Salmon recovery lead entities in Puget Sound were established under RCW 77.85.050. More information on their roles as well as links to the recovery plan and watershed chapters is available here: https://www.psp.wa.gov/salmon-recovery-overview.php.

[12] More information on Pierce County Coordinated Water System Planning is available here: https://www.co.pierce.wa.us/951/Coordinated-Water-System-Planning

2001, but it did not address changes associated with water resources, water supply, and land use planning. The County completed a more significant update in 2020.

This planning ensures that water system service areas are consistent with local growth management plans and development policies. The location of new homes in relation to and within designated retail water system service areas and related policies determine if homes connect to water system or rely on new PE wells. Within their designated retail service area(s), Group A water purveyors are given first right of refusal for new connections. The purveyor may allow an individual well if they are unable to provide service in a 'reasonable and timely' manner.

2.2.2 Coordination with Existing Plans

Throughout the development of this watershed plan, Ecology streamflow restoration staff have engaged with staff from the Salmon Recovery Lead Entity, PWR-LIO, and the Puget Sound Partnership, providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. The Committee chair conducted outreach to the WRIA 10 Salmon Recovery Lead Entity to align salmon recovery priorities and the streamflow planning process. Throughout the planning process, Ecology has coordinated closely with the lead entity and PWR-LIO, including inviting lead entity to take part as an ex-officio member on the Committee, selecting priority streams based on information from the Salmon Recovery Strategy, and incorporating priority salmon recovery projects in the watershed plan.

This watershed plan incorporates assumptions that reflect the Pierce County and King County Comprehensive Plan goals and policies. The counties' Comprehensive Plans set policy for development, housing, public services and facilities, and environmentally sensitive areas, among other topics. The Comprehensive Plans identify where and how future population, housing, and job growth is planned. The plan uses the Pierce and King county zoning districts and Group A water system service areas as the basis for estimating the likely areas of future PE wells.

As a component of a comprehensive plan, a capital facilities plan identifies public facilities that will be needed to ensure service levels keep pace with expected development. It includes projects from a range of county functions, including: airport/ferries, emergency management, general administration, parks, roads, sewer, sheriff/court/correctional facilities, and surface water management. The capital facilities plan must identify the location and cost of capital facilities, as well as the sources of revenue used to fund them. The counties update capital facilities plans annually and appropriate funding for the following year. If the costs exceed the revenue, the county must reduce its level of service, reduce costs by implementing noncapital alternatives or other methods, or modify the land use element to bring development into balance with available or affordable facilities.

Projects may also fall under the noncapital category. Noncapital alternatives include programs, strategies, and methods other than 'brick and mortar'-type capital improvement to achieve the county's required level of service. This category includes programs like education and outreach, improvements to existing facilities, and projects to improve natural drainage as an alternative to engineered solutions (e.g., levees and dikes).

The counties may evaluate and prioritize capital projects (structures or engineered improvements to land) identified through the watershed plan for placement into the capital facilities plan. Most projects will fall under the category of surface water management. Pierce County's Surface Water Management Division (SWM) uses the Surface Water Improvement Plan (SWIP) as its primary basis for project implementation planning. Not all projects listed in the SWIP make it into the capital facilities plan, but the SWIP does inform which projects are incorporated. The SWIP is also a six-year plan that the County updates bi-annually. Projects come from existing, County-approved plans and the County ranks for their ability to address flooding, water quality, habitat, and other factors. Limited available funding and new mandatory obligations also factor into capital project prioritization. If approved, the watershed plan will become one of the guiding project implementation plans for the SWIP.

2.3 Description of the Watershed – Geology, Hydrogeology, Hydrology, Streamflow, and Salmon Presence

2.3.1 Geologic Setting

The lowland geology of WRIA 10 is dominated by a broad drift plain formed from a sequence of unconsolidated glacial and interglacial deposits, intersected by several expansive river valleys. Volcanic and sedimentary rocks form the foothill and mountainous foothill terrains of the Cascade Range in the eastern watershed, but they also underlie the unconsolidated sediments to the west. Depths to bedrock in the lowlands can exceed 2,000 feet (Welch et al. 2015).

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 16,000 years ago, an ice sheet (the Puget Lobe) advanced southward into present day Puget Sound (Pringle 2008). Multiple advances and retreats of the ice sheet formed the Puget Sound Lowlands, depositing a complex sequence of glacial and inter-glacial sediments. The advancement of the alpine glaciers from Mount Rainier carved out the characteristic U-shaped valleys that form the upper and middle reaches of the present-day White, Puyallup, and Carbon river valleys (PRWC 2014).

The geologic setting lays the foundation for surface and groundwater flow through the basin. 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 PE wells.

2.3.2 Hydrogeologic Setting

The U.S. Geological Survey (USGS) described the hydrology of WRIA 10 in a hydrogeologic framework report for the Puyallup River Watershed based on previous studies and published reports for both King and Pierce counties (Welch et al. 2015). The hydrogeologic units of the area are described as being either water-bearing ("aquifer") and non-water-bearing ("aquitard" or "confining layer") sediments, without regard to geologic origin or age. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments throughout the central and lower regions of the watershed.

Groundwater in the aquifers generally flows to the northwest towards Puget Sound, and to the north and northeast towards the Puyallup River, White River, and Green River valleys. These generalized flow patterns are complicated by the presence of low permeability confining units and bedrock that separate discontinuous bodies of aquifer material and act as local groundwater-flow barriers (Welch et al. 2015). Summer base flows in the rivers and tributaries are sustained by groundwater on most of the lower-elevation tributaries, and on glacier and snow melt on the mainstem rivers (Puyallup, Carbon, and White) that drain from Mount Rainier (PRWC 2014).

USGS breaks the hydrogeology of the watershed into 12 units, typically alternating between aquifer and non-aquifer layers. The upper seven layers of the USGS definitions include four aquifer units that are present throughout the majority of the lower and central areas of the watershed (see Appendix E). These aquifers are the most likely sources for new PE wells. They are also the main source of direct recharge or baseflow to the surface water system.

The remaining five units become thinner or are not present in large portions of the central or eastern areas of the watershed. Future PE wells are therefore unlikely to access water from these layers.

2.3.3 Hydrology and Streamflow

The Puyallup, White, and Carbon rivers are located in a snowmelt transition region where the rivers are fed by both snowmelt and rainfall. Annual precipitation near the city of Tacoma ranges from approximately 30 to 40 inches per year, while over 120 inches of precipitation can fall in the Cascades. Most precipitation occurs during the winter (PRWC 2014). During the summer, when water demands are highest, streamflows are dependent upon glacier melt and groundwater inflow (Ecology 2020).

Anticipated future climate impacts will result in continued loss of snow and glacial volumes in the Cascades, combined with rising temperatures and changes in precipitation. Earlier spring snowmelt, lower snowpack, increased evaporative losses, and warmer and drier summer conditions will intensify summer drought conditions and low flow issues in WRIA 10. These climate impacts are expected to drive changes in seasonal streamflows, increasing winter flooding, while intensifying summer low flow conditions (Whitely Binder et. al. 2019). Climate modeling predicts average minimum flows[13] to be 27 percent lower[14] by the 2080s for a moderate warming scenario, relative to 1970-1999 (Mauger et al. 2015).

Glacial melting is a significant factor in maintaining streamflow during dry months. The lowest monthly flow normally occurs in September in most of WRIA 10. However, in higher elevations the lowest flows are often recorded in March, just prior to the beginning of peak snowmelt but before glacial melt water from the alpine areas of Mount Rainier contributes to summer flows.

[13] Average minimum flows, or 7Q10 flows, are the lowest 7-day average flow that occurs on average once every 10 years.
[14] Range: -39 to -16 percent.

Once snowpack is depleted, usually by the end of June, streamflow is then sustained by groundwater contribution and glacial melting (Ecology 1980).

Runoff contribution for most of the basin are measured at a downstream gaging station on the Puyallup River in Puyallup, and indicate a mean annual flow of 3,332 cfs at the USGS stream gage near Puyallup.

There are three water quantity diversion/control structures in the Puyallup-White watershed:

- Mud Mountain Dam is a flood control dam on the White River at river mile (RM) 29.6 operated by the U.S. Army Corps of Engineers (USACE). The dam was constructed solely as a flood control structure, and since 1948 it has provided a mechanism for flood control on the lower Puyallup.
- The Buckley diversion dam[15] is located on the White River at RM 24.3 and diverts water to Lake Tapps and also traps adult salmon to be hauled upstream of Mud Mountain Dam. The diversion dam is operated by the USACE.
- The Electron diversion dam, operated by Electron LLC, diverts water for power generation on the upper Puyallup River.

The WRIA 10 Instream Resources Protection Program (chapter 173-510 WAC) established instream flows on the Puyallup and Carbon Rivers. The rule protects the river from new permitted water rights by setting minimum flow levels, which are like water rights for the stream. Instream flows do not put water in the streams and do not affect existing (senior) water rights. The rule also creates flow limitations and year-round closures for most streams within the watershed, protecting existing flows from new appropriations.

2.3.4 Salmon Presence and Limiting Factors

The Puyallup River Basin, including the White and Carbon Rivers, have anadromous salmon runs that include four of the five Pacific salmon species (Kerwin 1999; Lead Entity 2018; SWIFD 2020; WDFW 2020). Chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), Chum (*Oncorhynchus keta*) and Pink salmon (*Oncorhynchus gorbuscha*) migrate in and out of the Puyallup River watershed from Puget Sound. The watershed is also inhabited by Steelhead Trout (*Oncorhynchus mykiss*), Cutthroat Trout (*Oncorhynchus clarki clarki*), and Bull trout (*Salvelinus confluentus*). These Puget Sound salmonids are keystone species that provide a gauge of the health of our watersheds and Puget Sound ecosystem (Kerwin 1999; Lead Entity 2018).

Of these populations, Chinook Salmon and steelhead are federally listed as threatened under the ESA of 1973 (70 FR 37160; 72 FR 26722). Bull Trout are also federally listed by the U.S. Fish and Wildlife Service throughout their range (64 FR 58910). Spring Chinook at the Muckleshoot Tribe's White River Hatchery are also included in the listing (64 FR 14308, March 24, 1999). Table 2 below lists the species present in the Puyallup/White watershed and their regulatory status.

[15] A multimillion dollar project is currently underway to improve fish passage at the Buckley diversion dam.

Table 2 Salmonid Species and Status in the Puyallup River Watershed

Common Name	Scientific Name	Evolutionary Significant Unit	Critical Habitat	Regulatory Agency Status
Chinook Salmon	*Oncorhynchus tshawytscha*	Puget Sound Chinook[16]	Yes/2005	NMFS/Threatened/ 1999
Chum Salmon	*Oncorhynchus keta*	Puget Sound Chum	No	No listing
Coho Salmon	*Oncorhynchus kisutch*	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/1997
Pink Salmon	*Oncorhynchus gorbuscha*	No listing	No listing	No listing
Steelhead Trout	*Oncorhynchus mykiss*	Puget Sound Steelhead	Yes/2016	NMFS/Threatened/ 2007
Bull Trout	*Salvelinus confluentus*	Puget Sound Dolly Varden/Bull Trout	Yes	USFWS/Threatened/ 1999
Coastal Cutthroat Trout	*Oncorhynchus clarki ssp.*	No listing	No listing	No listing

Table source: Puyallup and Chambers Watersheds Salmon Recovery Lead Entity 2018.

All anadromous salmonid species in the lower Puyallup River migrate out to Puget Sound as juveniles and return upstream as spawning adults. The subbasins within WRIA 10 have various passage and habitat conditions that distribute the species throughout subbasins and tributaries.

Table 3 lists the run timing and life stages of anadromous salmon and trout present throughout the watershed. The following sections describe the general distribution of salmonids in each of these subbasins.

[16] Includes Puyallup River Fall Chinook and White River Spring Chinook.

Table 3 Salmonid Presence and Life History Timing in Puyallup Watersheds

Species	Salmonid Life History and Habitat Utilization in Puyallup Watersheds Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
Chinook (spring)	Upstream migration													Upper White River Middle White River
	Spawning													
	Incubation													
	Juvenile rearing													
	Fry outmigration													
	Juvenile outmigration													
Chinook (fall)	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Coho	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Smolt outmigration													
Chum	Upstream migration													Lower White River Lower Puyallup

Species	Salmonid Life History and Habitat Utilization in Puyallup Watersheds Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
	Spawning													Upper Puyallup Carbon South Prairie Creek
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Pink	Upstream migration													Lower White River Lower Puyallup Upper Puyallup Carbon South Prairie Creek
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Bull Trout	Upstream migration													All
	Spawning													
	Incubation													
Coastal Cutthroat Trout	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Smolt outmigration													
Steelhead Trout (winter)	Upstream migration													All
	Spawning													

Species	Salmonid Life History and Habitat Utilization in Puyallup Watersheds Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
	Incubation													
	Juvenile rearing													
	Smolt outmigration													

Limiting Factors

Development and population growth in the Puget Sound region has dramatically altered the Puyallup-White Watershed from its historic conditions and natural stream habitat forming processes. The exception is Mount Rainier National Park and the upper Puyallup, White, and Carbon rivers which are predominantly within U.S. Forest Service and private commercial timberlands and have not been developed and urbanized compared to the Puget Sound lowlands. Shoreline armoring has blocked most of the historic nearshore area, estuarine river delta, floodplain, riparian, and forested habitat in the Puyallup-White Watershed. Large expanses of development have introduced impervious surfaces, heavy industry, commercial logging, mining, agriculture, and one of the largest marine ports on the west coast to the area, resulting in habitat loss and degradation.

In general, the primary limiting factors in the Puyallup Watershed include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone.
- Loss of off-channel and side-channel habitat.
- Loss of natural habitat-forming flow regimes.
- Loss of upstream, downstream, and lateral fish passage.
- Loss of riparian corridors, including marine riparian, and floodplain forests.
- Loss of instream habitat complexity and connectivity.
- Loss of large wood.
- Increase in river channelization.
- Loss of spawning and rearing habitat.
- Loss of estuarine and nearshore habitat, including bluffs.
- Loss of good water quality, including appropriate temperature.
- Increase in contamination of water, sediment, and prey resources.

Past and present timber harvest practices in both the upper Puyallup and upper White River watersheds have reduced the ability for riparian areas to provide wood and shade to the river and stream channels and continue to contribute fine sediments from road construction and landslides (Kerwin 1999). Loss of functioning riparian corridors combined with low flows in summer results in high water temperatures that can cause migration barriers and stress that can be lethal to adult and juvenile salmonids, as well as some of their prey resources (Lead Entity 2018).

Revetment and levee systems on portions of the White, Carbon, and Puyallup rivers have removed spawning and rearing habitat for salmon species. Other fish passage barriers including culverts, tide gates, diversion dams, and two hydroelectric facilities located throughout the watershed have further reduced available spawning and rearing habitats (Lead Entity 2018).

The watershed is crisscrossed with railroads, highways, roads, bridges, culverts, and tide gates that further impact habitat. These developments impact water quality via air-borne pollutants, industrial wastewater, stormwater runoff, and contaminated sediments from both past and current industrial activities. Altered flow regimes and extraction of groundwater, increased water temperatures, low dissolved oxygen, pH, nutrients, high turbidity and fine sediments further alter water quality (PRWC 2014).

Chapter Three: Subbasin Delineation

3.1 Introduction

WRIAs are large watershed areas formalized under Washington Administrative Code for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeologic regimes, levels of development, and variable natural resources. To allow meaningful analysis of the relationship between new consumptive use and offsets,[17] the plan divides WRIA 10 into subbasins. The plan uses the subbasins to 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. In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g. watershed divides) (Ecology 2019b).

3.2 Approach to Develop Subbasins

The plan divides WRIA 10 into seven subbasins to assess population growth, consumptive use, and project offsets.[18] The basic considerations in delineating subbasin boundaries for this planning process were:

- Areas of anticipated rural growth.
- Areas where few PE wells are expected.
- Surface hydrology and/or hydrogeology.

Other considerations were:

- Too few subbasins reduce the understanding of relationships between where pumping effects occur and where benefits of offset projects and actions occur.
- Too many subbasins can make it unwieldly to evaluate all of the offset projects and actions needed to achieve a NEB for the WRIA.
- Existing or concurrent planning efforts may have already delineated subbasins.
- Hydrogeologic subbasins (based on groundwater divides instead of surface water divides) can be more complex to delineate, since water in different aquifer units can travel in different directions, and a complete understanding of hydrogeology is lacking.
- Priority areas for salmon recovery.
- Lake Tapps and the location of the intake on the White River.

[17] "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 and actions. 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.

[18] 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).

The plan divides WRIA 10 into seven subbasins, as described in Section 3.3. A more detailed description of the subbasin delineation is in the technical memo available in Appendix F.

3.3 Subbasins

The WRIA 10 subbasin delineations are shown on Figure 3 and summarized below in Table 4:

Table 4 WRIA 10 Subbasins

Subbasin Name	Primary Rivers and Tributaries	County
Carbon River	Carbon River and Voight Creek	Pierce County
Lower Puyallup River	Puyallup River, Fennel Creek, Rody Creek, Clear Creek, Wapato/Simons Creek	Pierce County
Lower White River	White River	Pierce County and King County
Middle White River	White River, Clearwater River, Boise Creek	Pierce County and King County
South Prairie Creek	South Prairie Creek, Wilkeson Creek	Pierce County
Upper Puyallup River	Mowich River, North Puyallup River, South Puyallup River, Ohop Creek, Puyallup River. Kapowsin Creek	Pierce County
Upper White River	West Fork White River, Greenwater River	Pierce County and King County

The following section contains a brief description of the subbasins, salmonid presence, and limiting factors.

3.3.1 Carbon River

The Carbon River subbasin produces Chinook, Pink, Chum, and Coho Salmon and contains spawning areas for each of these species. Steelhead and Cutthroat Trout spawning, rearing, and migration are also present (SWIFD 2020; WDFW 2020). Bull Trout are present in the Carbon River subbasin; WDFW documented some spawning in the upper watershed in the mountains (Kerwin 1999; WDFW 2020).

Poorly designed and/or constructed culverts act as barriers to adult and juvenile salmonid migration on a few tributaries and act as total passage problems. Some are the result of low flows or represent partial barriers based upon water velocities (Kerwin 1999). Historical timber harvest activities have resulted in the loss of riparian old growth conifer trees that served as the source of short and long-term recruitment of functional sized wood pieces. The virtual lack of large woody debris is believed to be a limiting factor in providing channel stability and habitat necessary for successful salmonid production (Kerwin 1999; Puyallup River Watershed Council 2014).

3.3.2 Lower and Upper Puyallup

The lower and upper Puyallup River subbasins are inhabited by Chinook, Coho, Chum, and Pink salmon, as well as steelhead, Cutthroat Trout, and Bull Trout (SWIFD 2020; WDFW 2020). The Puyallup River Fall Chinook salmon and the White River Spring Chinook salmon use the Puyallup River, including the Puyallup River estuary and nearshore areas of Commencement Bay. Salmonids are present in habitat that supports their critical life history phases throughout the Puyallup-River in every month of the year (see Table 3).

The lower Puyallup River is generally contained in formal channelized banks and extensive levees with little to no bank cover or overhanging vegetation. Tidal influence extends about seven miles upstream from the mouth. Channelization and the loss of riparian and off-channel habitats have extensively altered the lower Puyallup River (Lead Entity 2018). Large woody debris is virtually absent in the lower Puyallup subbasin and river habitat lacks complexity. The extensive channelized nature of the mainstem of the Puyallup River through this reach serves as a salmonid transportation corridor with only limited rearing habitats available to salmonids (Kerwin 1999).

3.3.3 Lower, Upper, and Middle White

The White River is inhabited by Chinook, Coho, Chum, and Pink salmon, as well as steelhead, Cutthroat Trout, and Bull Trout (SWIFD 2020; WDFW 2020). The White River Spring Chinook is the only remaining spring Chinook salmon stock found in the South Puget Sound (PRWC 2014; Lead Entity 2018). The majority of documented spawning occurs in the larger clear water tributaries to the White River, including the Greenwater and Clearwater rivers, and Huckleberry and Boise creeks (PRWC 2014).

Downstream of Mount Rainier National Park boundary, the mainstem and many tributaries flow through industrial forestlands. There is a high road density in this timber production area. High road density can contribute to increased sedimentation, landslides, slope failures, changes in hydrology, and culverts preventing upstream migration in affected drainages (Marks et al. 2016). Mud Mountain Dam impedes natural habitat forming processes by blocking downstream input of large wood that starves the lower watershed of crucial habitat building materials (PRWC 2014).

3.3.4 South Prairie Creek

South Prairie Creek is one of the most important tributaries for salmon production in the Puyallup-White watershed (PRWC 2014). The South Prairie Creek subbasin contains important remaining spawning habitat for the watershed. Steelhead trout, Chinook, Pink, Coho and Chum Salmon all successfully reproduce within this subbasin (SWIFD 2020; WDFW 2020).

The lower 5 miles of South Prairie Creek and a 1-mile segment on Wilkeson Creek in the town of Wilkeson have been channelized and contained within levees (Kerwin 1999). These diked reaches have caused increased water velocities on the lower South Prairie and Wilkeson Creek channels and degraded salmonid habitat.

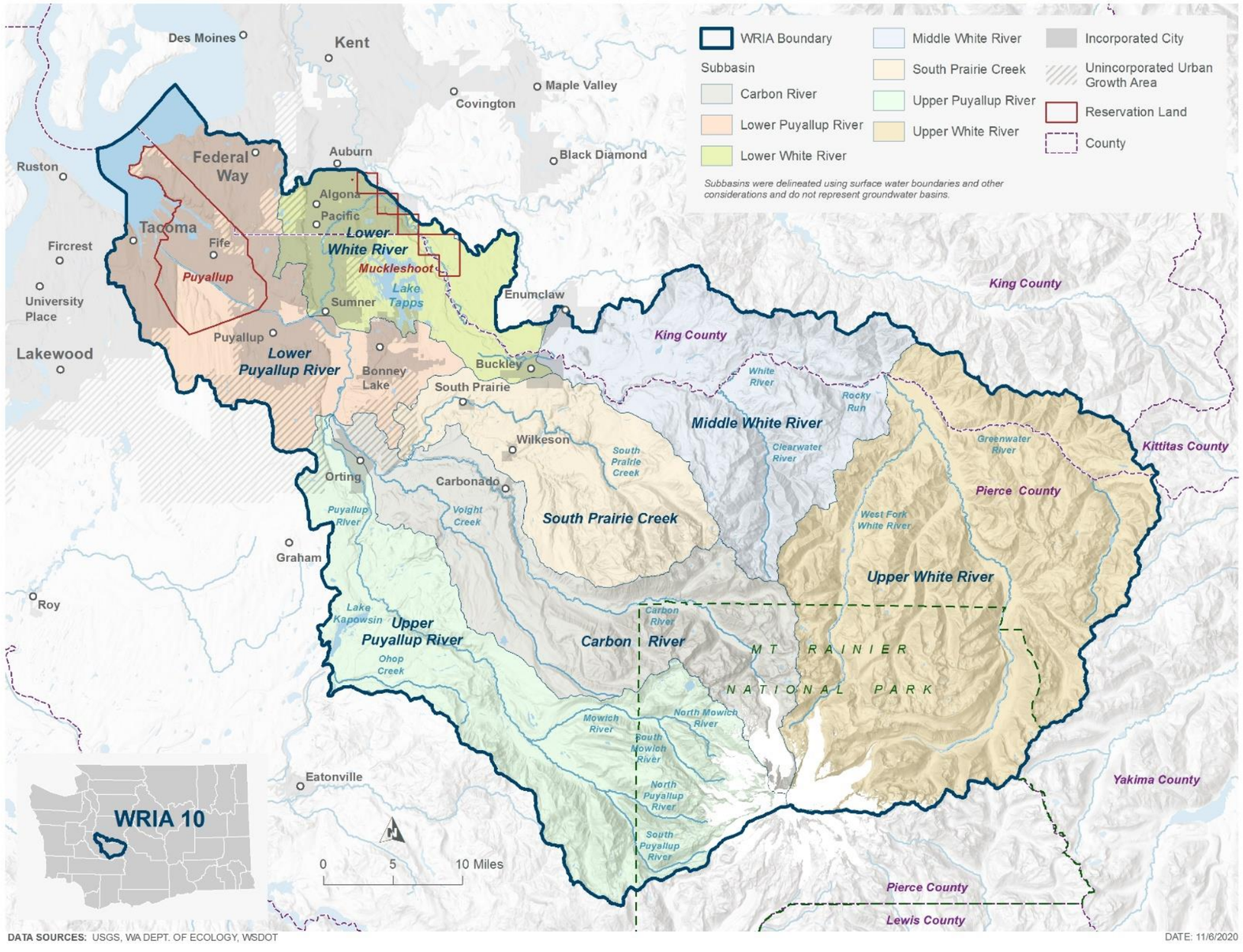

Figure 3 WRIA 10 WRE Subbasin Delineation

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 90.94.030(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". This chapter describes the projections of new PE well connections and their associated consumptive use for the planning horizon.[19] This chapter summarizes information from the technical memos (Appendices F and G) prepared for this plan.

4.2 Projection of PE Well Connections (2018–2038)

The plan projects 688 PE wells over the planning horizon. Installation of most of these wells is likely to occur in the urban fringe of the watershed between Enumclaw and Orting, and east of Lake Tapps.

The new PE wells projected over the planning horizon in WRIA 10 is part of the formula to estimate new consumptive water use. The methods were 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 10, the methods used to develop the projections, and the uncertainties associated with the projections.

4.2.1 PE Well Connections Projection by Subbasin

This watershed plan compiles growth projection data for Pierce and King counties at both the WRIA scale and by subbasin. The projection for new PE wells in WRIA 10 by subbasin is shown in Table 5 and Figure 4.

[19] New consumptive water use in this document is from projected new homes connected to PE 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.

Table 5 Number of PE Wells Projected between 2018 and 2038 for the WRIA 10 Subbasins

Subbasin	King County	Pierce County	Total
Carbon River	--	109	109
Lower Puyallup River	--	102	102
Lower White River	24	52	76
Middle White River	57	--	57
South Prairie Creek	--	167	167
Upper Puyallup River	--	165	165
Upper White River	--	12	12
WRIA 10 Total	**81**	**607**	**688**

Growth projections resulted in approximately 81 new PE wells in unincorporated King County within WRIA 10 and approximately 607 PE wells within incorporated cities and unincorporated areas of WRIA 10 in Pierce County over the planning horizon. The total projection for WRIA 10 is 688 new PE wells.

4.2.2 Methodology

This plan uses a different method for calculating the PE well projections within each county based on available data and county preference. The King County-based projections use historical building permit data and the Pierce County-based projections use historical well permit data. Both of these methods are summarized in this section. WRIA 10 Permit-Exempt Growth and Consumptive Use Summary (Appendix G) offers a more detailed description of the methods incorporated into this plan.

Growth Projection Methodology within King County

Historical building permit data from 2000 through 2017 were used to project the number of new PE wells for the planning horizon in unincorporated King County. This data set considers economic and building trends over an 18-year period and the methodology assumes that past trends will continue.

The number of new PE wells over the planning horizon using the following steps summarized from the King County Growth Projections Memo 2019 (Appendix G):

1. Compile 18 years (2000-2017) of building permit data for new residential structures and separate into public, private, and unknown water sources. Consider a building permit with water source listed as “private” as a PE well.
2. Calculate the annual average number of PE wells.
3. Estimate the total number of PE well connections anticipated over the 20-year planning horizon by multiplying the annual average number of PE wells by 20.
4. Allocate the new PE wells within each subbasin. Use GIS to assess potential areas for future residential development dependent on PE wells.

Growth Projection Methodology within Pierce County

The method for Pierce County used PE well installation data from the Tacoma-Pierce County Health Department (TPCHD) between 1999 and 2018 to project the number of new PE wells in the planning horizon. This method has several advantages:

- The TPCHD location data is accurate to parcel level and includes individual, shared, and Group B wells.[20]
- The database includes all wells in the county, including wells constructed within city limits and within Group A water service area boundaries.
- This dataset includes attributes such as the year the well was installed and the parcel on which the well was installed.

The following steps to project growth of PE well connections over the planning horizon were used:

1. Calculate historical growth rates of PE wells for each subbasin using the TPCHD well database (1999–2018).
2. Project future PE wells by subbasin for the planning horizon, based on the subbasin-specific historical growth rate.

4.2.3 Summary of Uncertainties and Scenarios

The methods described above for projected new PE wells include a number of uncertainties and limitations. The Committee discussed these uncertainties and recognized that uncertainties are inherent to the planning process. This section presents the uncertainties and limitations considered during the planning process and the steps taken to address or acknowledge the uncertainties.

One limitation is that the projection for King County does not account for PE wells installed within city limits. Although most cities require new homes to connect to water systems, they allow exceptions (for instance, if a home is more than 200 feet from a water line). This limitation is counteracted by the understanding that water lines and water service areas continue to expand. This limitation did not apply in Pierce County because PE well data included both incorporated and unincorporated areas.

The projections for both Pierce and King Counties relied on historical data. Areas that were not served by public water in 2000 might be served now or within the planning horizon, shrinking the areas where PE wells can still be installed. Since water line data is not readily available, the Committee was not able to compare actual water lines with the historical data to see where the water service has expanded in the past 20 years.

[20] The TPCHD permits PE wells during the subdivision and building permit process. TPCHD imposes limits on well withdrawals that are lower than the 950 gallon limit for subdivision projects. Based on their information, average water use is 400 gallons per day. TPCHD allows up to 12 lots in a subdivision if each lot is served by an individual well. Those wells are limited to using 400 gallons per day. Subdivisions served by Group B PE wells can have up to six connections and each connection can use up to 750 gallons per day.

The methods assumed that historical growth trends would continue into the future. However, many factors play into homebuilding trends. To acknowledge this uncertainty, the Committee developed PE well growth rates using different time-periods in the historical TPCHD well database. These time periods reflected the rapid rural development from 1999-2008 and the slower rural development from 2009-2018 (Table 6). Ultimately, this plan uses the projection based on the full historical record (1999-2018) because this moderate projection captured likely variations of development trends over the planning horizon.

Table 6 Number of PE Well Connections Projected between 2018 and 2038

Subbasin	Moderate Growth (1999-2018)			High Growth Scenario (1999-2008)			Low Growth Scenario (2009-2018)		
	King	Pierce	Total	King	Pierce	Total	King	Pierce	Total
Carbon River	--	109	109	--	142	142	--	87	87
Lower Puyallup River	--	102	102	--	153	153	--	53	53
Lower White River	24	52	76	24	67	91	24	42	66
Middle White River	57	--	57	57	--	57	57	--	57
South Prairie Creek	--	167	167	--	229	229	--	122	122
Upper Puyallup River	--	165	165	--	242	242	--	104	104
Upper White River	--	12	12	--	4	4	--	20	20
Total	**81**	**607**	**688**	**81**	**838**	**919**	**81**	**429**	**510**

4.2.4 Spatial Distribution of New PE Wells

This plan maps potential locations of new PE wells in the watershed based on parcels available for rural residential development to validate the PE well projection. These parcels are outside of Urban Growth Areas, outside of water and wastewater system boundaries, vacant, currently zoned for residential development, and not located within a commercial or national forest. The resulting map (Figure 4) shows the most likely areas that new residential development dependent on PE wells will occur. Most opportunity for new PE wells is within the unincorporated areas adjacent to the urban growth areas.

4.2.5 Projected Growth Map

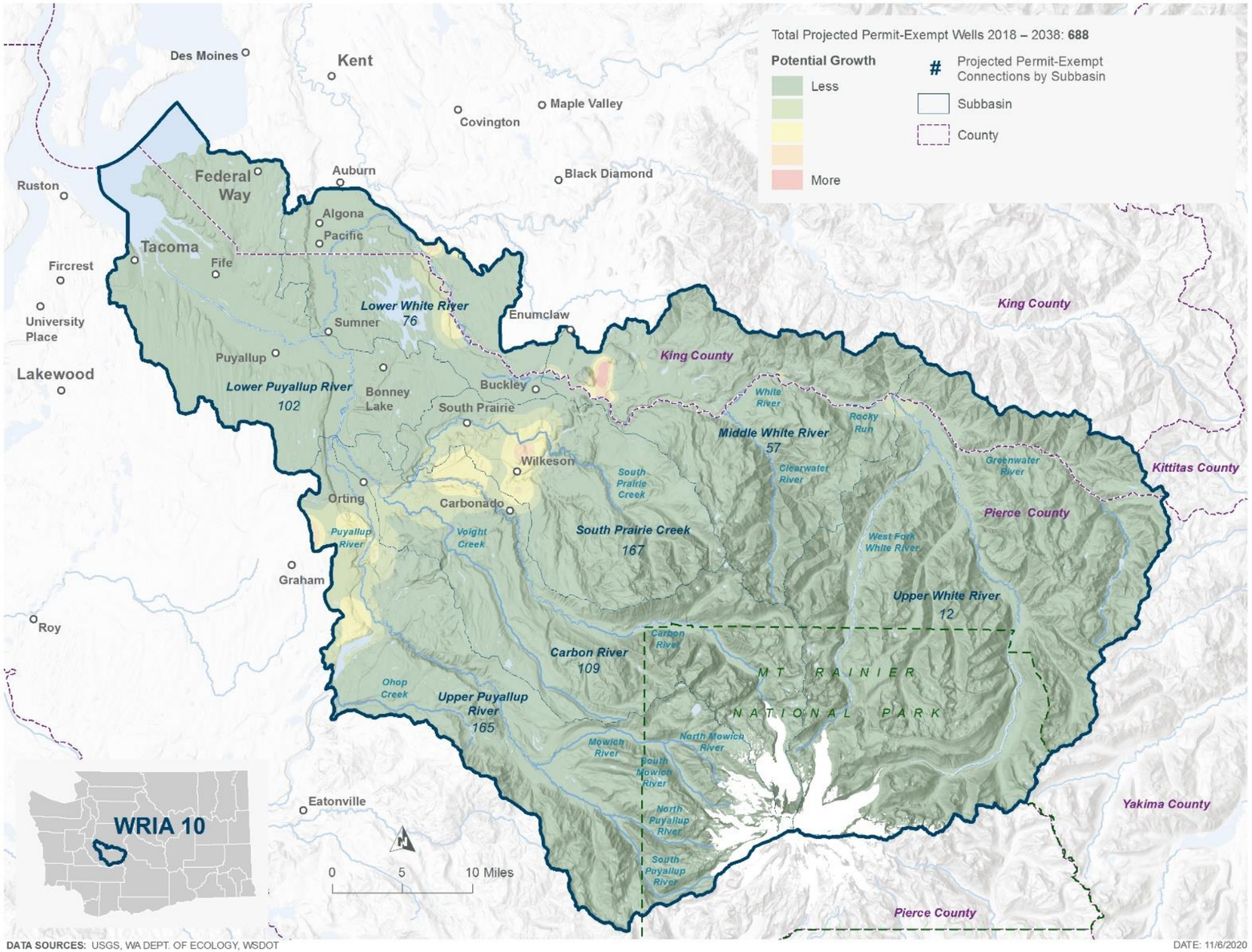

Figure 4 WRIA 10 WRE Distribution of Projected PE Wells

4.3 Impacts of New Consumptive Water Use

The plan uses the moderate projection of new PE wells (688) to estimate the consumptive water use that this watershed plan must address and offset. At the end of the planning horizon (i.e., 2038) the analysis estimated 277.4 acre-feet per year (0.38 cfs) of new consumptive water use in WRIA 10. This section includes an overview of the method used to estimate new consumptive PE well water use (consumptive use), an overview of the anticipated impacts of new consumptive PE well use in WRIA 10 over the planning horizon, and other considerations, such as assumptions and uncertainties.

Consistent with the Final NEB guidance, the plan assumes impacts from consumptive use on surface water are steady-state, meaning impacts to the stream from pumping do not change over time. This assumption is based on the wide distribution of future PE well locations and depths across varying hydrogeological conditions. As Appendix B of the Final NEB Guidance notes, the lag time between when the pumping occurs and when it impacts the stream makes estimating the temporal impacts of PE wells complicated to estimate.

The WRIA 10 Permit-Exempt Growth and Consumptive Use Summary provides a more detailed description of the analysis and alternative scenarios considered (Appendix G).

4.3.1 Methodology to Estimate Indoor and Outdoor Consumptive Water Use

Indoor water use patterns differ from outdoor water use. Indoor use is generally constant throughout the year, while outdoor use occurs primarily in the summer months. The portion of water that is consumptive varies for indoor and outdoor water use. Appendix A of the Final NEB Guidance describes a method (referred to in this plan as the Irrigated Area Method) which assumes average indoor water use per person per day, and reviews aerial imagery to provide a basis to estimate irrigated area of outdoor lawns and gardens. The Irrigated Area Method accounts for indoor and outdoor consumptive use variances by using separate approaches to estimate indoor and outdoor consumptive use.

To calculate the consumptive use estimate, the analysis used the Irrigated Area Method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance (Ecology 2019b).

To understand the full range of potential water use in WRIA 10, the analysis includes consumptive use estimates based on water system data and the legal withdrawal limit.[21] Some individual homeowners use water approaching or surpassing the legal limit during irrigation season.[22] Other homeowners do not irrigate at all. The Committee determined that these calculations did not accurately portray PE well water use in the watershed. The Committee considered the legal withdrawal limit was too much water for most homeowners to use each

[21] Legal withdrawal limits from PE wells in WRIA 10 are defined in RCW: "an applicant may obtain approval for a withdrawal exempt from permitting under RCW 90.44.050 for domestic use only, with a maximum annual average withdrawal of nine hundred fifty gallons per day per connection" RCW 90.94.030(4)(a)(vi)(B)

[22] Covington Water System data shows individuals using up to 2,673 gallons per day during the irrigation season.

day. Since there are costs associated with water systems, and water systems actively employ water conservation incentives, the Committee assumed that the water system data was most likely an underestimate of PE well water use. These calculations are provided in Appendix G.

New Indoor Consumptive Water Use

Indoor water use refers to the water that households use in kitchens, bathrooms, and laundry (USGS 2012). The plan uses Ecology's recommended assumptions for indoor daily water use per person and local data to estimate the average number of people per household, and then applied Ecology's recommended consumptive use factor (CUF) to estimate new indoor consumptive water use (Ecology 2019b).

- 60 gallons per day (gpd) per person.
- 2.5 persons per household assumed for rural portions of WRIA 10 (OFM 2020).
- 10 percent of indoor use is consumptively used (or a CUF of 0.10), based on the assumption that homes on PE wells are served by on-site sewage systems. On-site sewage systems return most wastewater back to the immediate water environment; a fraction of that water is lost to the atmosphere through evapotranspiration in the drainfield.

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

60 gpd x 2.5 people per house x 365 days x 0.10 CUF

This calculation results in an annual average of 15 gpd, or 0.017 AF[23] (0.000023 cfs[24]) indoor consumptive water use per PE well.

New Outdoor Consumptive Water Uses

Most outdoor water irrigates lawns, gardens, and landscaping. 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 on-site sewage systems, but instead infiltrates into the ground or is lost to the atmosphere through evapotranspiration (Ecology 2019b).

Aerial imagery was used to measure the irrigated areas of 80 randomly selected parcels served by PE wells to develop an average outdoor irrigated area. This analysis returned a large number of parcels with no visible irrigation; these parcels were assigned irrigated area values of zero. To account for undetected irrigation or potential outdoor water use other than irrigation, the analysis replaced the zero values with a value of 0.05 acres. An imputed value of 0.05 acres was used because that was the lower end (i.e., < 10th percentile) of measurable irrigated areas in WRIA 10. Using the replacement value of 0.05 acres, the average (sample mean) irrigated area for the 80 randomly selected parcels was 0.21 acres. The analysis then calculates the 95 percent

[23] Acre-Foot is a unit of volume for water equal to a sheet of water one acre in area and one foot in depth. It is equal to 325,851 gallons of water. One acre-foot per year is equal to 893 gallons per day.
[24] Cubic feet per second (cfs) is 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. One cubic foot per second is equal to 646,317 gallons per day.

upper confidence limit (UCL)[25] of the sample mean to account for uncertainty associated with the limited survey of parcels with existing PE wells. The 95 percent UCL equaled 0.27 acre. This method is further described in Appendix G.

The analysis used following assumptions, recommended in the NEB Guidance, to estimate outdoor consumptive water use:

- Crop irrigation requirements (IR) for turf grass according to Washington Irrigation Guide (WAIG) (NRCS 1997): 16.01 inches per year (weighted average of Buckley and Puyallup WAIG stations). This value represents the rate of watering needed for commercial growth turf grass (see Section 4.3.2 for further discussion).
- An irrigation application efficiency (AE) to account for water that does not reach the turf: 75 percent. This increases the amount of water used to meet the crop's irrigation requirement by 25 percent.
- Consumptive use factor of 0.8, reflecting 80 percent consumption for outdoor use. This means 20 percent of outdoor water is returned to the immediate water environment.
- Outdoor irrigated area based on existing homes using PE wells: 0.27 acre (95 percent UCL from the statistical analysis of irrigated area of existing homes).

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

16.1 IR (inches)/12 (inches per foot)/(0.75 AE) x 0.27 (acre) x 0.80 CUF

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

This calculation results in an annual average of 345 gpd, or 0.386 AF (0.000535 cfs) outdoor consumptive use per PE well.

The annual average consumptive water totals 360 gpd or 0.403 AF (0.00056 cfs) per PE well for the WRIA. This is an average for the year, however the plan expects that more outdoor water use will occur in the summer than in the other months. The outdoor consumptive use varies by subbasin due to different irrigation requirements across the watershed.

4.3.2 Uncertainties and Limitations

The Irrigated Area Method contains a number of uncertainties and limitations. The Committee discussed these uncertainties and limitations and accepted that the estimates produced by the analysis were satisfactory for projecting consumptive water use in the WRIA. This section describes the uncertainties and limitations, and the actions taken to resolve, address, or acknowledge those uncertainties and limitations.

[25] The 95 percent UCL is the sample mean plus the 95 percent confidence error. Therefore, there is a 95 percent chance that the true mean is equal to or less than the 95 percent UCL.

To reduce uncertainty, the analysis relied on existing data to the extent possible, such as the average number of people per household and information from studies that estimate average indoor water use per person.

The outdoor consumptive use calculation contains the most uncertainty. Some Committee members voiced concern on the lack of scientific rigor in the outdoor irrigated area analysis. The average outdoor irrigated area analysis relied on a sample size of 80 parcels distributed by location and property values. This small sample size relative to the number of parcels within WRIA 10 could lower the scientific certainty of the results. To acknowledge the concern, the Committee calculated the 95 percent upper confidence limit under the assumption that the average irrigated area would likely be lower than the 95 percent upper confidence limit. Using the 95 percent upper confidence limit likely resulted in a conservative estimate of consumptive use.

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 according to the Washington Irrigation Guide). The irrigated area analysis demonstrated that many people irrigate their lawns enough to keep the grass alive through the dry summers, not at the levels that commercial turf grass requires. Therefore, this plan assumes that the analysis for outdoor consumptive use was likely an overestimate.

The analysis accounted for the uncertainties, assumptions, and limitations in this method by using outdoor irrigation values at the high end of their ranges. This included assigning an irrigated lawn size of 0.05 acres to parcels with no detected irrigation, using the upper limit of the 95 percent confidence interval for outdoor irrigated area, and assuming water use rates necessary for commercial growth of turf grass. This approach provides assurance that if projects and actions in the plan are successfully implemented, the projects will offset more than the actual water consumed.

4.3.3 Summary of Consumptive Use Estimates

The total consumptive use estimate for WRIA 10 is 277.4 acre-feet per year and 0.38 cubic feet per second. This amount is equivalent to 360 gallons per day per PE well. The total consumptive use estimate for WRIA 10 is the PE well projection (Section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. Table 7 summarizes the estimated indoor and outdoor consumptive use by subbasin. The highest consumptive use is expected to occur in the subbasin with the most projected new PE wells, as presented in Figure 5.

Table 7 Indoor and Outdoor Consumptive Use Estimates by Subbasin

Subbasin	Projected PE wells	Indoor CU		Outdoor CU		Total CU/year in 2038	
		Acre-feet per year	Gallons per day	Acre-feet per year	Gallons per day	Acre-feet per year	Gallons per day
Carbon River	109	1.83	1,634	42.11	37,593	43.9	39,191
Lower Puyallup River	102	1.71	1,527	39.41	35,183	41.1	36,692
Lower White River	76	1.28	1,143	29.36	26,211	30.6	27,318
Middle White River	57	0.96	857	22.02	19,658	23.0	20,533
South Prairie Creek	167	2.81	2,509	64.52	57,600	67.3	60,082
Upper Puyallup River	165	2.77	2,473	63.75	56,912	66.5	59,367
Upper White River	12	0.20	179	4.64	4,142	4.8	4,285
TOTAL	**688**	**11.6**	**10,356**	**265.8**	**237,291**	**277.4**	**247,647**

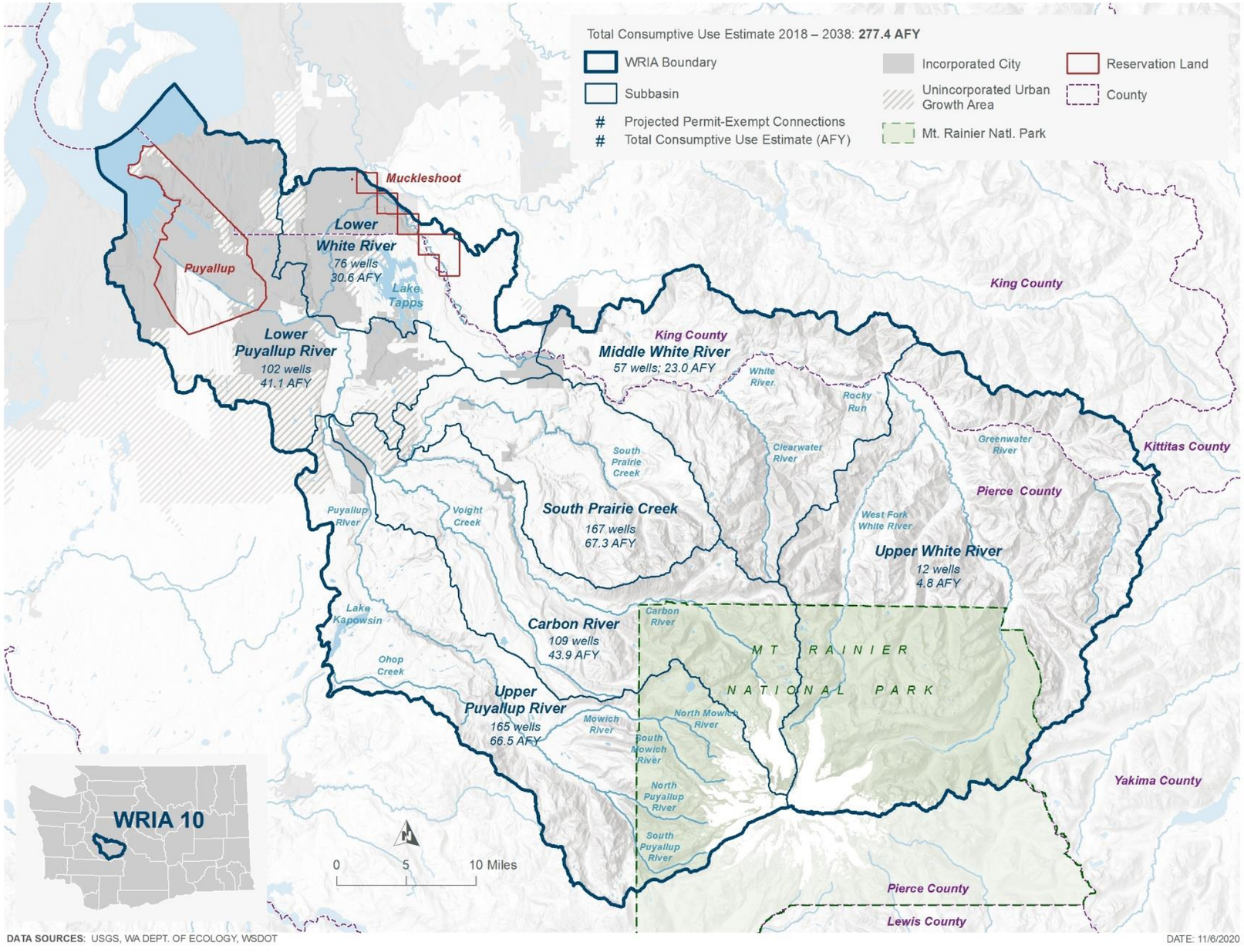

Figure 5 WRIA 10 Consumptive Use Estimate by Subbasin

Chapter Five: Projects and Actions

5.1 Description and Assessment

Watershed plans must identify projects that offset the potential impacts future PE wells will have on streamflows, and provide a NEB to WRIA 10. This chapter classifies projects as water offset projects, habitat projects, and programmatic actions. Water offset projects contribute to offsetting consumptive use. Habitat projects contribute toward achieving NEB by focusing on actions that improve the ecosystem function and resilience of aquatic systems, support the recovery of threatened or endangered salmonids, and protect instream resources including important native aquatic species. Habitat projects may also result in an increase in streamflow, but the water offset benefits for these projects are difficult to quantify with a high degree of certainty. Therefore, the plan does not rely on habitat projects to contribute toward offsetting consumptive use, however it recognizes they are still of value and therefore should be included in the plan. Programmatic actions are non-capital projects that are implemented at a subbasin or larger scale, increase knowledge of water use in the WRIA, and contribute to water conservation. While some of the programmatic actions may contribute to a lower overall consumptive use in the watershed, the benefits of these actions are widely dispersed and difficult to quantify. This chapter provides recommendations for projects to offset consumptive use and meet NEB.

To identify the projects summarized in this chapter, as well as the complete project inventory in Appendix H, Committee members and partners brought project suggestions forward to the workgroup and Committee for discussion. Potential projects with likely streamflow and habitat benefits came from the Puget Sound Action Agenda and salmon recovery lead entity four-year work plans. The Committee tracked all project ideas, no matter their phase of development, throughout the planning process. Ecology sought feedback on projects that align with other planning processes from Committee members that also represented the conservation district, PWR-LIO, and salmon recovery lead entity in WRIA 10.

The plan focuses on water right acquisition projects and other direct water replacement projects when available. Section 5.2.1 provides details on these water offset projects. The Committee focused on projects or project phases planned for future construction, and removed projects that did not directly contribute to water offset or NEB. The plan does not include projects that conflicted with current laws, rules, or case law. At any point in the process, Committee members or partners could identify concerns and recommend removal of specific projects from the project inventory. The Committee identified a subset of projects (at least one in each subbasin) for the technical consultants to develop detailed analysis on, including the offset value to attribute to each project as applicable.

5.2 Projects

The projects presented below have quantifiable streamflow benefit or habitat improvement and the Committee identified these projects as having the greatest potential for implementation and meeting NEB. The complete project inventory in Appendix H includes other projects that benefit streamflow and habitat in WRIA 10, but which the Committee did not have

the time and resources to further develop and assess within the given timeline. The Committee recommends implementation of all projects included in this chapter and Appendix H.

5.2.1 Water Offset Projects

This plan includes projects that the WRIA 10 Committee members support and consider feasible to accomplish within the planning horizon. Table 8 provides a summary of the water offset projects considered necessary to offset the consumptive use from PE wells over the planning horizon.

The plan focuses primarily on water right projects because water rights placed in permanent trust provide reliable, durable, and legally protected offsets. Several Committee members and partners identified potential water right acquisition opportunities throughout the watershed that would provide sufficient offset. The Tribes, WDFW, and salmon recovery lead entity developed a list of 10 priority streams to focus water right acquisition assessments (Appendix J).

Ecology contracted with Washington Water Trust (WWT) to identify opportunities for water right acquisition water offset projects within WRIA 10 and to develop information on Committee-identified water rights. In coordination with the Committee, WWT developed a water right selection criterion based on the unique local nature of water rights and water use in WRIA 10. The assessment focused on water rights within the 10 priority streams and outside of the agriculture and rural resource zoning districts. The water rights assessment consisted of four categories of potential projects: irrigation water rights in priority subbasins, irrigation water rights near existing reclaimed water infrastructure, water rights in the Trust Water Rights Program as a temporary donation, and specific water right acquisition opportunities identified by Committee members. WWT developed eleven water right acquisition project opportunity profiles for plan consideration.

Committee members conducted outreach to water right acquisition opportunities to assess the interest of the water right holder to be included in the project list. Due to the sensitive nature of water rights, only water rights with ongoing outreach are referred to by a project name. Several water rights within this list are in the process of being transferred to the project sponsor or associated with properties identified for acquisition as part of long-term planning processes.

This project list includes several levee setback and floodplain reconnection projects. While these projects may involve some additional infiltration and water storage during high flows, the Committee expressed concerns about estimating the storage and offset benefit, and opted not to count those benefits toward the project offset. However, the Committee recognized that these projects include large property acquisitions and decommissioning of existing PE wells. This plan counts the removal and decommissioning of PE wells towards the offset total.

Finally, the Committee searched for opportunities for Managed Aquifer Recharge (MAR) and other infiltration projects. MAR projects capture water from seasonal high flows and allow the water to slowly infiltrate through groundwater back to the stream, augmenting streamflows

during low flows. A search within the Carbon and Upper Puyallup subbasins[26] for geology favorable for MAR infiltration did not yield any suitable sites. After much consideration, the Committee looked at the possibility of using municipal water as a source for MAR projects, and basing potential locations at gravel pits along the Tacoma Water pipeline. This search yielded three potential locations for an MAR project.

The water offset projects listed in this plan are sorted into tiers. Tier 1 projects represent projects with the greatest certainty of being implemented. These projects have specific locations, project sponsors, and in some cases are already underway. Tier 2 projects have less certainty because they are less developed, lack project sponsors, or lack specific locations at this time. The Tier 1 projects will offset the consumptive use in WRIA 10. The water offset estimates from the Tier 2 projects provide reasonable assurance that the plan can meet NEB if Tier 1 offsets are not realized. The projects in this plan provide an estimated 788.3 acre-feet per year in offsets, more than double the consumptive use estimate of 277.4 acre-feet per year. Tier 1 projects provide an estimated 375.3 acre-feet per year in offsets. Figure 6 shows the locations within the watershed of the Tier 1 and Tier 2 projects.

[26] The Upper Puyallup and Carbon Rivers are not closed to surface water appropriation per WAC 173-510

Table 8 WRIA 10 Offset Projects

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier
Carbon River (CR)							
10-CR-W4	Alward Road	Levee Setback. Property acquisition and restoration of 150 acres of floodplain. Includes decommission of 20 PE wells	8	Year-round	Restoration of 150 acres of floodplain, flood hazard reduction	Pierce County	1
10-CR-W3	Carbon River Levee Setback and Acquisition	Water Right and Levee Setback. Purchase a property as part of a larger levee setback project and acquire associated water right.	14.3	Irrigation Season	Habitat restoration.	Pierce County	2
Lower Puyallup (LP)							
10-LP-W6	Potential MAR	MAR. Construct an MAR in a gravel pit supplied with Tacoma Water. Three potential locations are identified in the Lower Puyallup.	300	Year-round		TBD	2
10-LP-W10	Bond	Water Right. Acquire water right as part of a larger property transfer and protection with the City of Puyallup	30	Irrigation Season		City of Puyallup	2
Middle White (MW)							
10-MW-W7	CWA purchase	Water Right. Acquire a portion of the Cascade Water Alliance water right to place in trust.	277	Year-round		Potential: Ecology or partners	1
South Prairie Creek (SPC)							
10-SPC-W2	Old Inglin Dairy	Water Right. Floodplain restoration of former dairy, and place water rights into trust after plants are established.	89.09	Irrigation Season	Floodplain restoration/reconnection, habitat enhancement.	Pierce Conservation District	1
Upper Puyallup (UP)							

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier
10-UP-W1	Orville Road Revetment Phase 2C Year 1	Floodplain Reconnection/Levee Setback. Purchased and decommission a PE well that served 3 homes as part of this project.	1.2	Year-round	Habitat restoration. 1,500 Linear Feet of setback revetment, 19 engineered log jams.	Pierce County	1
WRIA-Wide (WW)							
10-WW-W8	Green Stormwater Infrastructure	Stormwater infiltration. Support Green Stormwater Infrastructure retrofits for both individual property owners and jurisdictions. Goal of 10 projects per year.	27	Year-round	Water quality improvements	Pierce Conservation District	2
10-W9-W17	WWT assessment	Water Right. Acquire 10% of the water rights identified through Washington Water Trust assessment. These rights are listed individually in this table.	41.71	Irrigation Season		TBD	2
		WRIA 10 Total Water Offset	**788.3**				
		WRIA 10 Consumptive Use Estimate	**277.4**				
		Tier 1 Offsets	**375.3**				

Carbon River Subbasin

Project Name: Alward Road Acquisition and Restoration

Project Description: Pierce County proposes to acquire property, construct a setback levee and make other restoration improvements which will reconnect 150 acres of floodplain adjacent to the Carbon River. The acquisition area of the proposed project is located between river miles 6.8 and 8.0 of the Carbon River. Proposed actions at the site include removing approximately 8,925 linear feet of existing levee located along the left (south) bank of the Carbon River. An armored levee of approximately 9,850 linear feet would be constructed and set back from the Carbon River to the south, encompassing an area of approximately 142 acres. Engineered log jams (ELJs) would be constructed alongside Alward Road to protect it from erosion. Riparian restoration would also occur in floodplain areas. The habitat benefits of this project include reconnecting previously disconnected floodplain, increasing fish habitat diversity in the lower Carbon River, and restoring channel forming processes in the reach.

A total of 30 properties will be acquired as part of this project. Outreach has occurred and landowner agreements have been signed for 10 properties in Phase 3 of the project. Additional outreach will occur in subsequent phases. An estimated 20 residential structures will be acquired and removed, providing an estimated water offset benefit equal to 20 new PE wells, or 8 acre-feet per year. This project is Tier 1 because it is underway and expected to continue to be implemented.

Project Name: Carbon River Future Levee Setback and Acquisition.

Project Description: Pierce County is currently conducting a feasibility study to increase flood protection and improve fish habitat conditions on the Carbon River near Bridge Street and Voights Creek. Elements of this project include selecting a preferred alternative, designing the project, acquiring properties, building a setback levee, adding habitat elements in the floodplain, and removing the existing levee. The habitat benefits of this project include reconnecting previously disconnected floodplain, increasing fish habitat diversity in the lower Carbon River, and restoring channel forming processes in the reach.

As part of the project, Pierce County anticipates acquiring a property and associated water rights upstream of river mile 4.4. The property is associated with a water right certificate. WWT used irrigation delineation analysis to estimate 9.71 acres have been irrigated in recent years. Using the same calculation that estimated this plan's consumptive use, this water right would be able to offset an estimated 14.3 acre-feet per year. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology is required to determine the actual quantity available for acquisition.

This project is Tier 2 because landowner outreach has lost momentum. Due to the sensitive nature of property and water right acquisition negotiations and the timing of this plan, this plan does not identify the specific location or property owner. Pierce County as expressed interest in placing the water right in permanent trust once the property is acquired.

Lower Puyallup Subbasin

Project Name: Managed Aquifer Recharge

Project Description: This project would construct a passive MAR project using source water from Tacoma Water pipeline to recharge a significant volume of water into shallow aquifers. In WRIA 10, a review of potential sites focused on gravel pit sites near the City of Tacoma pipeline. All of the potential sites are located in the Lower Puyallup River subbasin.

Preliminary calculations of the potential size and infiltration capacity if a suitable gravel pit site is located were performed. A MAR facility may only need a footprint of 2 acres to infiltrate 300 acre-feet per year. It was assumed that diversion and infiltration would occur during winter months as the City of Tacoma pipeline has excess capacity during winter. A flow rate of 1 cfs (450 gallons per minute) would be required from the City of Tacoma pipeline to infiltrate 300 acre-feet during the winter season. If several sites are feasible, the selection of how many are used and how much water is infiltrated at each would be a decision of the project sponsor. MAR facilities provide year-round benefits. A MAR project can be scaled to the desired water offset or streamflow benefit. The amount and timing of water infiltrated can also be adjusted to time streamflow benefits to maximize benefits for fish. This project is Tier 2 because it is conceptual and does not yet have a sponsor or specific location.

Project Name: Bond Water Right

Project Description: The City of Puyallup proposes to purchase a water right as part of a larger property transfer to the city for conservation and protection purposes. The property has been used in the past as a berry farm. In 1970, Ecology issued a groundwater water right certificate for 150 gallons per minute and 30 acre-feet a year from May 1 to October 1 to irrigate 25 acres.

The City of Puyallup has conducted initial outreach to the water right holder and has expressed interest in placing the water right into permanent trust once the property transfer is complete. This project is Tier 2 because the water use history is unknown. An extent and validity determination by Ecology is required to determine the actual quantity available for acquisition.

Middle White Subbasin

Project Name: CWA Water Right Acquisition

Project Description: This project would acquire and place into trust a portion of the municipal water right from the Cascade Water Alliance (CWA). CWA supplies water for several municipalities in King County. CWA has expressed willingness in working with Ecology for the purchase and transfer into permanent trust a small portion of their water right. The water is diverted from the White River at river mile 24.3, held in Lake Tapps and released at river mile 3.6.

This project is Tier 1 because the water right went through extent and validity in 2000. Ecology is currently in discussion with CWA on acquiring a small portion of the water right. The barriers to completion are negotiation of the acquisition and funding to purchase the water right. The project would have lasting benefits as the Trust Water Right would be held in perpetuity.

South Prairie Creek Subbasin

Project Name: Old Inglin Dairy Restoration and Water Right Acquisition

Project Description: The Pierce Conservation District (PCD) proposes to restore the Old Inglin Dairy property, located near the town of South Prairie, to functioning floodplain of South Prairie Creek. The restoration phase of the project includes planting and other habitat enhancements. Once the plants are established (about 3-5 years after planting), PCD proposes to place two water right certificates into permanent trust. South Prairie Creek is the source of both water rights and the purpose is irrigation. PCD currently uses the water right to irrigate plants in preparation and maintenance of riparian and floodplain plants.

WWT used irrigation delineation analysis to estimate consumptive use of 89.09 acre-feet per year. An extent and validity determination by Ecology is required to determine the actual quantity available for acquisition. This project is Tier 1 because PCD has expressed interest in selling the water rights into permanent trust once the restoration project is established, which will occur in three to five years.

Upper Puyallup Subbasin

Project Name: Orville Road Revetment Phase 2C Year 1

Project Description: Pierce County will continue a setback revetment project along left bank of the Puyallup River between river miles 27.8 and 28.2. Work under this phase will add 1,500 linear feet of setback revetment and 19 engineered log jams. This project will also decommission one PE well that served three homes, providing an offset of 1.2 acre-feet a year, or 0.4 acre-feet a year per home. This project is Tier 1 since this project is underway, the County has purchased the property, and there is high certainty that this offset will occur.

WRIA-Wide Offset Projects

Project Name: Various Water Right Acquisitions

Project Description: Acquire water rights included in the Washington Water Trust (WWT) water right assessment. WWT conducted a rapid water rights assessment on eleven rights that fit the criteria identified by the WRIA 10 Committee. The assessment estimated that these eleven water rights would provide a total offset of 417.1 acre-feet per year. This project is Tier 2 because no project sponsor or outreach has been conducted on these water rights, although some WRIA 10 Committee members have expressed willingness to sponsor a project or conduct outreach when an opportunity arose.

To account for the uncertainty and the state of outreach for these water rights, this plan only counts ten percent of the total offset estimate, or 41.7 acre-feet per year. The WWT assessment report is included in Appendix I.

Project Name: Rain Gardens and Green Stormwater Infrastructure

Project Description: Pierce Conservation District has proposed to implement a program of rain garden and Green Stormwater Infrastructure (GSI) construction. This type of project could be applied to existing roofs and driveways, roadways, parking lots and other impervious areas that generate stormwater. The techniques include rain gardens, planter boxes, bio-infiltration swales, permeable pavement and reducing the footprint of roadways and replacing with GSI (green streets).

The Pierce Conservation District is ready to proceed immediately if the program was supported and funded. The number of facilities may vary depending on finding suitable areas to retrofit, funding, and capacity of Pierce Conservation District, which is why this project is a Tier 2 project. This plan assumes 10 facilities installed per year. Assuming an offset volume of 0.15 acre-foot per rain garden, this project would provide an offset value of 27 acre-feet per year after 18 years of installing facilities.

Map No.	Project No.	Project Name	Water Offset (ac-ft)	Project Type
A	10-UP-W1	Orville Road Revetment Phase 2C Year 1	1.2	Tier 1
B	10-SPC-W2	Old Inglin Dairy	89.1	Tier 1
C	10-CR-W4	Alward Road	8.0	Tier 1
D	10-MW-W7	CWA Transaction	277.0	Tier 1

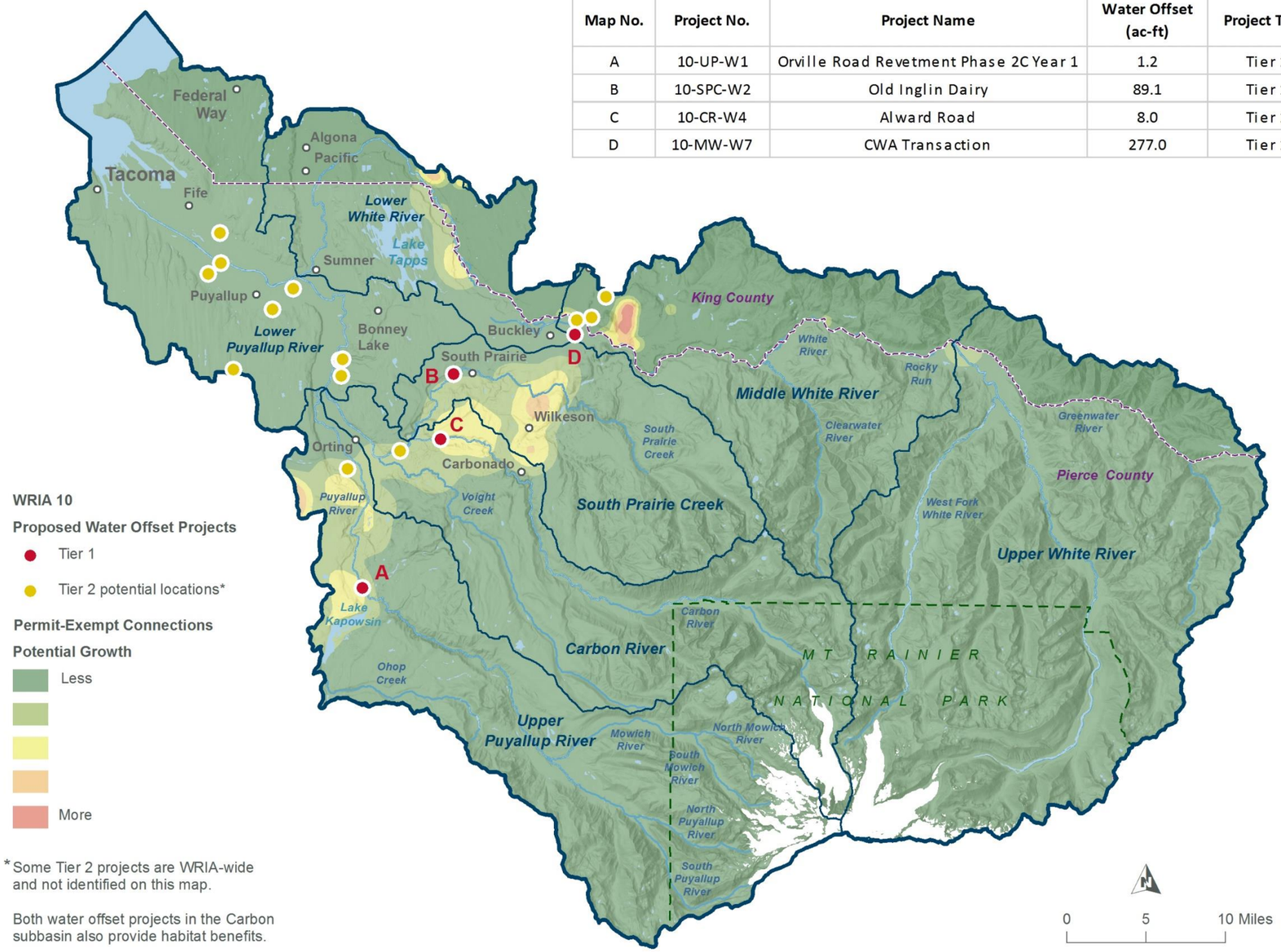

Figure 6 WRIA 10 Water Offset Projects

5.2.2 Habitat Projects

The Committee set the goal of including in the plan at least one habitat project in each subbasin. Table 9 lists the habitat projects. The Committee selected several habitat projects to provide more detail for this plan. Some of these projects were selected because they have the potential to contribute water offset, and others were selected to highlight the types of habitat projects included in this plan. This section includes a summary of those descriptions and Appendix H includes the detailed project descriptions. The Committee did not tier the habitat projects. The full project inventory is in Appendix H. Although they are not included on Table 9, the water offset projects in the South Prairie Creek, Carbon River, and Upper Puyallup subbasins include a habitat restoration component and contribute towards the goal of one habitat project per subbasin. Figure 7 shows the locations of habitat projects listed in this plan.

Most of these habitat projects are listed as Near-Term Actions by the Salmon Recovery Lead Entity. While several of these projects may produce a marginal water 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, and enhance natural processes that had been lost to the benefit of salmonids and other aquatic species.

Habitat restoration projects are durable as they restore natural processes to a stream. Given changing climate conditions that anticipates increases in winter precipitation and flood peaks and decreasing summer flow, restoration projects that increase floodplain connectivity and provide increased cover and habitat and more ways to hold and recharge water are important solutions to provide resiliency from a changing climate.

Table 9 WRIA 10 Habitat Projects

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Sponsor
Lower Puyallup (LP)				
10-LP-H5	Deer Creek Stream Bed Relocation	Relocate the creek bed to allow for a better connection to the floodplain, restore habitat in the adjacent areas.	Improve habitat and provide flood storage.	City of Puyallup
10-LP-H6	Swan Creek Channel and Bank Stabilization	In-channel stabilization and restoration measures including installation of woody material and streambed gravel.	Restore 2.5 miles of Swan Creek.	Pierce County and Puyallup Tribe
10-LP-H7	Silver Creek bank Stabilization	Restoration. Stabilize slopes of Silver Creek to stop channel incision.	Habitat restoration.	City of Puyallup
10-LP-H8	Puyallup River (Union Pacific) Setback Levee (RM 2.6-3.0) - Acquisition	Levee setback. Acquire up to 30 acres of floodplain and former intertidal habitat.	Habitat restoration.	Pierce County
10-LP-H9	Clear Creek RM 2.9 Acquisition and Levee	Levee setback and floodplain reconnection. Construct a new 13,600' levee along Clear Creek and remove flood gate. Reconnect up to 500 acres of floodplain.	Habitat restoration.	Pierce County
10-LP-H10	Fennel Creek Phase 3	Floodplain restoration This project will restore the Fennel Creek right bank floodplain to a more natural state. Project may include a small offset by removing existing PE wells.	Restore 14 acres of floodplain.	Pierce County
Lower White (LW)				
10-LW-H14	Jovita Creek Habitat Project	Restoration actions to address channel confinement, and that restore habitat and habitat forming processes.	Habitat restoration.	City of Edgewood

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Sponsor
10-LW-H15	Pacific Right Bank	Levee setback The proposed project will remove a levee and other artificial floodplain fill, allowing for off-channel habitat and floodplain restoration. The total project area available for restoration is estimated at 32 acres.	Habitat restoration, floodplain reconnection.	King County Flood Control District
10-LW-H16	White River LB RM 2.9-4.2 Restoration	Habitat restoration. White River Restoration will restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2. The tailrace between RM 3 and RM 3.5 is part of the Foster Pilot Project and not included as part of the offset and NEB accounting.	Restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2.	City of Sumner
10-LW-H17	White river bridge (Stewart Road) replacement RM 4.9	The project will consist of replacing the existing Stewart Road Bridge with a new bridge. The existing bridge is a restriction along the river, and a new bridge will allow the river more room to move naturally, allowing better utilization of instream habitat beneath the bridge. The current bridge also limits the flow of large woody debris, while a new bridge will let them large woody debris flow downstream and accumulate naturally through the rest of the lower White River.	Habitat restoration.	City of Sumner
10-LW-H18	White River Setback LB RM4.4-4.8 Stewart	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project will improve rearing opportunity by creating slow water habitat, increased number/depth of pools, engaged floodplain food webs. The project will result in better high flow refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 20 acres of floodplain.	Habitat restoration. Reconnect 20 acres of floodplain.	City of Sumner

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Sponsor
10-LW-H19	Pacific Pointbar	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project will improve rearing opportunity by creating slow water habitat, increased number/depth of pools, engaged floodplain food webs. The project will result in better high flow refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 25 acres of floodplain.	Habitat restoration. Reconnect 25 acres of floodplain.	City of Sumner
Middle White (MW)				
10-MW-H13	Enumclaw Golf Course Restoration	Stream restoration to move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course.	Increased habitat complexity and channel roughness.	City of Enumclaw and Puyallup Tribe
South Prairie Creek (SPC)				
10-SPC-H2	Implement habitat projects based on SPC study.	Habitat improvement projects. Identify and design protection and restoration actions for the lower 15.5 miles of South Prairie Creek and the lower 6 miles of Wilkeson Creek.	Habitat restoration, water quality improvements, fish passage improvements.	Pierce Conservation District, Puyallup Tribe
10-SPC-H3	Stubbs Project	In-channel stabilization and restoration measures including installation of woody material and streambed gravel. Slight chance of a water right acquisition included in this project.	Habitat restoration.	Pierce Conservation District

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Sponsor
10-SPC-H4	South Prairie Creek RM 4.0-4.5 Floodplain Planting	Habitat improvement. Continue planting on the South Prairie Creek Preserve property between river mile 4.0 and 4.5 to maintain and in-fill existing plantings on the property.	Habitat restoration and establishment of 50-55 acres of forested floodplain.	Pierce Conservation District, South Puget Sound Salmon Enhancement Group (SPSSEG)
10-SPC-H22	South Prairie Creek Floodplain Reconnection, RM 2.7-2.8 Phase 1	Floodplain restoration. Acquire 73 acres and implement a multi-benefit floodplain reconnection project that would reduce flood risk and maintenance costs, restore vital salmon habitat, and keep the property in agricultural production.	Habitat restoration. Water quality improvements.	Pierce Conservation District
Upper Puyallup (UP)				
10-UP-H1	Orville Road Revetment at Kapowsin Creek	This project will construct a setback revetment along the left bank Puyallup River near RM 26.3 from Kapowsin Creek confluence upstream. May allow for re-connection of approximately 25-acres of forested floodplain between Puyallup River and Orville Road.	Habitat restoration. Reconnect 25 acres of floodplain.	Pierce County
Upper White (UW)				
10-UW-H11	Greenwater Phase 4 Implementation	Reach scale restoration to restore instream complexity and floodplain connectivity.	Restore 1.2 miles of Greenwater River.	SPSSEG
10-UW-H12	West Fork White Floodplain Project	Floodplain restoration project to restore habitat and habitat-forming processes.		SPSSEG
WRIA-Wide (WW)				

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Sponsor
10-WW-H20	Land acquisition, water right acquisition, and restoration	Seek out opportunities for land and water right acquisitions, large scale habitat restoration (including beaver-related projects where appropriate), and floodplain reconnection/levee setbacks.	Habitat restoration, habitat protection.	Multiple
10-WW-H21	Levee setbacks	Implement projects included on the Pierce County Levee Setback Feasibility Study as opportunities arise. The study lists levees in Pierce County that may be set back to improve floodplain function and habitat. Any of these levee setback projects would contribute to NEB as well as small but difficult to calculate water offsets by allowing for additional infiltration during high flow events.	Floodplain reconnection, habitat restoration.	Pierce County

Lower Puyallup Subbasin

Project Name: Deer Creek Stream Bed Relocation

Project Description: The City of Puyallup is proposing to relocate Deer Creek from its current straightened and ditched configuration to a more natural channel that mimics historic conditions and reconnects the creek to its floodplain. This project would restore habitat in lower Deer Creek, providing opportunities for salmonids to spawn, rear, and forage in a tributary to the lower Puyallup River.

Project Name: Swan Creek Channel and Bank Stabilization

Project Description: Pierce County Surface Water Management and the Puyallup Tribe propose to implement in-channel stabilization and restoration measures along Swan Creek, within the Lower Puyallup River sub-basin (WRIA 10). In the lower reaches of Swan Creek, the channel is incised and eroding the streambanks due to increased stormwater runoff, undersized culverts, and insufficient stormwater detention and loss of flood storage. This project proposes to use a combination of woody material, streambed gravel, and plantings to stabilize streambeds and banks and provide sediment recruitment capacity within the channel. The intention is to slow erosion and allow the channel to return to a more natural state. The proposed project reach begins immediately downstream of the 64th Street East culvert crossing and extends to Pioneer Way.

Pierce County and the Puyallup Tribe are ready to implement the project as soon as funding is available. No estimate of the potential water offset was provided at this time as monitoring is proposed that would determine the offset.

Project Name: Silver Creek Bank Stabilization

Project Description: The City of Puyallup is proposing to stabilize Silver Creek. The channel is incised and eroding the streambanks due to increased stormwater runoff, undersized culverts, and insufficient stormwater detention and loss of flood storage. This project proposes to use a combination of woody material, streambed gravel, and plantings to stabilize the streambed and banks and provide sediment recruitment capacity within the channel. The intention is to slow erosion and allow the channel to return to a more natural state. The City of Puyallup constructed a similar project on Clarks Creek.

Project Name: Puyallup River (Union Pacific) Setback Levee (RM 2.6-3.0) - Acquisition

Project Description: In Pierce County's the levee report, an identified levee setback site is located at river mile 2.6 – 3.0 on the lower Puyallup River. Elements of this project include acquiring properties, designing the project, building a setback levee, and adding habitat elements in the floodplain. The potential habitat benefits of this project include reconnecting previously disconnected floodplain, increasing intertidal area in the lower River, and increasing fish habitat diversity.

Project Name: Clear Creek RM 2.9 Acquisition and Levee Setback

Project Description: The primary objective of this project is to minimize the impact of flooding related to the backwater created where Clear Creek and the Puyallup River meet. The project

also provides refuge and habitat for juvenile salmon and other associated wildlife in the lower Puyallup River system. The lower Puyallup River and Clear Creek combined floodplain is currently managed by two flood/tide gates underneath State Route 167/River Road. The project will reconnect 250-590 acres of floodplain. The project will allow the floodplain to react more naturally with the creek and the river.

This project is expected to take at least 10 years to complete. The first phase will focus on property acquisitions from willing sellers in the area. Once property acquisitions are completed, a new levee system to protect infrastructure outside of the property purchase area will be constructed.

Project Name: Fennel Creek Phase 3

Project Description: Pierce County partnered with Forterra to acquire a 14-acre property adjacent to Fennel Creek. The site is adjacent to the first two project phases. Remaining project elements include demolishing buildings and roads, removing previous fill-areas, and installing plantings and fish habitat features. Property acquisition was completed by Forterra in 2020. Demolition will be completed in 2021 and 2022. Habitat improvements and project construction planned for 2023. This project will restore fish habitat and 14 acres of floodplain in lower Fennel Creek.

Pierce County is ready to implement the restoration project as soon as funding is secured. Along Fennel Creek, upstream from its confluence with the Puyallup River, Pierce County is continuing to improve flood plain connectivity and fish habitat. Previous phases included; property acquisition, a 40+acre floodplain restoration project, and 1,900+ linear feet channel restoration project.

Lower White Subbasin

Project Name: Jovita Creek Habitat Project

Project Description: The City of Edgewood proposes to identify potential and implement multi-benefit restoration project(s) that restore habitat and habitat forming processes in Jovita Creek. An assessment will focus on evaluating geomorphic impacts from Jovita Boulevard (which is adjacent to the stream), channel bed and bank restoration in the mainstem of Jovita Creek, and replacement of a fish passage barrier (culvert at 114th street) on a tributary to Jovita Creek.

One primary issue in Jovita Creek is channel confinement due to Jovita Boulevard, causing channel erosion from high velocities. Restoration actions that address this channel confinement would function by providing space for the creek to meander, wood to stabilize the creek bed and connection to the limited amount of off-channel habitat in the floodplain. Depending on the results of the feasibility study, benefits to stream processes may occur in the project area upstream of the culvert at highway 167. Salmonids in Jovita Creek and its tributaries have the potential to benefit from restoration actions.

Project Name: Pacific Right Bank

Project Description: The King County Flood Control District proposed a levee setback project located on the right bank floodplain of the White River in the City of Pacific extending from the BNSF Railway (RM 6.3) south to the King-Pierce County boundary line (RM 5.5). The

proposed project will remove a levee and other artificial floodplain fill, allowing for off-channel habitat and floodplain restoration. The total project area available for restoration is estimated at 32 acres. The final project will restore off-channel rearing habitat for ESA-listed Chinook salmon and improve other wildlife habitat.

Project work to date has focused on property acquisitions from willing sellers, installation and maintenance of the temporary floodwater barriers, and some feasibility studies for the future levee setback project. The project is expected to take 5 years to complete.

Project Name: White River LB RM 2.9 – 4.2 Restoration

Project Description: The City of Sumner proposed a levee setback project located on the left bank floodplain of the White River on the City owned golf course property and adjacent open space (RM 2.9 – 4.2). The proposed project will create/restore side channels, lower floodplain for better connectivity, and create wetland habitats within a 170 acre area along the Lower White River. The tailrace between RM 3 and RM 3.5 is part of the Foster Pilot Project and not included as part of the offset and NEB accounting.

Project work to date has included finalizing the design for the project. The City of Sumner has submitted for permits and is ready to implement the restoration project as soon as funding is secured.

Project Name: White River Bridge (Stewart Road) Replacement RM 4.9

Project Description: The City of Sumner proposed the project to replace the existing Stewart Road Bridge with a new bridge. The existing bridge is undersized and is a constriction on the Lower White River. The new bridge will be longer, higher, and have less piers within the channel. This will allow river migration under the bridge, greater connectivity between the Countyline setback and the RM 4.4-4.8 setback, and allow for large woody debris (that currently gets stuck on existing bridge) to accumulate downstream naturally.

Project Name: White River Setback LB RM 4.4 – 4.8 Stewart

Project Description: The City of Sumner proposed a levee setback project located on the left bank floodplain of the White River at RM 4.4 – 4.8. The project will reconnect about 20 acres of floodplain. This project would improve salmonid rearing opportunities in the lower White River by creating slow water habitat, re-establishing floodplain wetlands, and restoring riparian forests. When the Stewart Road bridge is replaced, this project will also be connected to the Countyline setback project.

Project Name: Pacific Pointbar

Project Description: The project consists of a levee setback on the right bank of the White River between RM 4.4 - RM 4.6. This project will improve rearing opportunity by creating side channel, slow water habitat, increasing number/depth of pools, and engaging floodplain food webs. The project will improve high flow refuge with floodplain wetlands and greater main

channel roughness. The project will reconnect about 25 acres of floodplain and restore riparian forests.

The City of Sumner has acquired several properties within the project area and is continuing to conduct outreach with landowners.

Middle White Subbasin

Project Name: Enumclaw Golf Course Restoration

Project Description: The City of Enumclaw and the Puyallup Tribe propose reach-scale stream restoration actions in Boise Creek. This project would move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course. Additionally, large woody material would be added to increase habitat complexity and channel roughness, diversifying habitats available to fish. The project will function by restoring the natural channel and improving habitat conditions, which will allow natural processes to develop in Boise Creek. The project is proposed to occur from river miles 3.7 to 4.2.

The Puyallup Tribe is ready to implement the project as soon as funding is secured, and property owner permissions are obtained. A 30% design was completed for this project in 2010, and the proposed project would include finalizing the design and moving forward with construction.

South Prairie Creek Subbasin

Project Name: Implement habitat projects based on SPC study

Project Description: The project will use existing information from past and present assessments and evaluations to identify and design protection and restoration actions for the lower 15.5 miles of South Prairie Creek and the lower 6 miles of Wilkeson Creek. Project elements will include landowner outreach to parcels identified as high priority for protection in the 2002 South Prairie Creek Action Plan that have not yet been conserved, development of preliminary designs for up to 4 reach-scale floodplain restoration projects, and detailed site specific recommendations for: other properties to be acquired, areas for improved forestry management, restoration of drainage ditches, tributary confluences, groundwater seeps, and wall based channels, fish passage improvements, beaver reintroduction and installation of beaver dam analogues. This project will design actions to create and maintain necessary habitat functionality, thermal diversity, hydrologic stability, and geomorphic structure to support adult to juvenile out-migrant survival, and productivity for the salmonid species.

South Puget Sound Salmon Enhancement Group is planning these projects.

Project Name: Stubbs Project

Project Description: Forterra and partners acquired 33.6 acres much of it floodplain along South Prairie Creek (Parcel Number 0519123054). The goal of this project is to protect the property from development, as well as to provide opportunities to restore and improve salmon habitat and floodplain. Restoration would benefit in-stream habitat, off-channel habitat, riparian function, and floodplain connectivity to increase the overall capacity of this stream reach to support salmonids. The acquisition and conceptual restoration design will integrate the

subject property restoration with restoration activities being conducted on the adjacent property South Prairie Creek Preserve property. This project would likely include in-channel stabilization and restoration measures including installation of woody material and streambed gravel.

Forterra received funding in 2019 to acquire the Stubbs property and develop a conceptual restoration design.

Project Name: South Prairie Creek RM 4.0 – 4.5 Floodplain Planting

Project Description: This project includes continuing riparian planting on the South Prairie Creek Preserve property between river miles 4.0 and 4.5 on South Prairie Creek (13518 Pioneer Way E Orting). The goal of the project is to maintain and in-fill existing riparian plantings on the property in order to ensure long term survival and establishment of 50-55 acres of forested floodplain. Planting began in 2005 and continue to the present day. Enhancing and planting the riparian area and floodplain on the property has many habitat benefits including shade, cover for juvenile fish, and increased food.

A habitat project on this property was completed in 2020 by the South Puget Sound Salmon Enhancement Group. The project included side-channel creation, woody material installation, and floodplain reconnection.

Project Name: South Prairie Creek Floodplain Reconnection RM 2.7 – 2.8 Phase 1

Project Description: The project will entail acquiring 73 acres on river mile 2.7 – 2.8 of South Prairie Creek. The goal of this project is to protect the property from development, as well as to provide opportunities to restore and improve salmon habitat and floodplain. Restoration would benefit in-stream habitat, off-channel habitat, riparian function, and floodplain connectivity to increase the overall capacity of this stream reach to support salmonids. This project would likely include in-channel stabilization and restoration measures including installation of woody material and streambed gravel.

The Pierce Conservation District is the project sponsor.

Upper White Subbasin

Project Name: West Fork White Floodplain Project

Project Description: South Puget Sound Salmon Enhancement Group (SPSSEG) proposes to implement reach-scale floodplain restoration actions in the West Fork White River. This project would complete assessment, feasibility, design, and construction of a floodplain restoration project on the lower 6 miles of the West Fork White River. Initial work would focus on a reach-scale assessment of the lower White River from river miles 2.4 to 5.7. The assessment would evaluate geomorphic threats from a road (which is adjacent to the stream) to floodplain processes, instream flow velocities, and habitat structure and the assessment would prescribe and implement restoration treatments to remove fill and armor and restore habitat and habitat forming processes.

Benefits to river processes will occur in the project area between river miles 2.4 to 5.7; side channel and other habitat features formed as a result of this project will benefit a variety of

salmonid species as described in the next paragraph. Salmonids in the West Fork White River and in the White River will benefit from increased habitat and reduced peak flow and sediment input. The potential for the project to increase groundwater recharge has not been estimated.

Project Name: Greenwater Phase 4 Implementation

Project Description: South Puget Sound Salmon Enhancement Group proposes to implement reach-scale restoration actions in the Greenwater River between river mile 2 and 4 to restore instream complexity and floodplain connectivity. This proposed phase 4 project builds upon work completed in 2010, 2011, and 2014 (phases 1-3) on upper sections of the Greenwater River between river mile 6 and 8. As part of the proposed phase 4 project, road and fill would be removed and log jams would be installed in the 2-mile project reach, increasing the functional habitat on the Greenwater River. These structures will provide relatively stable, instream structure currently lacking in the Greenwater system due to a legacy of aggressive timber harvest practices between the late 1950s to early 1970s.

The project will create large stable structures that will trap mobile debris and sediment, increase floodplain connectivity and off channel habitat, increase number of pools with overhead cover, decrease median substrate size, and overall improve spawning and rearing conditions for salmonids in the Greenwater River. The proposed structures will accelerate and maintain system-wide natural processes while providing habitat for fish. Removing roads, fill, and armor will additionally allow natural processes to develop in a large floodplain. There are no anticipated offset benefits related to the project because the potential for the project to increase groundwater recharge has not been estimated.

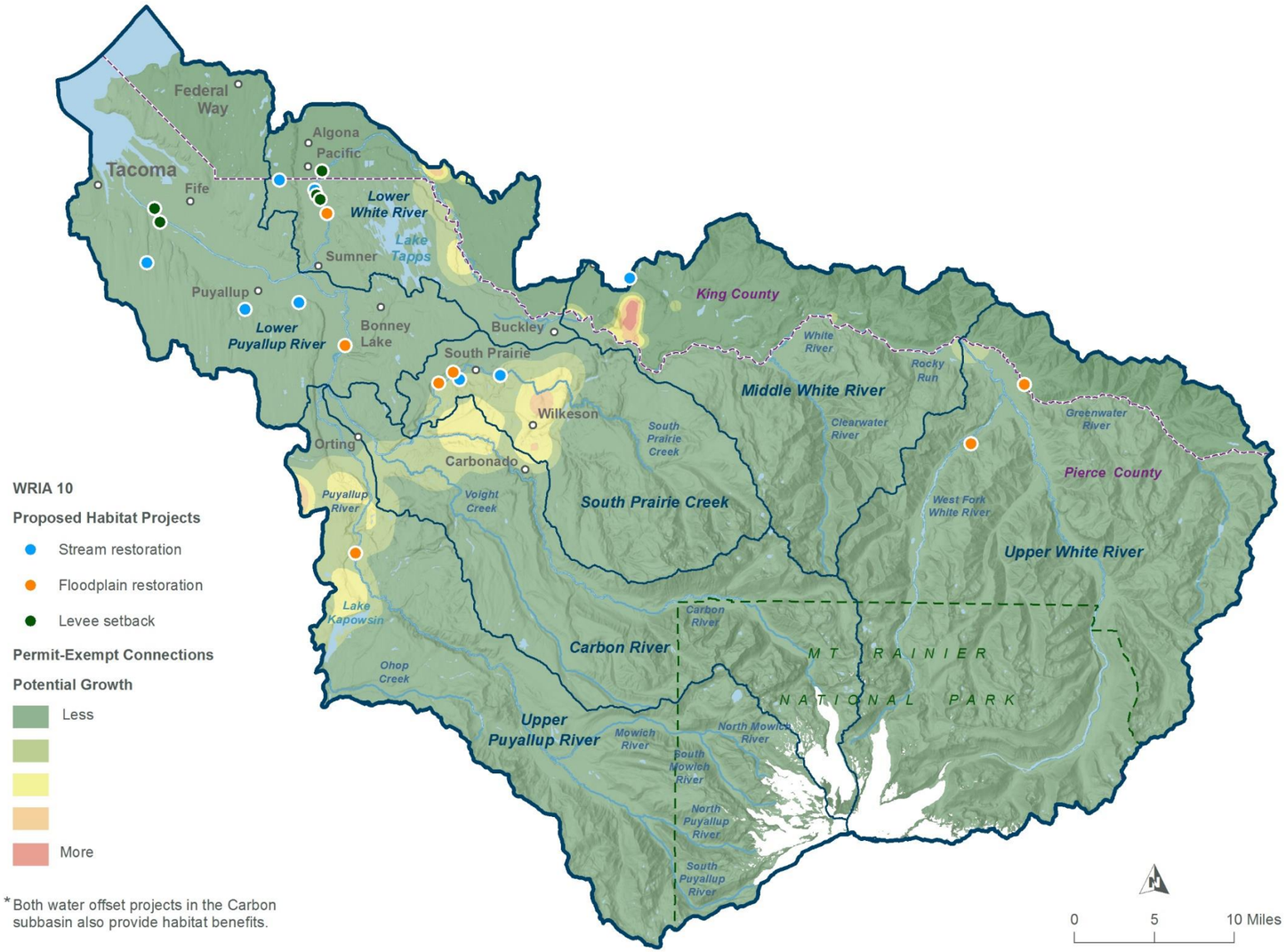

Figure 7 WRIA 10 Habitat Projects

5.2.3 Programmatic Actions

In addition to the projects described above, the plan identifies programmatic actions that will increase the knowledge of PE well water use in the watershed and increase water conservation throughout the WRIA. These programmatic actions do not have specific locations, but would improve PE well water management through voluntary actions and improved data collection.

Water Conservation Education and Incentives Program

This plan recommends Ecology partner with Pierce and King Counties, the Pierce Conservation District, and the Tacoma-Pierce County Health Department to develop and implement outreach and incentives programs that encourage rural landowners with PE wells to (1) reduce their indoor and outdoor water use through water conservation best practices; and (2) comply with drought and other water use restrictions.

This program would raise awareness of the impacts PE well water usage has on groundwater levels and the connection to streams and rivers. This program would supplement water offset and restoration projects, especially in subbasins critical for fish and where water offsets were difficult to find.

Potential funding sources could include: new funding from Washington State Legislature; grants (e.g., Ecology's Streamflow Restoration Grant Program); allocation of Ecology resources; contributions from local governments and tribes; part of county or conservation district ongoing education, outreach, and incentive program.

Voluntary PE Well Metering Pilot Project

This plan encourages a non-profit organization, university, or government agency to pilot a voluntary five-year program in one or more WRIA 10 subbasins to meter PE wells (indoor and outdoor residential use). The voluntary metering program would be supplemented with a robust education and community engagement program about water consumption and conservation.

This program would increase confidence in assumptions made regarding the average water use of individual PE well users to inform the adaptive management process and future water management and planning activities. Data could inform (1) growth policies and patterns, (2) where to target incentives and education/outreach programs, and (3) where to place resources across subbasins to help improve streamflow, water levels, and temperature.

Update Ecology's Well Log Database

The Committee recommends that Ecology make the following changes to Ecology's well data tracking system in order to track the number and location of PE wells in use:

- Implement a web-based well report form that mimics the current well report forms, and that uploads directly to Ecology's database with Ecology verification.
- Require coordinates (latitude and longitude) of wells on well report forms, and implement an intuitive web tool for well drillers which automatically provides the Public Lands Survey (PLS) location and coordinates for a new well.

- Identify PE wells on well report forms.
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

Accurate tracking of the locations and features of PE wells will support Committee's desire to monitor plan success and respond with adaptive management measures after plan adoption.

5.3 Project Implementation Summary

5.3.1 Summary of Projects and Benefits

Per RCW 90.94.030(3), this plan must include actions necessary to offset potential impacts to instream flows associated with new PE well water use and result in a net ecological benefit to instream resources within the WRIA.

As specified in Chapter 4, the plan estimates 277.4 acre-feet per year of consumptive use from new PE wells over the planning horizon. The projects included in Table 8 provide an estimated offset of 788.3 acre-feet per year and exceed the consumptive use estimate.

Twenty-two habitat projects are included in Table 9. Ecological benefits associated with these projects include floodplain restoration, wetland reconnection, availability of off-channel habitat for juvenile salmonids, increase in groundwater levels and baseflow, and increase in channel complexity. While many of these projects have potential streamflow benefits, water offset from habitat projects are not accounted for in this plan. The ecological and streamflow benefits from habitat projects are supplemental to the quantified water offsets. A description of how the water offset and habitat projects result in a net ecological benefit to instream resources in WRIA 10 is provided in Chapter 7.

Three programmatic actions are included in section 5.2.3. These actions will measure, track, and contribute offset by reducing the amount of water used.

5.3.2 Cost Estimate for Offsetting New Domestic Water Use Over 20 Year Planning Horizon

Per RCW 90.94.030(3)(d), this watershed plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years. To satisfy this requirement, planning-level cost estimates for each of the water offset projects are listed in Table 10. Costs estimates for habitat projects, when that information was readily available, are displayed in Table 11.

The costs for water offset projects range from $3,100 for the offset portion of the Orville Road Revetment Phase 2C Year 1 project to $1.1 million for the MAR project. The total estimated cost for implementing the water offset projects listed and described in this chapter is $2.6 million. Several of the water offset projects are part of larger restoration projects, such as levee setback and floodplain reconnections. The full cost of the water offset projects, including the habitat components, is over $18.9 million.

Table 10 WRIA 10 Water Offset and Habitat Projects Cost Estimates

Project Number	Project Name	Subbasin(s)	Estimated Cost
10-CR-W3	Carbon River Future Levee Setback and Acquisition	**Carbon River**	$37,000 (water offset) full project value unknown
10-CR-W4	Alward Road	**Carbon River**	$21,000 (water offset) $14 million (full project)
10-LP-W6	Potential MAR	**Lower Puyallup**	$1.1 million
10-LP-W10	Bond	**Lower Puyallup**	$80,000
10-MW-W7	CWA purchase	**Middle White**	$750,000
10-SPC-W2	Old Inglin Dairy	**South Prairie Creek**	$230,000
10-UP-W1	Orville Road Revetment Phase 2C Year 1	**Upper Puyallup**	$3,100 (water offset) $2.2 million (full project)
10-WW-W8	Green Stormwater Infrastructure	**WRIA-wide**	$900,000
10-WW-W9	WWT assessment	**WRIA-wide**	$110,000
Water Offset Project Costs **Full Project Costs**			$3.23 million $19.41 million

The costs for habitat projects range from $250,000 for the initial study for the Jovita Creek Habitat Project to $79 million for the Pacific Right Bank project. The total estimated cost for implementing the habitat projects listed and described in this chapter is over $191 million.

Table 11 Habitat Project Cost Estimates

Project Number	Project Name	Project Type and Brief Description	Estimated Total Project Cost
10-LP-H5	Deer Creek Stream Bed Relocation	Lower Puyallup	TBD
10-LP-H6	Swan Creek Channel and Bank Stabilization	Lower Puyallup	$3.7 million
10-LP-H7	Silver Creek bank Stabilization	Lower Puyallup	TBD
10-LP-H8	Puyallup River (Union Pacific) Setback Levee (RM 2.6-3.0) - Acquisition	Lower Puyallup	$8.5 million
10-LP-H9	Clear Creek RM 2.9 Acquisition and Levee	Lower Puyallup	$5.5 million
10-LP-H10	Fennel Creek Phase 3	Lower Puyallup	$1.7 million
10-LW-H14	Jovita Creek Habitat Project	Lower White	$250,000
10-LW-H15	Pacific Right Bank	Lower White	$79 million
10-LW-H16	White River LB RM 2.9-4.2 Restoration	Lower White	$25 million
10-LW-H17	White river bridge (Stewart Road) replacement RM 4.9	Lower White	$30 million
10-LW-H18	White River Setback LB RM4.4-4.8 Stewart	Lower White	$7 million
10-LW-H19	Pacific Pointbar	Lower White	$18 million
10-MW-H13	Enumclaw Golf Course Restoration	Middle White	$2.3 million
10-SPC-H2	Implement habitat projects based on SPC study.	South Prairie Creek	$469,000
10-SPC-H3	Stubbs Project	South Prairie Creek	TBD
10-SPC-H4	South Prairie Creek RM 4.0-4.5 Floodplain Planting	South Prairie Creek	$369,000
10-SPC-H22	South Prairie Creek Floodplain Reconnection, RM 2.7-2.8 Phase 1	South Prairie Creek	$1.2 million
10-UP-H1	Oroville Road Revetment at Kapowsin Creek	Upper Puyallup	$3.8 million
10-UW-H11	Greenwater Phase 4 Implementation	Upper White	$1.5 million
10-UW-H12	West Fork White Floodplain Project	Upper White	$3 million

Project Number	Project Name	Project Type and Brief Description	Estimated Total Project Cost
10-WW-H20	Land acquisition, water right acquisition, and restoration	WRIA-Wide	TBD
10-WW-H21	Levee setbacks	WRIA-Wide	TBD
Total Habitat Project Costs			**$191 million**

5.3.3 Certainty of Implementation

WRIA 10 Committee members have a track record of success in working together and implementing projects. An example is the Puyallup and Chambers Salmon Recovery Lead Entity whose participants overlap with the WRIA 10 Committee. The history of successful collaboration provides certainty to implementation of projects contained in this plan. Chapter 6 describes the adaptive management recommendations that will increase reasonable assurance that the projects and actions in the plan will be implemented.

Chapter Six: Plan Implementation and Adaptive Management

6.1 Plan Implementation and Adaptive Management Recommendations

This plan recommends an adaptive management process for implementation of the watershed plan. The Final NEB Guidance defines adaptive management 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*."

Adaptive management is intended to help address uncertainty, provide more reasonable assurance for plan implementation, and to ensure that 1) water use from new PE wells is adequately offset and 2) implementation of the watershed plan produces a net ecological benefit to the watershed. The periodic review in this adaptive management process will provide a verifiable process for plan monitoring and ensure accountability in plan implementation.

Opportunities

The following opportunities to develop more understanding of PE well water use in the watershed during the planning process were identified during the planning process. Seeking out these opportunities will improve monitoring and adaptive management of the plan:

- The watershed plan includes projected PE well water use by subbasin. Monitoring the number of new PE wells, actual PE well water use, and associated consumptive water use would provide data for comparison and adjustments.
- The watershed plans include water offset and habitat projects, and estimated benefits associated with each, by subbasin. Measuring and tracking actual water offsets by subbasin, to the extent possible, can be used to verify intended benefits.
- Many factors could influence the consumptive water use from new PE wells in the future, including water system infrastructure expansion, policies or programs to require or incentivize homes to connect to public water systems, and programs that provide education and incentives for homeowners to conserve water. Ongoing monitoring could track these related factors.
- Projects identified in the plan are expected to increase groundwater storage, augment streamflows, and provide habitat benefits. Water offset projects should be monitored in order to ensure that they continue to function as designed under a changing climate. Habitat projects should be analyzed for their resilience to changing conditions. The adaptive management recommendations in this plan will help to monitor and assess the validity of the projections identified, to determine whether projects are functioning as designed even under climate change conditions, and to allow for course corrections where needed.

To address the above challenges, this plan recommends the following adaptive management strategies.

6.1.1 Tracking and Monitoring

This plan recommends that Ecology monitor watershed plan implementation, in consultation with the WDFW, and project sponsors. Ecology, in consultation with WDFW and project sponsors, should review projects and actions in this watershed plan to ensure projects are offsetting PE water use:

- Track annual new PE wells by subbasin.
- Track project implementation by subbasin.
- Develop a process to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan.

This plan recommends Ecology change the Ecology well tracking system in the following ways, in order to efficiently and transparently track the number and location of PE wells in use:

- Implement a web-based well report form that mimics the current well report forms, and that uploads directly to Ecology's database with Ecology verification.
- Require coordinates (latitude and longitude) of wells on well report forms, and implement an intuitive web tool for well drillers which automatically provides the Public Lands Survey (PLS) location and coordinates for a new well.
- Identify PE wells on well report forms.
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

These updates would directly and efficiently address identified shortcomings in Ecology's existing well tracking database and reporting protocols. Accurate tracking of the locations and features of PE wells will support the Committee's desire to engage in monitoring and adaptive management after adoption of the watershed plan.

This plan recommends WDFW, in collaboration with Ecology and the Recreation and Conservation Office (RCO), pilot the Salmon Recovery Portal,[27] managed by RCO, for tracking streamflow restoration projects. To improve harmonization of streamflow restoration with ongoing salmon recovery actions, local salmon recovery Lead Entity Coordinators will be consulted prior to initial data uploads. University of Washington data stewards will be employed to conduct data entry, quality assurance, and quality control.[28]

Tracking streamflow restoration projects and new domestic PE wells will:

- Improve the capacity to conduct implementation monitoring of streamflow restoration projects and actions.
- Build grant funding opportunities and track streamflow restoration associated costs.
- Provide a template for adaptively managing emergent restoration needs.

[27] https://srp.rco.wa.gov/about
[28] More details on the Project Tracking proposal are available on the WRIA 10 webpage: https://www.ezview.wa.gov/site/alias__1962/37323/watershed_restoration_and_enhancement_-_wria_10.aspx

Table 12 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 12 Implementation of Tracking and Monitoring Recommendation

Action	Entity or Entities Responsible	Funding Considerations
Track building permits issued with PE wells.	Ecology (via reporting from counties and cities)	The number of building permits and associated fees are transmitted to Ecology annually. No additional funding is needed.
Maintain an ongoing list and map of new PE wells within each subbasin.	Ecology	Update the existing Ecology well report tracking database. No additional funding is needed.
Update well tracking system.	Ecology	Additional funding may be needed from the Washington State Legislature to increase capacity for Ecology to verify well reports.
Maintain a summary of the status of implementation for each project.	WDFW using the Salmon Recovery Portal	WDFW may need additional funding to support maintaining the Salmon Recovery Portal.

6.1.2 Oversight and Adaptation

This plan recommends Ecology leverage the 2027 report to the legislature[29] for adaptive management. Ecology will share the report with WRIA 10 Committee member jurisdictions and other interested parties in advance of reporting to the Legislature and allow for review and comment. This plan recommends that Ecology develop similar reports in 2032 and 2037.

The report should include:

- A list of completed projects that benefit instream resources and other directly related watershed improvements conducted in coordination with the restoration and enhancement planning process.
    - Include projects implemented in the reporting period and projects expected to be implemented in the next reporting period.
    - A detailed summary of actual project costs from completed projects.
    - Amount of Streamflow Restoration Fund grants received for projects in the WRIA.
- Total number of new PE wells each year for the reporting period (2018-2027, 2018-2032, and 2018-2037) and estimated consumptive use associated with the new PE wells.
    - Compare total number of new PE wells with PE well projections within this plan, representing the cumulative number of PE wells at the time of reporting.

[29] 90.94.050 requires Ecology to report to the legislature by December 31, 2027.

- A description of potential or planned projects, included projected costs and anticipated streamflow, water supply, and watershed health benefits.
- A comparison between the amount of instream benefit from completed projects and estimated consumptive use associated with new PE wells.

Ecology's report should recommend actions if water offsets and NEB are not on track to being achieved within the planning horizon. These actions may:

- Elevate Tier 2 projects to a priority status by conducting outreach, encouraging potential or likely sponsors to lead a project, and provide case studies of other similar, successful projects.
- Estimate water offsets of habitat, programmatic, or conceptual projects.
- Revise the Ecology Streamflow Restoration Grant Guidance to prioritize or give preference to projects in watersheds that have not offset PE well water use.
- Identify barriers to project completion.
- Develop a target implementation schedule for projects.

A notice of action to prioritize projects and estimate offsets should be sent to member jurisdictions of the WRIA 10 Committee for comment. Ecology may offer a webinar to collect questions and comments and WDFW may offer orientations on the project tracking system. However, members of the WRIA 10 Committee are not expected to reconvene after approving the plan. Neither Ecology nor Committee members will make changes to the plan after its adoption. Final prioritization, estimates, outreach activities, and amendments to the grant guidance shall be at the sole determination of Ecology after member jurisdiction input.

Ecology should send the report to all member jurisdictions of the WRIA 10 Committee, all local jurisdictions within the watershed, and any additional stakeholders identified at the time of reporting.

Preference for funding of new projects should be given to watersheds that have not offset PE well water use.

Table 14 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 13 Implementation of Oversight and Adaptation Recommendation

Action	Entity or Entities Responsible	Funding Considerations
Develop and distribute report, including any recommended adjustments to projects and actions.	Ecology	Ecology may need additional funding to support development of the 2032 and 2037 reports.
Revise Streamflow Restoration Grant Guidance to prioritize projects in watersheds that have not offset PE well water use.	Ecology	No additional funding is needed.

6.1.3 Funding

The Committee recommends funding implementation and adaptive management from a variety of sources, including the Streamflow Restoration Grant Program administered by Ecology, Washington State Legislature, and other sources of public and private funding. Funding and staffing at local, county, and state levels is likely to see continued shortfalls due to COVID-19 related impacts over the next several years.

The Committee recognizes that no single source of funding is available that could implement every project contained in this plan and multiple funding sources will be required. The funding sources may have objectives different than solely streamflow restoration, such as habitat restoration, flood reduction, water quality, open space protection, and others. The Committee also urges the legislature to fund Ecology and WDFW to ensure plan implementation and monitoring, streamflow benefits, water offsets, and NEB.

Chapter Seven: Net Ecological Benefit

7.1 Water Offsets

This plan uses a moderate growth scenario to project a total of 688 new PE wells installed within WRIA 10 during the planning horizon. This plan uses this PE well projection to estimate 277.4 acre-feet per year of new consumptive water use in WRIA 10, as described in detail in Chapter 4. This consumptive use estimate reflects the use of a moderate growth projection combined with the 95 percent upper confidence limit of the average measured irrigated area with adjustments for parcels with no discernable irrigated acreage in aerial photos (resulting in an average irrigated area of 0.12 acres per well). Irrigation requirements were assumed to be for that of commercial turf grass. The more conservative estimate of consumptive use from irrigation provides a water offset target that accounts for uncertainties in the planning process related to the PE well projection, consumptive use assumptions, and project implementation.

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 water right acquisition, Managed Aquifer Recharge (MAR), Green Stormwater Infrastructure (GSI), and decommissioning PE wells as part of levee setback and floodplain reconnection projects.

This plan estimates a total water offset of 788.3 acre-feet per year from nine water offset projects (described in Chapter 5 and listed in Table 14), a WRIA-wide surplus offset of 510.9 acre-feet per year above the consumptive use offset target. Four of the most highly implementable projects (Tier 1) account for 375.3 acre-feet per year of offset, a surplus offset of 97.9 acre-feet per year above the consumptive use target. These offsets will occur either year-round to offset the year-round impact of PE well consumptive use, or during the irrigation season to offset the anticipated higher consumptive use during the irrigation season. The WRIA 10 Committee has determined that this plan succeeds in offsetting consumptive use impacts at the WRIA scale from implementation of the projects listed in Table 14.

Table 14 Summary of WRIA 10 Water Offset Projects included in NEB analysis

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Tier
Carbon River (CR)						
10-CR-W4	Alward Road	Levee Setback. Property acquisition and restoration of 150 acres of floodplain. Includes decommission of 20 PE wells	8	Year-round	Restoration of 150 acres of floodplain, flood hazard reduction	1
10-CR-W3	Carbon River Levee Setback and Acquisition	Water Right and Levee Setback. Purchase a property as part of a larger levee setback project and acquire associated water right.	14.3	Irrigation Season	Habitat restoration.	2
Lower Puyallup (LP)						
10-LP-W6	Potential MAR	MAR. Construct an MAR in a gravel pit supplied with Tacoma Water. Three potential locations are identified in the Lower Puyallup.	300	Year-round		2
10-LP-W10	Bond	Water Right. Acquire water right as part of a larger property transfer and protection with the City of Puyallup	30	Irrigation Season		2
Middle White (MW)						
10-MW-W7	CWA purchase	Water Right. Acquire a portion of the Cascade Water Alliance water right to place in trust.	277	Year-round		1
South Prairie Creek (SPC)						

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Tier
10-SPC-W2	Old Inglin Dairy	Water Right. Floodplain restoration of former dairy, and place water rights into trust after plants are established.	89.09	Irrigation Season	Floodplain restoration/reconnection, habitat enhancement.	1
Upper Puyallup (UP)						
10-UP-W1	Orville Road Revetment Phase 2C Year 1	Floodplain Reconnection/Levee Setback. Purchased and decommission a PE well that served 3 homes as part of this project.	1.2	Year-round	Habitat restoration. 1,500 Linear Feet of setback revetment, 19 engineered log jams.	1
WRIA-Wide (WW)						
10-WW-W8	Green Stormwater Infrastructure	Stormwater infiltration. Support Green Stormwater Infrastructure retrofits for both individual property owners and jurisdictions. Goal of 10 projects per year.	27	Year-round	Water quality improvements	2
10-W9-W17	WWT assessment	Water Right. Acquire 10% of the water rights identified through Washington Water Trust assessment. These rights are listed individually in this table.	41.71	Irrigation Season		2
		WRIA 10 Total Water Offset	**788.3**			
		WRIA 10 Consumptive Use Estimate	**277.4**			
		Tier 1 Offsets	**375.3**			

The WRIA 10 Committee tiered the projects to identify projects with greater implementation certainty based on information available. Tier 1 projects all have specific locations, project sponsors or champions, and in some cases are already underway. Some Tier 1 projects are components of larger projects that are high priority for the project sponsor. The Tier 1 projects will offset the consumptive use in WRIA 10. Tier 2 projects are less developed, lack project sponsors or lack specific locations at the time of plan writing. The water offset estimates from the Tier 2 projects provide reasonable assurance that the plan can meet NEB if Tier 1 offsets are not realized. The projects in this plan provide an estimated 788.3 acre-feet per year in water offsets, more than double the consumptive use estimate of 277.4 acre-feet per year. Tier 1 projects provide a water offset of 375.3 acre-feet per year.

Consumptive use and project water offset are compared at the subbasin scale in Table 15. Surplus water offset is achieved in a total of three subbasins (Lower Puyallup, Middle White, and South Prairie Creek), ranging from 21.8 acre-feet per year in the South Prairie Creek subbasin to 288.9 acre-feet per year in the Lower Puyallup subbasin. A deficit in water offset occurs in a total of four subbasins (Carbon River, Lower and Upper White, and Upper Puyallup), ranging from 4.8 acre-feet per year in the Upper White subbasin to 65.30 acre-feet per year in the Upper Puyallup subbasin. However, there are two projects that are specified as "WRIA-wide" that have not been located in a specific subbasin. Those projects would provide an additional offset of 68.7 acre-feet per year in yet to be determined locations in the watershed. The highest projected growth in PE wells is expected in the South Prairie Creek subbasin and the lower portions of the Middle White and Upper Puyallup subbasins. All of the offset projects listed in Table 14 are located within these growth areas or downstream of the growth as shown in Figure 6 in Chapter 5. Each project contributes to offsetting consumptive use in the subbasin where it is located and downstream where impacts of low streamflow are propagated. For example, the surplus offset from the Middle White subbasin will benefit the Lower White.

Table 15 Subbasin Water Offset Totals Compared to Permit-Exempt Well Consumptive Use Estimate

Subbasin	Offset Project Totals (AFY)	Tier 1 Offsets (AFY)	Tier 2 Offsets (AFY)	Permit-Exempt Well Consumptive Use (AFY)[1]	Surplus/ Deficit (AFY) [2]
Carbon River	22.3	8	14.3	43.9	-21.6
Lower Puyallup River	330	0	330	41.1	+288.9
Lower White River	0	0	0	30.6	-30.6
Middle White River	277	277	0	23.0	+254
South Prairie Creek	89.1	89.1	0	67.3	+21.8
Upper Puyallup River	1.2	1.2	0	66.5	-65.3

Subbasin	Offset Project Totals (AFY)	Tier 1 Offsets (AFY)	Tier 2 Offsets (AFY)	Permit-Exempt Well Consumptive Use (AFY)[1]	Surplus/ Deficit (AFY) [2]
Upper White River	0	0	0	4.8	-4.8
WRIA-wide projects	68.71	0	68.7	-	+68.71
WRIA 10 Total	**788.3**	**375.3**	**413**	**277.4**	**+510.9**

Notes:
[1] Values in table have been rounded, which is why totals may differ.
[2] Surplus water offset is associated with a positive value and a deficit in water offset is associated with a negative value.

The water offset projects listed in Table 14 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 10, additional benefits could include the following:

- **Water right acquisition projects:** Aquatic habitat improvements during low-flow periods; reduction in groundwater withdrawals and associated benefit to aquifer resources; and/or beneficial use of reclaimed water; permanent offset.
- **MAR projects:** Aquatic habitat improvements during low-flow periods; increased groundwater recharge; reduction in summer/fall stream temperature; and/or increased groundwater availability to riparian and near-shore plants.
- **Levee Setback and Floodplain Reconnection projects:** Aquatic habitat improvements; reduction in stream temperature; flood hazard reduction; PE well decommissioning (permanent offset); and/or additional infiltration.
- **Green Stormwater Infrastructure (GSI) projects:** Aquatic habitat improvements during low-flow periods; increased groundwater recharge; reduction in summer/fall stream temperature; flood hazard reduction; water quality improvements.

The water right acquisition and the PE well decommissioning projects will provide permanent offsets. The infrastructure projects, such as the MAR projects and the GSI projects will likely require periodic maintenance for offset benefits to continue.

7.2 Habitat Benefits

The Committee set the goal of including in the plan at least one habitat project in each subbasin. This plan achieves that goal. Table 16 lists the habitat projects selected by the Committee. Although they are not included on Table 16, the water offset projects in the Carbon River subbasin include a habitat restoration component and contribute towards the goal of one habitat project per subbasin. Many of the habitat projects are listed as Near-Term Actions by the Salmon Recovery Lead Entity. Some may produce a marginal water offset benefit, however, benefits were too small and too complex to estimate and are not included in the offset totals.

Twenty-two habitat improvement projects are summarized in Table 16 and shown in Figure 7 in Chapter 5. In general, these habitat improvement projects increase stream complexity, reconnect floodplains and enhance natural processes, previously lost, to the benefit of salmonids and other aquatic species. These projects are varying stages of development and implementation, from conceptual to in progress. The project details in Chapter 5 and the full project inventory in Appendix H provide more information about the stage of each project at the writing of this plan.

These habitat projects address many of the salmonid limiting factors described in Chapter 2.3.5. Table 16 indicates a 'project type' for each habitat project, used to group the projects as the projects address many of the same limiting factors. The project types are levee setbacks, stream restoration and floodplain reconnection. Many projects fall into multiple project types, however only the primary project type is listed in Table 16. Table 17 lists the limiting factors addressed by each habitat project type.

Table 16 Summary of WRIA 10 Habitat Improvement Projects included in NEB Analysis

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Type
Lower Puyallup (LP)				
10-LP-H5	Deer Creek Stream Bed Relocation	Relocate the creek bed to allow for a better connection to the floodplain, restore habitat in the adjacent areas.	Improve habitat and provide flood storage.	Stream restoration
10-LP-H6	Swan Creek Channel and Bank Stabilization	In-channel stabilization and restoration measures including installation of woody material and streambed gravel.	Restore 2.5 miles of Swan Creek.	Stream restoration
10-LP-H7	Silver Creek bank Stabilization	Restoration. Stabilize slopes of Silver Creek to stop channel incision.	Habitat restoration.	Stream restoration
10-LP-H8	Puyallup River (Union Pacific) Setback Levee (RM 2.6-3.0) - Acquisition	Levee setback. Acquire up to 30 acres of floodplain and former intertidal habitat.	Habitat restoration.	Levee setback
10-LP-H9	Clear Creek RM 2.9 Acquisition and Levee	Levee setback and floodplain reconnection. Construct a new 13,600' levee along Clear Creek and remove flood gate. Reconnect up to 500 acres of floodplain.	Habitat restoration.	Levee setback
10-LP-H10	Fennel Creek Phase 3	Floodplain restoration This project will restore the Fennel Creek right bank floodplain to a more natural state. Project may include a small offset by removing existing PE wells.	Restore 14 acres of floodplain.	Floodplain restoration
Lower White (LW)				
10-LW-H14	Jovita Creek Habitat Project	Restoration actions to address channel confinement, and that restore habitat and habitat forming processes.	Habitat restoration.	Stream restoration

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Type
10-LW-H15	Pacific Right Bank	Levee setback The proposed project will remove a levee and other artificial floodplain fill, allowing for off-channel habitat and floodplain restoration. The total project area available for restoration is estimated at 32 acres.	Habitat restoration, floodplain reconnection.	Levee setback
10-LW-H16	White River LB RM 2.9-4.2 Restoration	Habitat restoration. White River Restoration will restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2. The tailrace between RM 3 and RM 3.5 is part of the Foster Pilot Project and not included as part of the offset and NEB accounting.	Restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2.	Floodplain restoration
10-LW-H17	White river bridge (Stewart Road) replacement RM 4.9	The project will consist of replacing the existing Stewart Road Bridge with a new bridge. The existing bridge is a restriction along the river, and a new bridge will allow the river more room to move naturally, allowing better utilization of instream habitat beneath the bridge. The current bridge also limits the flow of large woody debris, while a new bridge will let them large woody debris flow downstream and accumulate naturally through the rest of the lower White River.	Habitat restoration.	Stream restoration

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Type
10-LW-H18	White River Setback LB RM4.4-4.8 Stewart	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project will improve rearing opportunity by creating slow water habitat, increasing number/depth of pools, engaging floodplain food webs, improving high flow refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 20 acres of floodplain.	Habitat restoration. Reconnect 20 acres of floodplain.	Levee setback
10-LW-H19	Pacific Pointbar	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project will improve rearing opportunity by creating slow water habitat, increasing number/depth of pools, engaging floodplain food webs, improving high flow refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 25 acres of floodplain.	Habitat restoration. Reconnect 25 acres of floodplain.	Levee setback
Middle White (MW)				
10-MW-H13	Enumclaw Golf Course Restoration	Stream restoration to move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course.	Increased habitat complexity and channel roughness.	Stream restoration
South Prairie Creek (SPC)				
10-SPC-H2	Implement habitat projects based on SPC study.	Habitat improvement projects. Identify and design protection and restoration actions for the lower 15.5 miles of South Prairie Creek and the lower 6 miles of Wilkeson Creek.	Habitat restoration, water quality improvements, fish passage improvements.	Stream restoration

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Type
10-SPC-H3	Stubbs Project	In-channel stabilization and restoration measures including installation of woody material and streambed gravel. Slight chance of a water right acquisition included in this project.	Habitat restoration.	Stream restoration
10-SPC-H4	South Prairie Creek RM 4.0-4.5 Floodplain Planting	Habitat improvement. Continue planting on the South Prairie Creek Preserve property between river mile 4.0 and 4.5 to maintain and in-fill existing plantings on the property.	Habitat restoration and establishment of 50-55 acres of forested floodplain.	Floodplain restoration
10-SPC-H22	South Prairie Creek Floodplain Reconnection, RM 2.7-2.8 Phase 1	Floodplain restoration. Acquire 73 acres and implement a multi-benefit floodplain reconnection project that would reduce flood risk and maintenance costs, restore vital salmon habitat, and keep the property in agricultural production.	Habitat restoration. Water quality improvements.	Floodplain restoration
Upper Puyallup (UP)				
10-UP-H1	Orville Road Revetment at Kapowsin Creek	This project will construct a setback revetment along the left bank Puyallup River near RM 26.3 from Kapowsin Creek confluence upstream. May allow for re-connection of approximately 25-acres of forested floodplain between Puyallup River and Orville Road.	Habitat restoration. Reconnect 25 acres of floodplain.	Floodplain restoration
Upper White (UW)				
10-UW-H11	Greenwater Phase 4 Implementation	Reach scale restoration to restore instream complexity and floodplain connectivity.	Restore 1.2 miles of Greenwater River.	Floodplain restoration
10-UW-H12	West Fork White Floodplain Project	Floodplain restoration project to restore habitat and habitat-forming processes.		Floodplain restoration

Project Number	Project Name	Project Type and Brief Description	Additional Benefits	Project Type
WRIA-Wide (WW)				
10-WW-H20	Land acquisition, water right acquisition, and restoration	Seek out opportunities for land and water right acquisitions and large scale habitat restoration and floodplain reconnection/levee setbacks.	Habitat restoration, habitat protection.	Floodplain restoration Levee setback Stream restoration
10-WW-H21	Levee setbacks	Implement projects included on the Pierce County Levee Setback Feasibility Study as opportunities arise. The study lists levees in Pierce County that may be set back to improve floodplain function and habitat. Any of these levee setback projects would contribute to NEB as well as small but difficult to calculate water offsets by allowing for additional infiltration during high flow events.	Floodplain reconnection, habitat restoration.	Levee setback

Table 17 Limiting Factors Addressed by Habitat Improvement Project Type

Project Type[1]	Limiting Factor(s) Addressed by Project Type[2]
Levee Setback	• Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone • Loss of riparian corridors, including marine riparian, and floodplain forests • Increase in river channelization • Loss of large wood • Loss of instream habitat complexity and connectivity due to large wood • Increase in river channelization
Floodplain Restoration	• Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone • Loss off-channel and side-channel habitat • Loss of riparian corridors, including marine riparian, and floodplain forests • Increase in river channelization • Loss of large wood • Loss of instream habitat complexity and connectivity • Loss of spawning and rearing habitat • Loss of good water quality, including appropriate temperature
Stream Restoration	• Loss of off-channel and side-channel habitat • Loss of riparian corridors, including marine riparian, and floodplain forests • Increase in river channelization • Loss of large wood • Loss of instream habitat complexity and connectivity • Loss of spawning and rearing habitat

[1]Note that WRIA-wide land and water right acquisition projects that provide restoration opportunities do not fall directly into one of these project type categories, however, acquisitions do address a number of limiting factors depending on location and acquisition type.

[2] Habitat projects of a specific project type may address all or some of the limiting factors listed in column 2.

7.3 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 offsets associated with specific project types, project implementation, 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 actions if offsets are not being achieved. These measures, in addition to the surplus water offset and supplemental habitat improvement projects and programmatic actions described above, provide reasonable assurance that the plan will offset consumptive use from new PE wells during the planning horizon.

7.4 NEB Evaluation Findings

This watershed plan provides a path forward for offsetting an estimated 277.4 acre-feet per year of new consumptive water use in WRIA 10. The plan achieves this offset through a total of four Tier 1 projects and five Tier 2 water offset projects with a cumulative offset projection of 788.3 acre-feet per year, WRIA-wide. This projected total water offset yields a surplus offset of 510.9 acre-feet per year above the consumptive use estimate of 277.4 acre-feet per year in WRIA 10. Tier 1 projects alone account for a water offset of 375.3 acre-feet per year, a surplus offset of 97.9 acre-feet per year.

Within this plan, water offset projects are complimented by a total of 22 habitat improvement projects, which provide numerous additional benefits to aquatic and nearshore 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 Chapter 5 include a Water Conservation Education and Incentives Program, Voluntary PE Well Metering Pilot Project, and a recommendation to update the Ecology Well Log Database.

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. WRIA 10 has demonstrated successful collaboration and project implementation through similar processes, such as the WRIA 10/12 Salmon Recovery Lead Entity. This history of successful collaboration is expected to continue.

Based on the information and analyses summarized in this plan and the assumption that projects and programmatic actions in the plan will be implemented, the WRIA 10 Committee finds that this plan achieves a net ecological benefit, as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019b).

1

Appendices

Appendix A – References

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Appendix B – Glossary

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: An administrative rule that establishes Instream Flows. (ECY)

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

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

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

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

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

Local Integrating Organizations (LIO): Local Integrating Organizations are local forums in Puget Sound that collaboratively work to develop, coordinate, and implement strategies and actions that contribute to the protection and recovery of the local ecosystem. Funded and supported

by the Puget Sound Partnership, the LIOs are recognized as the local expert bodies for ecosystem recovery in nine unique ecosystems across Puget Sound. (Partnership)

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

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

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

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

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

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

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

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

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

Permit exempt wells: The Groundwater Code (RCW 90.44), identified four "small withdrawals" of groundwater as exempt from the permitting process. Permit-exempt groundwater wells

often provide water where a community supply is not available, serving single homes, small developments, irrigation of small lawns and gardens, industry, and stock watering.

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

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

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

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

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

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

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

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

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

RCW 90.54 **(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 90.82 **(Watershed Planning)**: Watershed Planning was passed in 1997 with the purpose of developing a more thorough and cooperative method of determining what the current water resource situation is in each water resource inventory area of the state and to provide local citizens with the maximum possible input concerning their goals and objectives for water resource management and development.

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

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

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

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

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

Section 203 or Section 030: Refers to Section 203 of ESSB 6091 or Section 030 of RCW 90.94 respectively. The section details the role of WRE committees and WRE plans (see definitions below) in ensuring the protection and enhancement of instream resources and watershed

functions. This section includes WRIAs 7, 8, 9, 10, 12, 13, 14 and 15. New permit-exempt withdrawals are limited to 950 gpd annual average.

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

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

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

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

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

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

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

Washington Department of Ecology (DOE/ECY): The Washington State Department of Ecology is an environmental regulatory agency for the State of Washington. The department

administers laws and regulations pertaining to the areas of water quality, water rights and water resources, shoreline management, toxics clean-up, nuclear and hazardous waste, and air quality.

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

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

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

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

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

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

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

Appendix C – Committee Roster

Entity	Representative
Tribes	
Muckleshoot Tribe	Henry Martin
Muckleshoot Tribe	Carla Carlson
Puyallup Tribe	Russ Ladley
Puyallup Tribe	Char Naylor
County	
Pierce County	Dan Cardwell
Pierce County	Austin Jennings
Pierce County	Tom Kantz
Cities	
City of Auburn	Lisa Tobin
City of Auburn	Jeff Tate
City of Auburn	Susan Fenhaus
City of Bonney Lake	Ryan Johnstone
City of Bonney Lake	Andrew Fonda
City of Edgewood	Jeremy Metzler
City of Enumclaw	Scott Woodbury
City of Enumclaw	Chris Searcy
City of Enumclaw	Jeff Lincoln
City of Fife	Lorna Fuller
City of Fife	Russ Blount
City of Orting	Greg Reed
City of Orting	Mark Barfield
City of Pacific	Jim Morgan
City of Puyallup	Paul Marrinan
City of Puyallup	Ryan Rutkosky
City of Sumner	Michael Kosa
City of Sumner	Robert Wright
City of Tacoma	Merita Trohimovich
City of Tacoma	Stephanie Seivert Wilson
Water Purveyor	
Lakehaven Water and Sewer District	Tim Osborne
Lakehaven Water and Sewer District	John Bowman
Building Industry Representative	
Master Builder Association of Pierce County	Jessie Gamble
Master Builder Association of Pierce County	Kurt Wilson
Master Builder Association of Pierce County	Chuck Sundsmo
Environmental Representatives	
Puyallup River Watershed Council	Carrie Hernandez

Entity	Representative
Agriculture Representative	
Pierce Conservation District	Allan Warren
Pierce Conservation District	Ryan Mello
WA Department of Fish and Wildlife	
WDFW	Liz Bockstiegel
WDFW	Tristan Weiss
Department of Ecology	
Department of Ecology	Rebecca Brown
Department of Ecology	Angela Johnson
Department of Ecology	Mike Noone
Ex Officio	
WRIA 10/12 Salmon Recovery Lead Entity	Lisa Spurrier

Appendix D – Operating Principles

Operating Principles are available on the WRIA 10 webpage:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA10/202005/WRIA10_OP_final.pdf

Appendix E - Aquifer Units in WRIA 10

The local hydrogeology has previously been described by the U.S. Geological Survey (USGS) in a hydrogeologic framework report for the Puyallup River Watershed (Welch and others, 2015). The USGS describes the hydrogeologic units of the area as being comprised of either water-bearing ("aquifer") and non-water-bearing ("aquitard" or "confining layer") sediments. The layer definition is focused solely on these hydrogeologic properties without regard to geologic origin or age. The USGS definitions are based on previous studies and published reports for both King and Pierce Counties. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments throughout the central and lower regions of the watershed.

The USGS study breaks the hydrogeology of the watershed into 12 units, typically alternating between aquifer and non-aquifer layers. The upper seven layers of the USGS definitions are the most likely units to be encountered by new permit-exempt wells. This includes four aquifer units (Aquifers AL1, A1, A3, and C) that are present through the majority of the lower and central areas of the watershed (See Table 1: Aquifer Units within WRIA 10, below). These aquifers are the most likely to be sources for new permit-exempt wells. They will also be the main source of direct recharge or baseflow to the surface water system.

Table 18: Aquifer Units within WRIA 10

Aquifer	Description	Typical Thickness
AL1	Often present at land surface, the upper alluvial aquifer is found throughout the Puyallup River, Carbon River, and White River valleys (Qal, Qa, Qp, af). The unit primarily consists of alluvial silt, sand, gravel deposits, and local lenses of clay. Where saturated, the unit represents a water-table aquifer. However, local lenses of clay can create confined conditions.	100 feet thick and can exceed 240 feet thick where the Puyallup River meets Commencement Bay
AL2	The lower alluvial aquifer primarily consists of Holocene alluvium and deltaic deposits from estuarine margins of the ancestral Puyallup River. The unit is confined by the overlying MFL confining unit but can be unconfined when the MFL unit is not present.	110 feet
A1	Often present at land surface, this aquifer primarily consists of stratified silt, sand, and gravel deposits of Vashon recessional outwash (Qvr) of the Frasier glaciation. Locally, this unit includes very coarse outwash gravels of the Steilacoom Gravel (Qvs) in broad plains to the west and in the bottoms of outwash channels (the channels were originally described by Walters and Kimmel, 1968).	A few feet up to about 50 feet thick. Where saturated, the unit represents a water-table aquifer and is often in direct continuity with surface-water bodies.

C	Sometimes also called the "sea-level aquifer" due its coincident elevation, this system is usually sand and gravel deposits of pre-Olympia age glacial drift, but lower-permeability deposits of silt, clay, or till are sometimes encountered.	70 to 150 feet thick in most places in the area. Productive zones in this unit seem to be more discontinuous across the region than is the case with Aquifer A3 or Aquifer E.

The remaining five units become thinner or are not present in large portions of the central or eastern areas of the watershed and are not anticipated to be the primary target supply for future permit-exempt wells. These deeper units include three aquifer sources (Aquifers E and G, plus the bedrock).

Appendix F– WRIA 10 Subbasin Delineation Memo

The Subbasin Delineation Technical Memo is available on the WRIA 10 Webpage: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA10/Final Plan/Appendix F WRIA 10 Subbasin Delineation Memo.pdf.

Appendix G – WRIA 10 Permit-Exempt Growth and Consumptive Use Summary

The Permit-Exempt Connection Growth and Consumptive Use Technical Memo is available on the WRIA 10 Webpage: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA10/Final%20Plan/Appendix%20G%20WRIA%2010_Combined%20GPandCU%20Technical%20Memo_Final.pdf.

Appendix H – Projects

Link to Appendix H materials in Box:
https://app.box.com/s/rqh31tg712g5q426kpfbzxuxglw5uhmx

WRIA 10 Project Inventory

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
Carbon River (CR)										
10-CR-W4	Alward Road	Levee Setback. Property acquisition and restoration of 150 acres of floodplain. Includes decommission of 20 PE wells	8	Year-round	Restoration of 150 acres of floodplain, flood hazard reduction	Pierce County	1	Feasibility Study	$ 21,000	$ 14,000,000
10-CR-W3	Carbon River Levee Setback and Acquisition	Water Right and Levee Setback. Purchase a property as part of a larger levee setback project and acquire associated water right.	14.3	Irrigation Season	Habitat restoration.	Pierce County	2	Assessment	$ 37,000	$ 19,000,000
Lower Puyallup (LP)										
10-LP-W6	Potential MAR	MAR. Construct an MAR in a gravel pit supplied with Tacoma Water. Three potential locations are identified in the Lower Puyallup.	300	Year-round		None	2	Conceptual	$ 1,100,000	$ 1,100,000
10-LP-W10	Bond	Water Right. Acquire water right as part of a larger property transfer and protection with the City of Puyallup	30	Irrigation Season		City of Puyallup	2	Outreach	$ 80,000	$ 80,000
10-LP-H5	Deer Creek Stream Bed Relocation	Relocate the creek bed to allow for a better connection to the floodplain, restore habitat in the adjacent areas.	N/A	N/A	Improve habitat and provide flood storage.	City of Puyallup	H	Design	N/A	TBD
10-LP-H6	Swan Creek Channel and Bank Stabilization	In-channel stabilization and restoration measures including installation of woody material and streambed gravel.	N/A	N/A	Restore 2.5 miles of Swan Creek.	Pierce County and Puyallup Tribe	H	Design	N/A	$ 3,700,000
10-LP-H7	Silver Creek bank Stabilization	Restoration. Stabilize slopes of Silver Creek to stop channel incision.	N/A	N/A	Habitat restoration.	City of Puyallup	H	Conceptual	N/A	TBD
10-LP-H8	Puyallup River (Union Pacific) Setback Levee (RM 2.6-3.0) - Acquisition	Levee setback. Acquire up to 30 acres of floodplain and former intertidal habitat.	N/A	N/A	Habitat restoration.	Pierce County	H	Conceptual		$ 8,500,000
10-LP-H9	Clear Creek RM 2.9 Acquisition and Levee	Levee setback and floodplain reconnection. Construct a new 13,600' levee along Clear Creek and remove flood gate. Reconnect up to 500 acres of floodplain.	N/A	N/A	Habitat restoration.	Pierce County	H	Conceptual		$ 5,473,802
10-LP-W18	Troutlodge Source Switch	Switch hatchery water right from surface diversion to groundwater.	N/A	N/A	Barrier removal	Pierce County, Puyallup Tribe	2	Conceptual	TBD	TBD
10-LP-H10	Fennel Creek Phase 3	Floodplain restoration This project will restore the Fennel Creek right bank floodplain to a more natural state. Project	N/A	N/A	Restore 14 acres of floodplain.	Pierce County	H	Design		$ 1,662,329

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
		may include a small offset by removing existing PE wells.								
10-LP-W9	Puyallup R. # 1	Water right acquisition would result in an additional 0.75 cfs in 10 miles of the Puyallup River.	82.82	Irrigation Season		TBD	2	Conceptual	$ 212,930	$ 212,930
10-LP-W10	Puyallup R. # 3	Water right acquisition would result in an additional 0.3 cfs in 6.5 miles of the Puyallup River.	36.23	Irrigation Season		TBD	2	Conceptual	$ 93,147	$ 93,147
10-LP-W11	Puyallup R. # 4	Water right acquisition would result in an additional 0.38 cfs in 1.5 miles of Clarks Creek and 6.7 miles of Puyallup River.	19.92	Irrigation Season		TBD	2	Conceptual	$ 51,214	$ 51,214
10-LP-W12	Fennel Cr - Puyallup R. #5	Water right acquisition would result in an additional 0.22 cfs in 16 miles of the Puyallup River.	23.55	Irrigation Season		TBD	2	Conceptual	$ 60,547	$ 60,547
10-LP-W13	Hylebos Cr - Fr Comm Bay #1	Water right acquisition would result in an additional 0.67 cfs in 6 miles of Wapato Creek.	34.35	Irrigation Season		TBD	2	Conceptual	$ 88,314	$ 88,314
Lower White (LW)										
10-LW-H14	Jovita Creek Habitat Project	Restoration actions to address channel confinement, and that restore habitat and habitat forming processes.	N/A	N/A	Habitat restoration.	City of Edgewood	H	Feasibility	N/A	$ 250,000
10-LW-H15	Pacific Right Bank	Levee setback The proposed project will remove a levee and other artificial floodplain fill, allowing for off-channel habitat and floodplain restoration. The total project area available for restoration is estimated at 32 acres.	N/A	N/A	Habitat restoration, floodplain reconnection.	King County Flood Control District	H	Design	N/A	$ 79,000,000
10-LW-H16	White River LB RM 2.9-4.2 Restoration	Habitat restoration. White River Restoration will restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2. The tailrace between RM 3 and RM 3.5 is part of the Foster Pilot Project and not included as part of the offset and NEB accounting.	N/A	N/A	Restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2.	City of Sumner	H	Design	N/A	$ 25,000,000

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-LW-H17	White River Bridge (Stewart Road) replacement RM 4.9	The project will consist of replacing the existing Stewart Road Bridge with a new bridge. The existing bridge is a restriction along the river, and a new bridge will allow the river more room to move naturally, allowing better utilization of instream habitat beneath the bridge. The current bridge also limits the flow of large woody debris, while a new bridge will let them large woody debris flow downstream and accumulate naturally through the rest of the lower White River.	N/A	N/A	Habitat restoration.	City of Sumner	H	Design	N/A	$ 30,000,000
10-LW-H18	White River Setback LB RM4.4-4.8 Stewart	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project Improve Rearing Opportunity by creating slow water habitat, increased number/depth of pools, engaged floodplain food webs. Better High Flow Refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 20 acres of floodplain.	N/A	N/A	Habitat restoration. Reconnect 20 acres of floodplain.	City of Sumner	H	Design	N/A	$ 7,000,000
10-LW-H19	Pacific Pointbar	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project will improve rearing opportunity by creating slow water habitat, increased number/depth of pools, and engaged floodplain food webs. Better High Flow Refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 25 acres of floodplain.	N/A	N/A	Habitat restoration. Reconnect 25 acres of floodplain.	City of Sumner	H	Design	N/A	$ 18,000,000
Middle White (MW)										
10-MW-W7	CWA purchase	Water Right. Acquire a portion of the Cascade Water Alliance water right to place in trust.	277	Year-round		Ecology	1	Outreach/Negotiation	$ 750,000	$ 750,000
10-MW-H13	Enumclaw Golf Course Restoration	Stream restoration to move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course.	N/A	N/A	Increased habitat complexity and channel roughness.	City of Enumclaw and Puyallup Tribe	H	Design	N/A	$ 2,300,000
10-MW-W14	Boise Cr - White R # 2	Water right acquisition would result in an additional 0.22 cfs in 24.7 miles of White River and 10.5 miles of Puyallup River.	53.86	Irrigation Season		TBD	2	Conceptual	$ 138,474	$ 138,474

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-MW-W15	Boise Cr - White R # 3	Water right acquisition would result in an additional 0.3 cfs in 0.2 miles of Cyclone Creek, 24.3 miles of White River, and 10.5 miles of Puyallup River.	47.06	Irrigation Season		TBD	2	Conceptual	$ 120,991	$ 120,991
10-MW-W16	Boise Cr - White R # 4	Water right acquisition would result in an additional 0.3 cfs in 3 miles of Boise Creek, 23.4 miles of White River, and 10.5 miles of Puyallup River.	4.706	Irrigation Season		TBD	2	Conceptual	$ 12,099	$ 12,099
South Prairie Creek (SPC)										
10-SPC-W2	Old Inglin Dairy	Water Right. Floodplain restoration of former dairy, and place water rights into trust after plants are established.	89.09	Irrigation Season	Floodplain restoration/reconnection, habitat enhancement.	Pierce Conservation District	1	In progress	$ 230,000	$ 230,000
10-SPC-H2	Implement habitat projects based on SPC study.	Habitat improvement projects. Identify and design protection and restoration actions for the lower 15.5 miles of South Prairie Creek and the lower 6 miles of Wilkeson Creek.	N/A	N/A	Habitat restoration, water quality improvements, fish passage improvements.	Pierce Conservation District, Puyallup Tribe, South Puget Sound Salmon Enhancement Group	H	Planning study funded	N/A	$ 469,000
10-SPC-H3	Stubbs Project	In-channel stabilization and restoration measures including installation of woody material and streambed gravel. Slight chance of a water right acquisition included in this project.	N/A	N/A	Habitat restoration.	Pierce Conservation District	H	Conceptual	TBD	TBD
10-SPC-H4	South Prairie Creek RM 4.0-4.5 Floodplain Planting	Habitat improvement. Continue planting efforts on the South Prairie Creek Preserve property between river mile 4.0 and 4.5 to maintain and in-fill existing plantings on the property.	N/A	N/A	Habitat restoration and establishment of 50-55 acres of forested floodplain.	Pierce Conservation District, South Puget Sound Salmon Enhancement Group (SPSSEG)	H	In progress	N/A	$ 369,000
10-SPC-H22	South Prairie Creek Floodplain Reconnection, RM 2.7-2.8 Phase 1	Floodplain restoration. Acquire 73 acres and implement a multi-benefit floodplain reconnection project that would reduce flood risk and maintenance costs, restore vital salmon habitat, and keep the property in agricultural production.	N/A	N/A	Habitat restoration. Water quality improvements.	Pierce Conservation District	H	Conceptual	N/A	$ 1,239,000
Upper Puyallup (UP)										

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-UP-W1	Orville Road Revetment Phase 2C Year 1	Floodplain Reconnection/Levee Setback. Purchased and decommission a PE well that served 3 homes as part of this project.	1.2	Year-round	Habitat restoration. 1,500 Linear Feet of setback revetment, 19 engineered log jams.	Pierce County	1	In progress/complete	$ 3,100	$ 2,200,000
10-UP-H1	Orville Road Revetment at Kapowsin Creek	This project will construct a setback revetment along the left bank Puyallup River near RM 26.3 from Kapowsin Creek confluence upstream. May allow for re-connection of approximately 25-acres of forested floodplain between Puyallup River and Orville Road.	N/A	N/A	Habitat restoration. Reconnect 25 acres of floodplain.	Pierce County	H	Preliminary Design	N/A	$ 3,880,306
10-UP-W17	Fiske Cr - Puyallup R. #3	Water right acquisition would result in an additional 0.45 cfs in 23 miles of the Puyallup River.	72.15	Irrigation Season		TBD	2	Conceptual	$ 185,498	$ 185,498
Upper White (UW)										
10-UW-H11	Greenwater Phase 4 Implementation	Reach scale restoration to restore instream complexity and floodplain connectivity.	N/A	N/A	Restore 1.2 miles of Greenwater River.	SPSSEG	H	Design	N/A	$ 1,500,000
10-UW-H12	West Fork White Floodplain Project	Floodplain restoration project to restore habitat and habitat-forming processes.	N/A	N/A		SPSSEG	H	Conceptual	N/A	$ 3,000,000
WRIA-Wide (WW)										
10-WW-W8	Green Stormwater Infrastructure	Stormwater infiltration. Support Green Stormwater Infrastructure retrofits for both individual property owners and jurisdictions. Goal of 10 projects per year.	27	Year-round	Water quality improvements	Pierce Conservation District	2	Planning	$ 900,000	$ 900,000
10-W9-W17	WWT assessment	Water Right. Acquire 10% of the water rights identified through Washington Water Trust assessment. These rights are listed individually in this table.	41.71	Irrigation Season		Unknown	2	Conceptual	$ 110,000	$ 110,000
10-WW-H20	Land acquisition, water right acquisition, and restoration	Seek out opportunities for land and water right acquisitions and large scale habitat restoration and floodplain reconnection/levee setbacks.	N/A	N/A	Habitat restoration, habitat protection.	Multiple	2	Conceptual	TBD	TBD
10-WW-W19	General source switches for ag producers	Ag producers switch from surface to groundwater rights. More water in the stream during the low flow periods. Individual projects would need to be evaluated for Foster impacts, and might not be legal until the Foster is addressed.	N/A	N/A	Improved water quality for agriculture producers.	PCC Farmland Trust	2	Conceptual	TBD	TBD

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-WW-H21	Levee setbacks	Implement projects included on the Pierce County Levee Setback Feasibility Study as opportunities arise. The study lists levees in Pierce County that may be set back to improve floodplain function and habitat. Any of these levee setback projects would contribute to NEB as well as small but difficult to calculate water offsets by allowing for additional infiltration during high flow events.	N/A	N/A	Floodplain reconnection, habitat restoration.	Pierce County	H	Conceptual	N/A	TBD

ALWARD ROAD ACQUISITION AND RESTORATION

Narrative description, including goals and objectives.

Pierce County has been acquiring property along Alward Road near Orting since 1989, in the Carbon River sub-basin (WRIA 10). This proposal would complete the acquisition and construct a setback levee and make other restoration improvements which will reconnect 150 acres of floodplain adjacent to the Carbon River. Proposed actions at the Site include removing approximately 8,925 linear feet of existing levee located along the left (south) bank of the Carbon River. An armored levee of approximately 9,850 linear feet would be constructed and set back from the Carbon River to the south, encompassing an area of approximately 6,190,596 square feet (142 acres). Engineered log jams (ELJs) would be constructed alongside Alward Road to protect it from erosion. Riparian restoration would also occur in floodplain areas. A total of 30 properties will need to be acquired. An ongoing phase of the project (Phase 3) will purchase 10 of those properties.

The goals of the project include the following:

- Remove the existing river levee and reconnect the Carbon River left bank floodplain which will allow salmon and trout species to access an additional 150 acres of off-channel habitat.
- Allow for more natural floodplain inundation and function respective to frequency, depth and duration without obstruction.
- Facilitate the restoration of natural watershed and conserve the properties for habitat in perpetuity.

The objectives of the project are:

- Acquire thirty Carbon River Alward Road reach floodplain properties
- Remove structures on purchased property
- Remove existing levee and install setback levee
- Install ELJs alongside Alward Road
- Restore floodplain areas with riparian plantings

An estimated 20 residential structures will be acquired and removed, potentially providing a water offset benefit equal to 20 new permit-exempt wells. The water offset benefit will occur when the structures are acquired, likely within the next five years.

Qualitative assessment of how the project will function.

The project will function by allowing natural processes to develop in a large floodplain area currently isolated by a levee.

Conceptual-level map of the project and location.

The acquisition area of the proposed project is located along the north side of Alward Road between river miles 6.8 and 8.0 of the left bank side of the Carbon River. This segment of river lies between 226th AVE CT E and the end of Alward Road. Figure 1, prepared by Pierce County, shows the vicinity of the project. Figure 2 shows the parcels needing to be acquired and includes the ten parcels being acquired as part of Phase 3.

Figure 3, prepared by GeoEngineers, shows an overview of the 30% design of the levee setback portion of the project. (The full set of 30% design drawings are available on Box.)

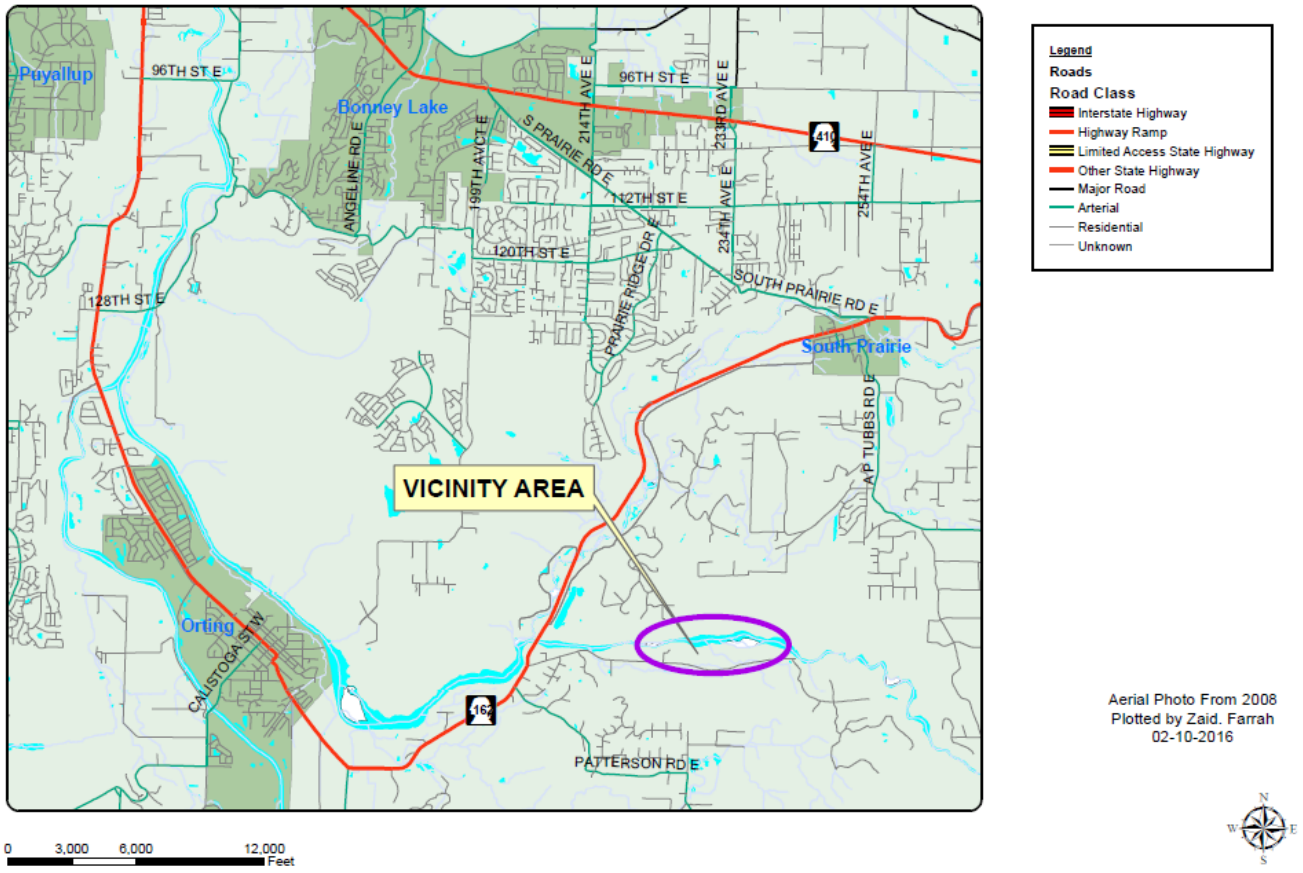


Figure 1. Alward Road Acquisition Project (from Pierce County, 2016)

Performance goals and measures.

The performance goal is to acquire 30 parcels between river miles 6.4 and 8.4 of the Carbon River. All existing structures will be removed, and all properties will be retained as open space in perpetuity. An existing levee will be removed and a setback levee constructed. Floodplain areas will be restored. This project builds upon SRFB project 13-1422 and other County efforts to acquire all floodplain parcels within the project reach.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river mile 6.4 and 8.4; side channel and other habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph. Salmonids in the lower Carbon River and in the Puyallup River will benefit from increased habitat and reduced peak flow and sediment input.

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

The Carbon River supports a variety of salmonid species including ESA threatened Chinook, Steelhead, and Bull Trout. Other salmonid species on the Carbon River that would receive benefit from this project include Coho, fall chum, and pink salmon, and Cutthroat Trout. The Carbon River fall Chinook salmon run is also listed as one of 22 unique species, or Evolutionarily Significant Units (ESUs), in Puget Sound. The salmonids and other aquatic species in the Greenwater River are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone
- Loss of bank stability
- Loss of off channel and side-channel habitat
- Loss of instream habitat complexity and connectivity due to large wood
- Loss of riparian habitat

Removal of the existing levee will promote the creation of a variety of habitat types including side channels, backwater channels, deep complex pools, spawning habitat and summer and winter rearing habitat by promoting the creation of a variety of habitat types and hydrologic features. ELJs would be placed strategically to promote lateral migration of the river. These complex habitats provide protection from flood events and act as riparian cover and rearing habitat, which supports juvenile salmonids and provides areas for fry to colonize. Coho salmon may also spawn in low velocity side channels. Deep complex pools would also be created. These provide cover and prey availability during migratory periods for adult salmonids and cover for juveniles when log jams are present. Deep pools are also generally colder than other in-water environments, providing appropriate temperatures and acting as a refuge. As new, sinuous channels develop, there will be a significant increase in the development of shallow edge habitat along the expanding channel system, providing shade and cover for fry and juvenile salmon during rearing. Invertebrates colonizing the edge habitat are also a prey source for juveniles. A more sinuous river will result in a slower velocity system where a greater range of sediment and substrate types are available due to the complexity of habitats present. Spawning salmonids would benefit from a range of substrate sizes. It should also be noted that habitat restoration is extremely important for Steelhead stocks due to the extended period of time they spend in freshwater. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in the Carbon River.

Identification of anticipated support and barriers to completion.

This project builds upon other County efforts to acquire all floodplain parcels within the project reach. Prospective property owners have been contacted and Landowner Acknowledgment Forms have been signed for the Phase 3 portion of the project (acquisition of 10 parcels). All property owners in the Phase 3 project have indicated their willingness to sell their properties. The project is sponsored by Pierce County and supported by the Lead Entity.

Priority actions within the WRIA 10/12 Lead Entity Strategy include levee setbacks with highest priority to reestablish floodplain connectivity and to restore stream processes. Setbacks are identified as a Near Term Action and a High priority because they can result in re-connecting large areas of floodplain to the main river. They allow natural processes to create side-channel and off-channel habitat areas. The WRIA 10/12

Lead Entity Strategy additionally states that this type of action will provide the greatest restoration benefit to Puyallup/White River Chinook abundance. The Puget Sound Chinook Recovery Plan identified levee and dike setbacks as both a near-term and a long-term strategy to reduce further degradation of the mainstem rivers. Chapter 3 of the WRIA 10/12 Lead Entity Strategy and/or the PS Chinook Recovery Plan states, "Based on the tremendous benefits that floodplain reconnection projects will have for Chinook in WRIA 10/12, we think that our focus on freshwater habitat restoration in the lower Puyallup, lower Carbon and lower White River floodplains is an appropriate strategy."

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

The funding requested to complete acquisitions, removal of structures, levee setback, levee construction, and restoration of floodplain habitat is approximately $14 million. This cost estimate is based on acquisition and construction estimates that were completed in 2014. Some parcels have been acquired (RCO, 2020) which may reduce the cost; however, costs are likely higher due to inflation. A revised cost estimate will be needed.

No O&M costs have been identified for structure removal and levee removal. Levee installation and floodplain restoration may require some O&M to maintain riparian plantings and the new setback levee. These costs have not been estimated.

The costs of just decommissioning the existing wells to provide a water offset is not known; a unit cost of $2571 per acre-foot is recommended by Washington Department of Ecology for water right acquisitions (Melcher, 2020) and was used for this project. For 20 wells with an average water offset of 0.4 acre-feet per year, the total cost would be approximately $20,600. That cost is preliminary and is used just for purposes of estimating costs of water offset projects for the watershed plan.

Anticipated durability and resiliency.

Levee setback and floodplain restoration projects are durable as they restore natural processes to a reach of the river, allowing flooding and channel migration to occur unimpeded. Instream wood placement projects are also durable; they support natural processes and encourage accumulation of smaller debris. Given the changing climate conditions, that anticipates receding glaciers, and increases in precipitation, rain-on-snow events, and channel aggradation, setback projects that provide the river with more room to meander are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

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

Pierce County is the project sponsor and is ready to implement the project as property owners have indicated their willingness to sell their properties. The overall project can likely be implemented within the next five years.

Documentation of sources, methods, and assumptions.

The following references were used:

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

GeoEngineers, 2008. Levee Setback Project Carbon River - Alward Road Site River Mile Post 8.30 To 6.40 Left Bank 30% Design Plans.

GeoEngineers, 2008. Levee Setback Feasibility Analysis Puyallup River Watershed Pierce County, Washington. Prepared for Pierce County Public Works & Utilities, June 19, 2008

Mary Ann Reinhart & Tim Abbe, December 29, 2014. Flood Plain Reconnection Feasibility Study Puyallup, Carbon, White Rivers Pierce County, Washington. Prepared for: Puyallup River and Chambers Creek Lead Entity Technical Advisory by Natural Systems Design, Inc.

Melcher, Austin (Washington Department of Ecology). Memo regarding: Water Offset Project Potential Cost Estimate Methodology. Sent to Ingria Jones, John Covert. September 17, 2020

Pierce County, Alward Road Setback Levee Fact Sheet. Undated

Washington State Recreation and Conservation Office (RCO), 2020. Alward Rd. Acquisition Phase 3. PRISM Project #17-1355. Available from: https://secure.rco.wa.gov/prism/search/projectsnapshot.aspx?ProjectNumber=17-1355

Figure 2 [Attached]. Alward Road Parcels Map

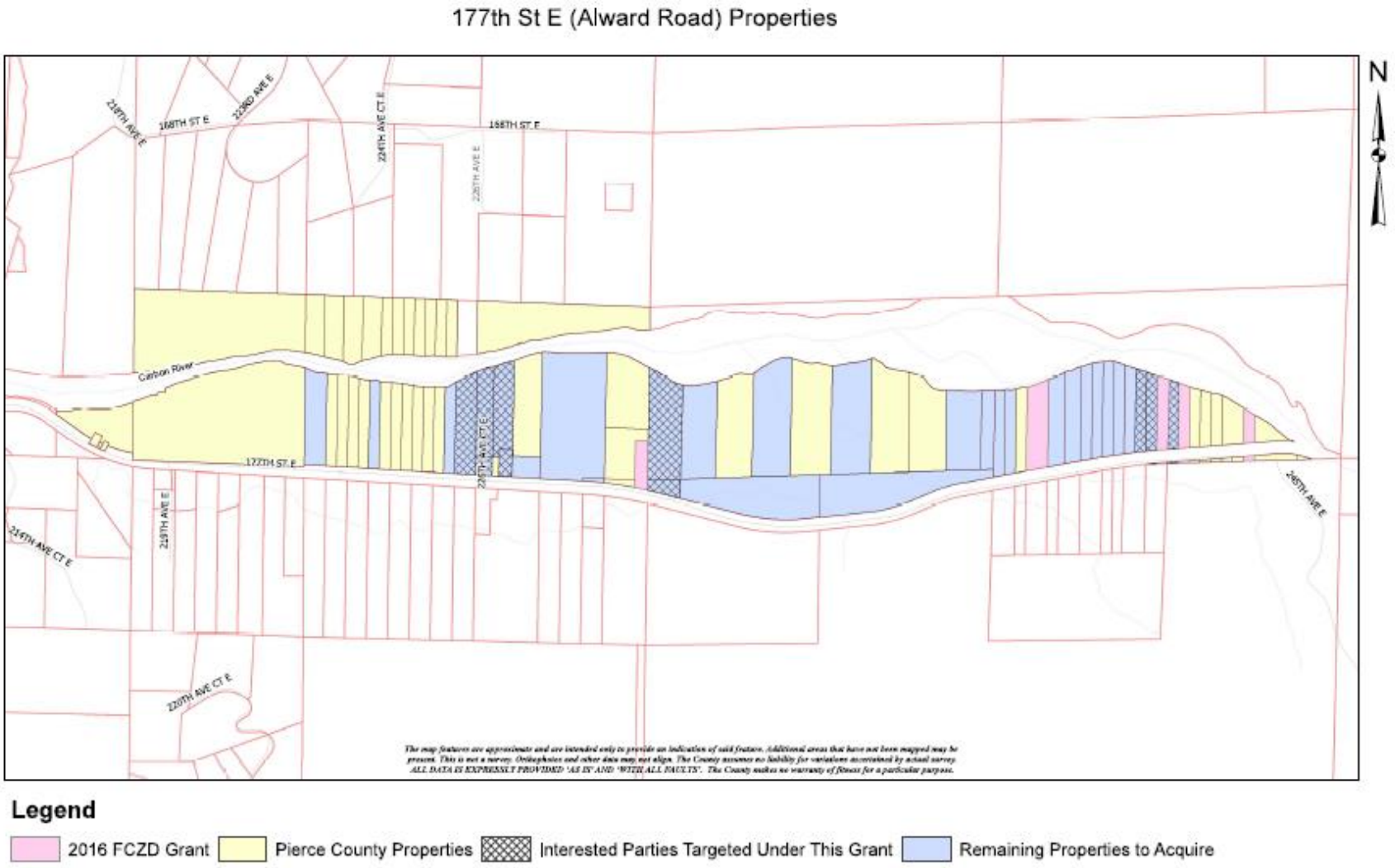
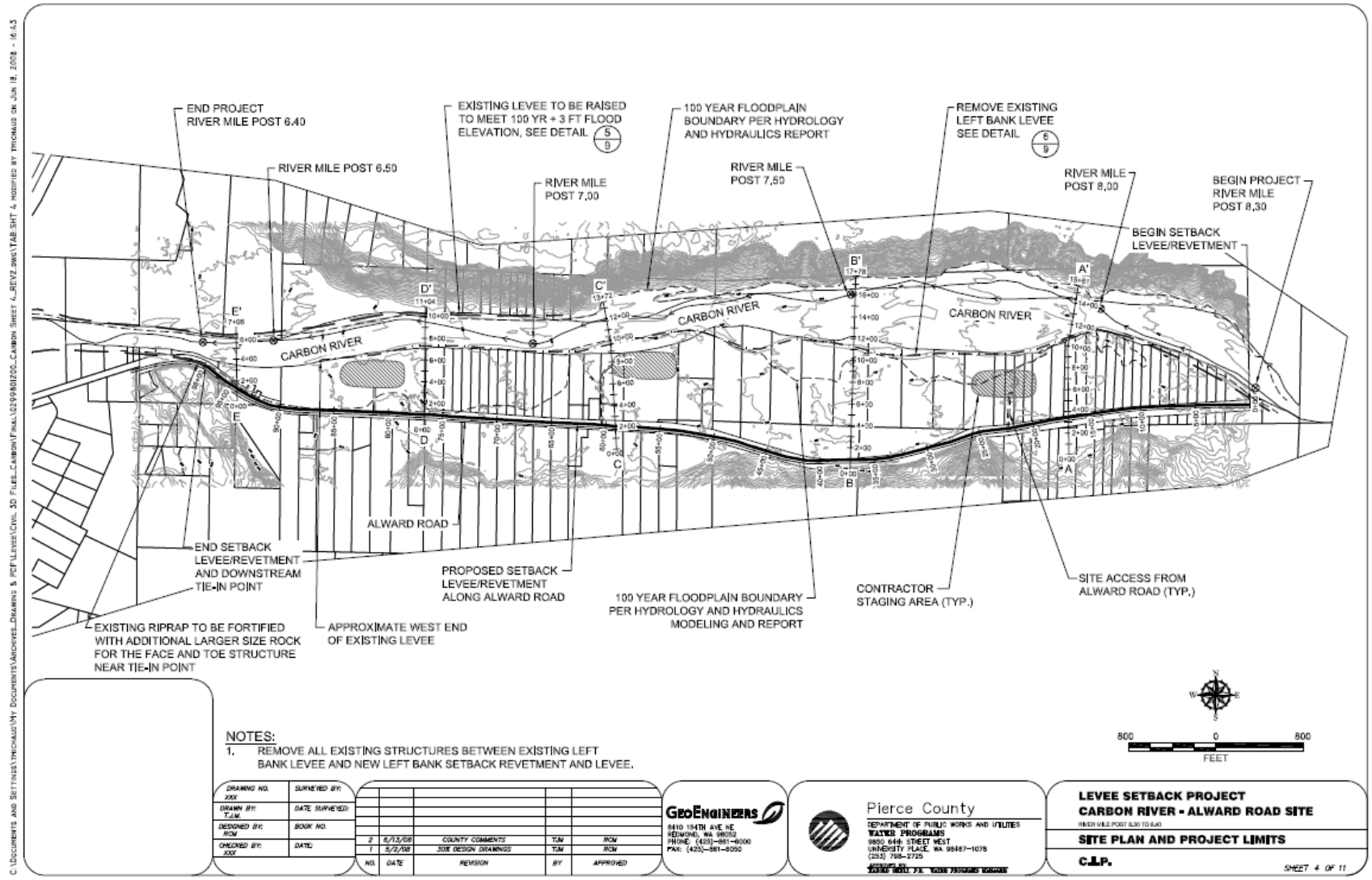


Figure 3 [Attached]. Alward Road 30% Design Drawings Overview (Page 4 from GeoEngineers, 2008)



WRIA 10 CASCADE WATER ALLIANCE WATER RIGHTS ACQUISITION
PROJECT DESCRIPTION – DECEMBER 28, 2020

Description

Cascade Water Alliance (CWA) currently serves communities north of WRIA 10 in the Green River and Lake Washington Watersheds. They acquired the Lake Tapps project from Puget Sound Energy and obtained water rights for future municipal use. This project would acquire a portion of the water rights from CWA and place it in the State's Trust Water Rights Program to contribute to streamflow while protecting the water right from relinquishment.

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

CWA were granted water rights (Permit S2-29920(A)) with a priority date of June 20, 2000 for withdrawal of up to 1,000 cfs and 54,300 acre-feet from the White River. The purpose of use is municipal. The place of use for this water right is shown in Figure 1. This project would acquire 277 acre-feet from the municipal permit held by CWA and place that quantity in the State's Trust Water Right Program. The streamflow benefit will likely occur year-round.

Description of the anticipated spatial distribution of likely benefits

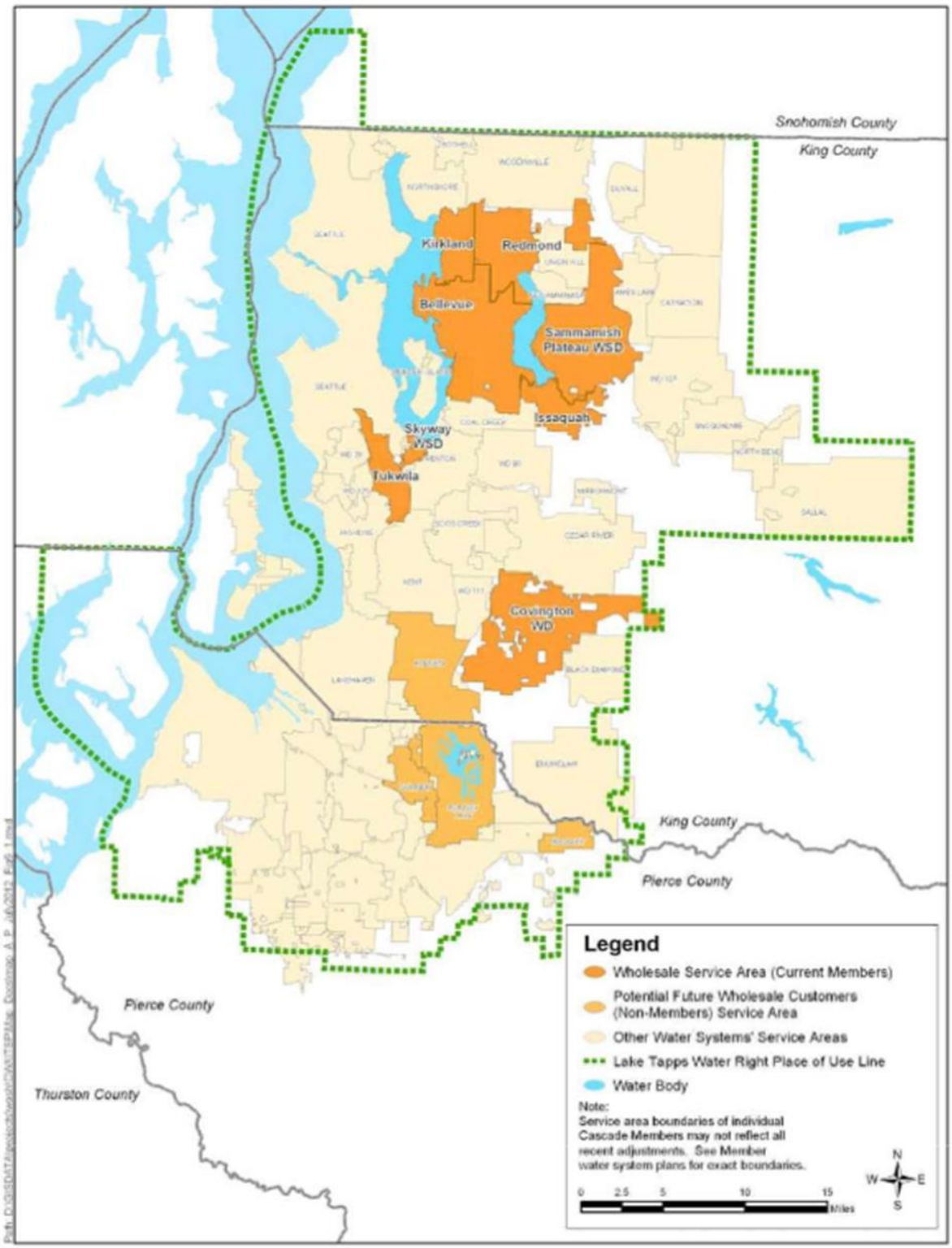
The water is currently diverted from the White River at river mile 24.3, held in Lake Tapps and released at river mile 3.6. The benefits on the White River could extend from the diversion dam at river mile 24.3 to its confluence with the Puyallup River at river mile 0.0 and on the Puyallup River from its river mile 10.4 to river mile 0.0. Those reaches of the White and Puyallup rivers are within WRIA 10. Figure 2 provides a schematic of the White and Puyallup river stream reaches.

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

This project will slightly increase instream flow. The primary limiting factors in the Puyallup Watershed (Kerwin, 1999; Lead Entity, 2018) which would be addressed through this project include:

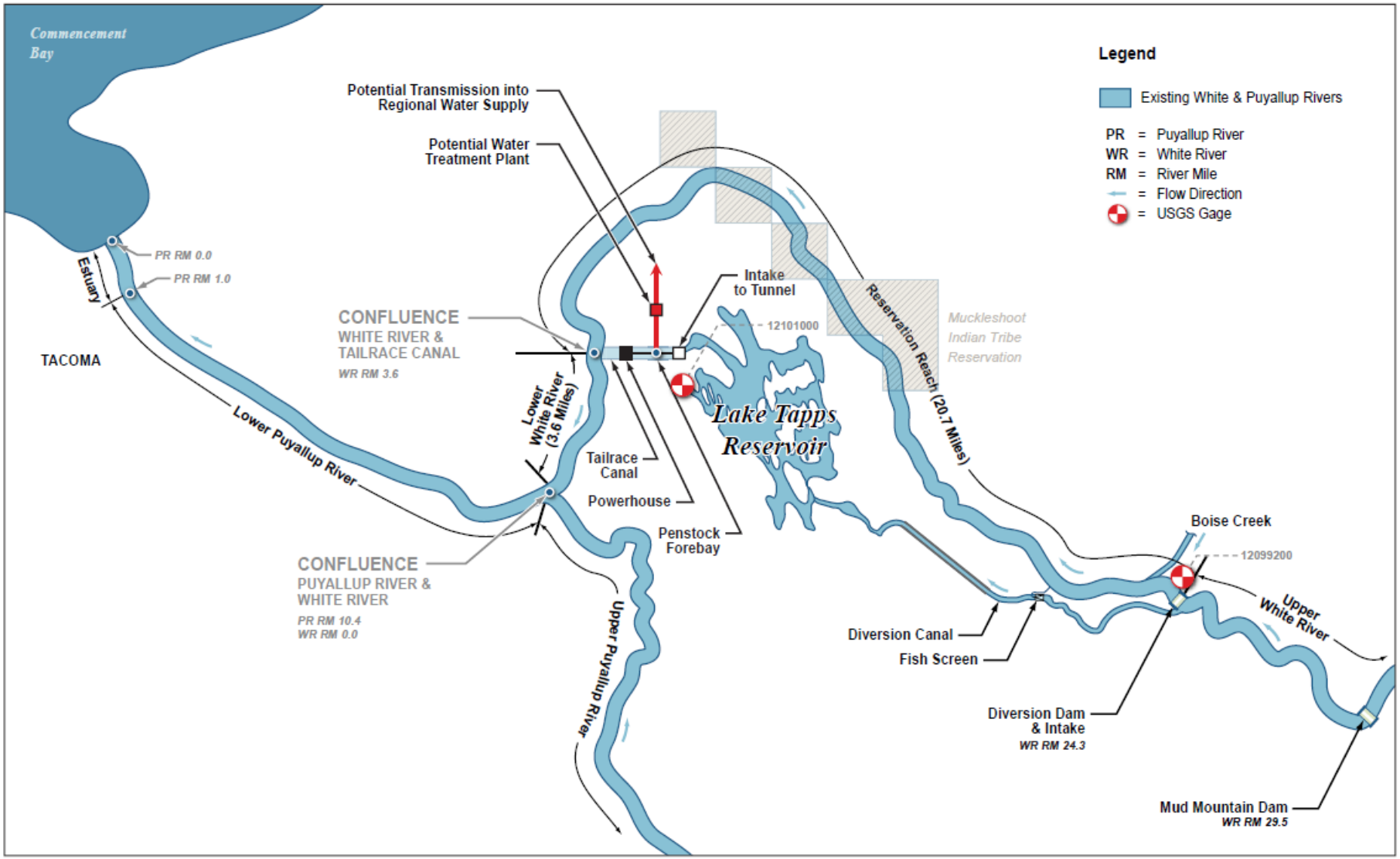
- Loss of upstream, downstream, and lateral fish passage
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Figure 1. Cascade Water Alliance Water Right Place of Use



Source: Cascade Water Alliance Transmission and Supply Plan, July 2012, Figure 6-1

Figure 2. Stream Reaches of the White and Puyallup Rivers



Source: Lake Tapps Reservoir Water Rights and Supply Project Draft Environmental Impact Statement January 29, 2010

Identification of anticipated support and barriers to completion.

The project is supported by the Watershed Restoration and Enhancement Committee and the barriers to completion would be negotiation of the water right acquisition from CWA and obtaining funding to purchase the water right. CWA has indicated a willingness to discuss the acquisition.

Potential budget and O&M costs.

No agreement or purchase price has been discussed with CWA. For planning purposes, a cost of $2,571 per acre-foot was used, resulting in an estimated cost of $750,000. The unit cost was obtained from an Ecology memo titled Water Offset Project Potential Cost Estimate Methodology (Melcher, 2020). No O&M costs would likely be incurred with this project.

Anticipated durability and resiliency.

The project would have lasting benefits as the Trust Water Right would be in perpetuity.

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

Washington Department of Ecology would be the project sponsor and would be ready to proceed immediately if acquiring a trust water right is feasible.

Sources of Information

Kerwin. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resources Inventory Area 10). Washington State Conservation Commission. Olympia, WA.

Melcher, Austin. Memo regarding: Water Offset Project Potential Cost Estimate Methodology. Sent to Ingria Jones, John Covert. September 17, 2020

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June.

Managed Aquifer Recharge Project Portfolio for WRIA 10
December 28, 2020

Summary

Managed Aquifer Recharge (MAR) projects are being considered in WRIA 10 as a method to increase infiltration to aquifers to improve streamflow and to offset the water use from future permit exempt (PE) wells in the watershed. The planning and implementation of MAR projects is complex, leading to uncertainty as to their potential use as water offset projects and inclusion in the Watershed Restoration and Enhancement Plan. A potential approach to addressing uncertainty is to include a portfolio of MAR projects that have different locations, project sponsors, water sources, and size.

Potential WRIA 10 MAR Projects

There are different types of MAR projects. Aquifer Storage and Recovery (ASR) projects are a type of MAR project that actively injects water into aquifers for storage and recovery by pumping later. Passive MAR projects infiltrate water into shallow aquifers, with the intent that water discharges from the shallow aquifer into streams on a delayed basis and improves streamflow during low-flow periods. For WRIA 10, only passive MAR projects are being considered.

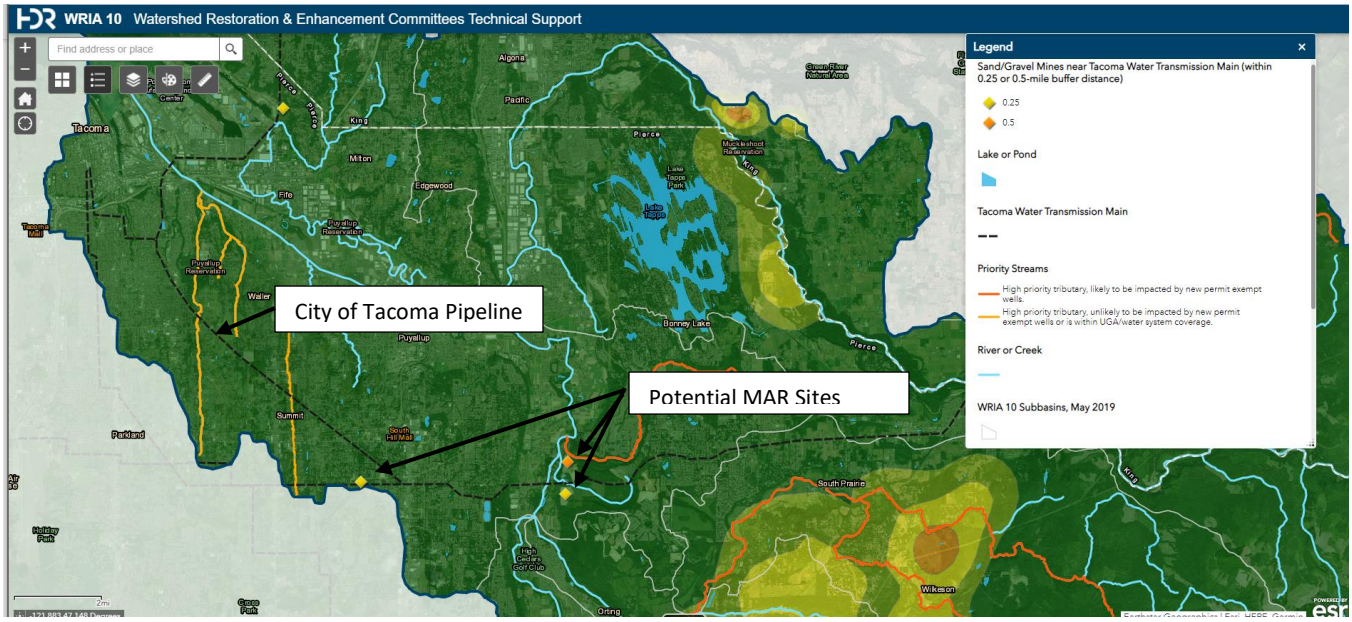
Passive MAR projects have the potential to recharge a significant volume of water into shallow aquifers, greater than the estimated consumptive use of PE wells forecast for the next 20 years in WRIA 10. The estimated consumptive use for future PE wells in WRIA 10 is 277 acre-feet per year.

The source of water for passive MAR projects in WRIA 10 may be stormwater, diverted surface water or water obtained from a City of Tacoma pipeline that delivers drinking water from the Green River watershed. Recycled water (highly treated wastewater) could be a source but at this time no source for recycled water was identified in WRIA 10 that is located outside of the Tacoma urban area.

The Watershed Restoration and Enhancement Committee expressed an interest in using City of Tacoma water supplied by their pipeline as it would be a clean and reliable source of water and may be easier to implement a project with that water source. A high-level screening of potential MAR sites was performed by PGG and HDR by searching for permitted sand and gravel mining operations located within a ½ mile distance of the pipeline. Three were found within ¼ mile and one within ½ mile. All the sites are located in the Lower Puyallup River subbasin. Three sites are included in this project description. The other site was located close to Commencement Bay and infiltration at that location would not provide a streamflow benefit. These sites have potential for MAR, however other sites not yet identified may also be suitable. A more intensive screening of sites should be performed if a MAR project is needed to provide water offsets for the Watershed Plan.

The location of the 3 sites and the City of Tacoma pipeline are shown in Figure 1.

Figure 1. Location of Potential MAR Sites



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

Preliminary calculations of the potential size and infiltration capacity if a suitable gravel pit site is located were performed. A MAR facility may only need a footprint of 2 acres to infiltrate 300 acre-feet per year, using a conservative assumption of 2 feet/day for the infiltration rate. It was assumed that infiltration would occur during winter months as the City of Tacoma pipeline has excess capacity during winter. A flow rate of 1 cfs (450 gallons per minute) would be required from the City of Tacoma pipeline to infiltrate 300 acre-feet during the winter season. If several sites are feasible, the selection of how many are used and how much water is infiltrated at each would be a decision of the Watershed Restoration and Enhancement Committee. A MAR project can be scaled to the desired water offset or streamflow benefit.

A preliminary review of geology was performed for the sites. Geologic maps are shown in Figures 2 and 3. All three sites are in formations that would be suitable for infiltration. However additional geologic and geotechnical analyses are required before determining whether MAR projects would be feasible at those sites. The additional analyses are also required to determine the timing of the offset benefit. Water infiltrated at the two sites located just east of the Puyallup River would likely reach the adjacent streams (Fennel Creek, Canyonfalls Creek or the Puyallup River) more quickly than the third site which is located in the headwaters of Clarks Creek and Swan Creek. At this time, assuming the MAR facilities operate all but summer time, some streamflow benefit will likely occur year-round.

Figure 2. Geology Map for MAR Sites East of Puyallup River near Bonney Lake

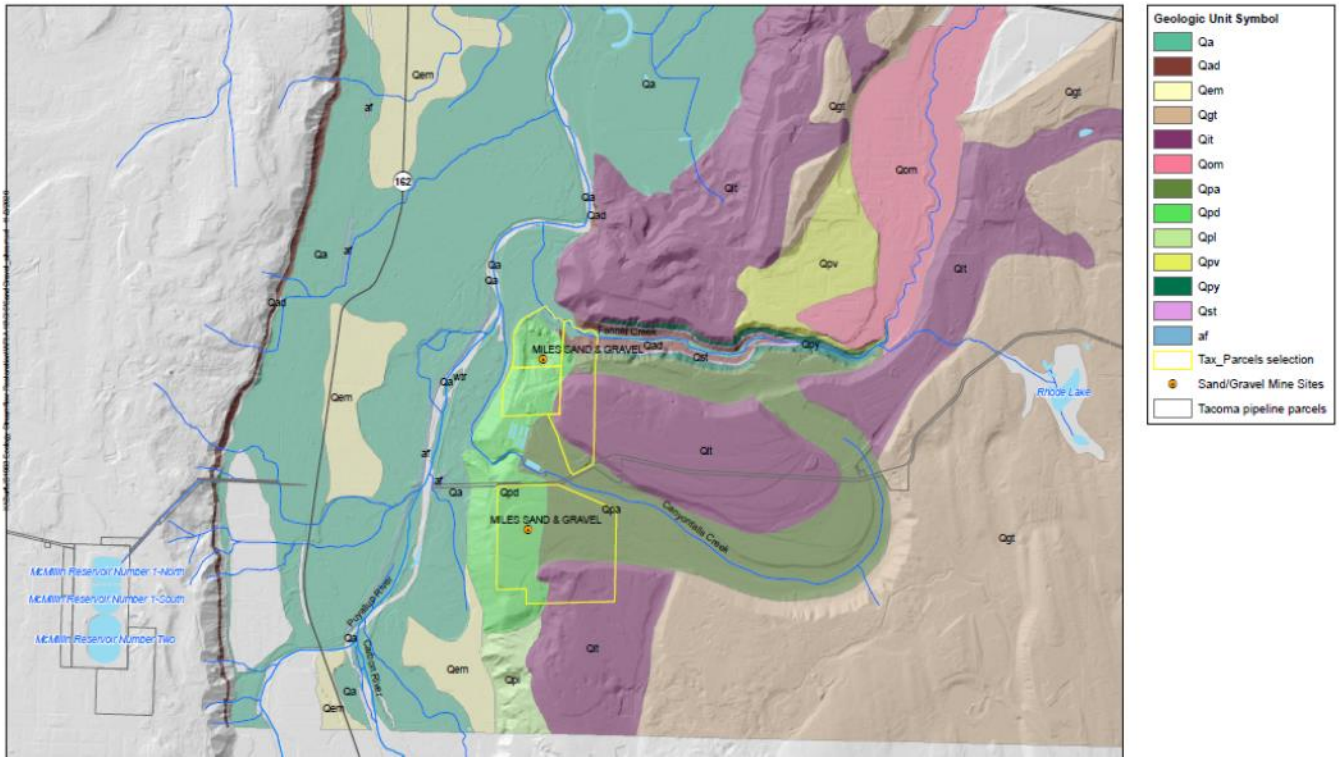
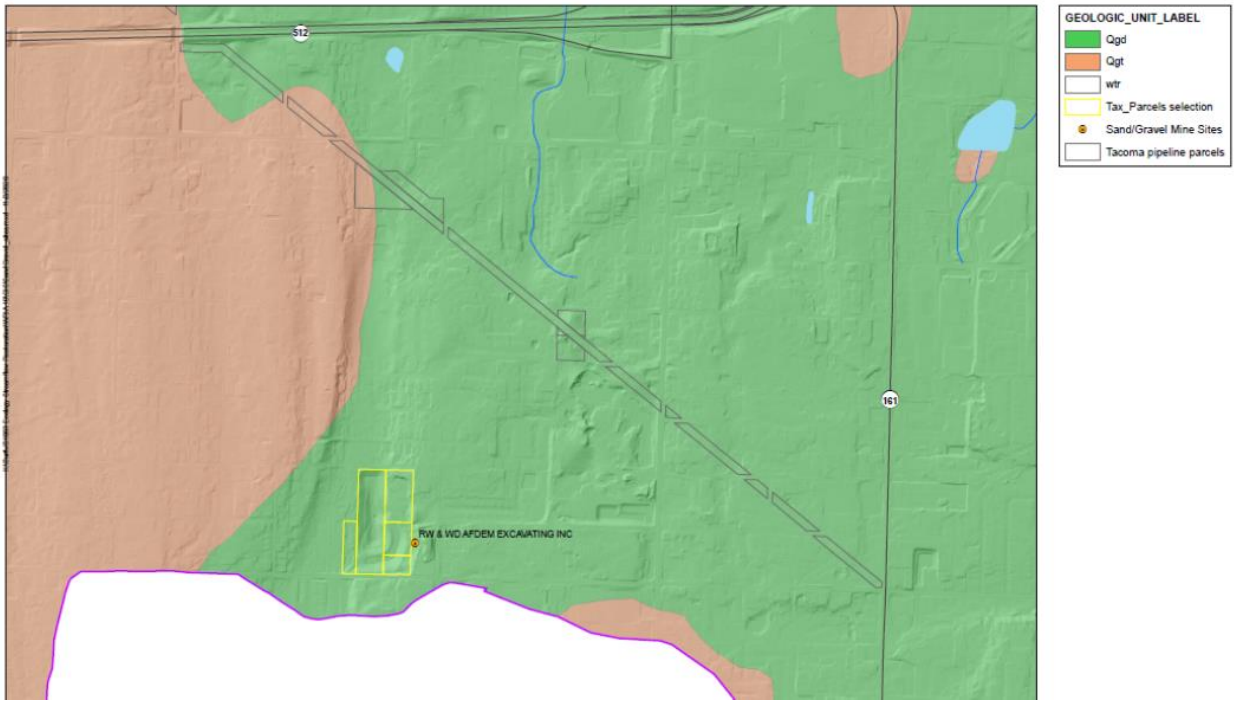


Figure 3. Geology Map for MAR Site in South Hill Area of Unincorporated Pierce County



Description of the anticipated spatial distribution of likely benefits

Two of the sites are active gravel pits located about ½ mile east of the Puyallup River near the City of Bonney Lake. Water infiltrated at those sites may improve stream flow conditions in the lower reach of Fennel Creek and Canyonfalls Creek or the Puyallup River. The length of the Puyallup River downstream of the sites is about 17 miles.

The third site is in unincorporated Pierce County in the South Hill area. Water infiltrated at that site may benefit Clarks Creek or possibly Swan Creek. Since the project is in the headwaters of those two creeks, a longer reach of the creeks may be benefitted. Clarks and Swan Creek merge together and flow into the Puyallup River approximately 5.8 miles from its mouth.

To assess the streamflow benefits of each project more detailed geologic mapping and hydrogeologic studies is needed. That work could be performed in a feasibility study of a site.

Locations relative to future PEW demand

Figure 1 also shows the heat map, with yellow to red colors indicating the geographic areas that are predicted to have the highest concentration of new permit-exempt wells. All the potential MAR sites are in locations with lower potential for growth in permit-exempt wells.

Performance goals and measures.

The volume of water purchased from the City of Tacoma will be measured and recorded using totalizing flow meters. The infiltration volume can be tracked through the amount of water purchased. A goal for infiltration can be established at the outset of the project and tracked at any time scale required. The amount and timing of water infiltrated can also be adjusted to time streamflow benefits to maximize benefits for fish.

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

Projects that infiltrate water will increase groundwater recharge, provide more baseflow in summer and fall by increasing groundwater discharge, reduce summer and fall stream temperatures because of increased groundwater discharge and increase groundwater availability to riparian and near-shore plants.

The primary limiting factors in the Puyallup Watershed (Kerwin, 1999; Lead Entity, 2018) which would be addressed through this program include:

- Loss of riparian corridors, including marine riparian, and floodplain forests
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Two of the streams that may benefit from MAR are Fennel Creek and Swan Creek. Both were

identified by the committee as being high priority streams.

Identification of anticipated support and barriers to completion.

There is no sponsor currently. The barriers to implementing the project are finding a sponsor, landowner willingness and the availability of funding for the analysis, design and construction of a MAR project.

Potential budget and O&M costs.

The construction cost for a MAR project was preliminarily estimated using guidance from Ecology (Melcher, 2020). The cost per acre-foot for a MAR project is estimated to be $3442, resulting in a total estimated cost of $1.03 million. Much more analysis and design are needed to provide more certainty on the costs.

Anticipated durability and resiliency.

The projects could have lasting benefits, assuming a project sponsor is found. The City of Tacoma water supply would be a reliable source of water.

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

No project sponsor has been identified and the projects will need additional analysis and design before being ready to proceed. The successful implementation of a MAR project is complex and involves several critical steps prior to actual construction (Covert, 2019):

- Identification of potential locations that:
- Have available aquifer capacity such that water infiltration can occur without creating overflows to the surface,
- Have soils and underlying geology with suitable hydraulic properties,
- Are located such that enough infiltrated water will discharge to surface water during low streamflow periods, and
- Are available for permanent use through acquisition or easements.
- Identification of a physically and legally available water source.
- Characterization and evaluation of site-specific hydrogeologic properties.
- Assessment of source water and aquifer compatibility, potential water quality changes during infiltration, and other water quality considerations.
- Development of preliminary MAR project designs and implementation cost estimates.
- Identification of project permitting requirements and potential hurdles.
- Assessment of ongoing operation and maintenance (O&M) costs, and identification of potential funding sources to support O&M.

Sources of Information

Covert, John. Presentation to Watershed Restoration and Enhancement Committee WRIA 15. Managed Aquifer Recharge Opportunities, January 14, 2019

Kerwin. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resources Inventory Area 10). Washington State Conservation Commission. Olympia, WA.

Melcher, Austin. Memo regarding: Water Offset Project Potential Cost Estimate Methodology. Sent to Ingria Jones, John Covert. September 17, 2020

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June.

WRIA 10 RAIN GARDEN AND GREEN STORMWATER INFRASTRUCTURE PROGRAM PROJECT DESCRIPTION DECEMBER 28, 2020

Description

Rain gardens and Green Stormwater Infrastructure (GSI) retrofit projects could be applied to existing homes and driveways, roadways, parking lots and other impervious areas that generate stormwater. The techniques include rain gardens, planter boxes, bio-infiltration swales, permeable pavement and reducing the footprint of roadways and replacing with GSI (green streets).

Rain gardens are small stormwater facilities that collect, store, and filter rainwater and stormwater runoff from lawns, rooftops, sidewalks, driveways and other impervious surfaces. Designed as shallow, sunken planting beds with rain garden soil, runoff flows into them from nearby hard surfaces and connected downspouts. The rain gardens can also be designed to infiltrate water.

Planter boxes are urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in dense urban areas and as a streetscaping element.

Bioswales are vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, they are particularly well suited to being placed along streets and parking lots. Bio-infiltration swales are specifically designed to infiltrate stormwater.

Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. Permeable pavements can be installed in sections of a parking lot and rain gardens and bioswales can be included in medians and along the parking lot perimeter.

Green streets are created by integrating green infrastructure elements into their design to store, infiltrate, and evapotranspire stormwater. Permeable pavement, bioswales, planter boxes, and trees are among the elements that can be woven into street or alley design.

In WRIA 10, Pierce Conservation District and City of Puyallup have assisted residences in rain garden design and construction and the Conservation District has indicated they would be willing to help implement a program of additional rain garden and GSI construction. Links to information on these techniques:

- https://piercecd.org/244/Rain-Gardens

- https://www.cityofpuyallup.org/192/Puyallup-Rain-Gardens
- https://www.co.pierce.wa.us/2812/Rain-Gardens
- https://kitsapcd.org/programs/raingarden-lid/rgbasics
- https://fortress.wa.gov/ecy/publications/publications/1310027.pdf
- http://www.seattle.gov/utilities/your-services/sewer-and-drainage/green-stormwater-infrastructure
- https://www.epa.gov/green-infrastructure

The goal of this project would be to support the implementation of rain gardens and GSI across WRIA 10, with an emphasis on subbasins that will experience the most growth and/or contain priority streams, as defined by the WRIA 10 Committee.

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

The draft Watershed Restoration and Enhancement Committee identified rain gardens and GSI projects as having potential for implementation to help meet water offsets. The Committee set the goal for implementation at 10 projects per year.

The water offset from rain gardens and GSI projects was estimated using analyses performed for a Mason County rooftop runoff infiltration analysis. To estimate the potential water offset, the soil type, impervious area rain is collected from, the rain garden size and annual precipitation is required. For planning purposes, it is assumed Type B soils are present, a rooftop or driveway area of 2,000 square feet is directed to a rain garden, the rain garden has a 200 square feet infiltration area and the annual precipitation is between 40 and 50 inches. The estimated infiltration volume is 0.14 acre-feet per year for annual precipitation of 40 inches and 0.17 acre-feet per year for annual precipitation of 50 inches. Calculations are shown in the Appendix. The timing of the streamflow will depend on the location of the project and geologic conditions. With a number of rain garden and GSI projects implemented, it is expected their would be a range of timing of benefits and benefits would occur year-round.

The water offset benefit of adding 10 rain garden type projects per year is about 1.5 acre-feet per year, using an average of the 40- and 50-inch precipitation values. Over 18 years of plan implementation, the water offset benefit would add up to 27 acre-feet per year. If GSI projects were implemented that have greater impervious area, the water offset would be higher.

Description of the anticipated spatial distribution of likely benefits

The projects can occur in any subbasin and this program is described in the Watershed Restoration and Enhancement Plan as a WRIA-wide project. A committee goal is to focus the program on subbasins that will experience the most growth and/or contain priority streams. Figure 1 shows

WRIA 10 with the areas of highest growth in permit-exempt wells in yellow to red and priority stream in orange and yellow.

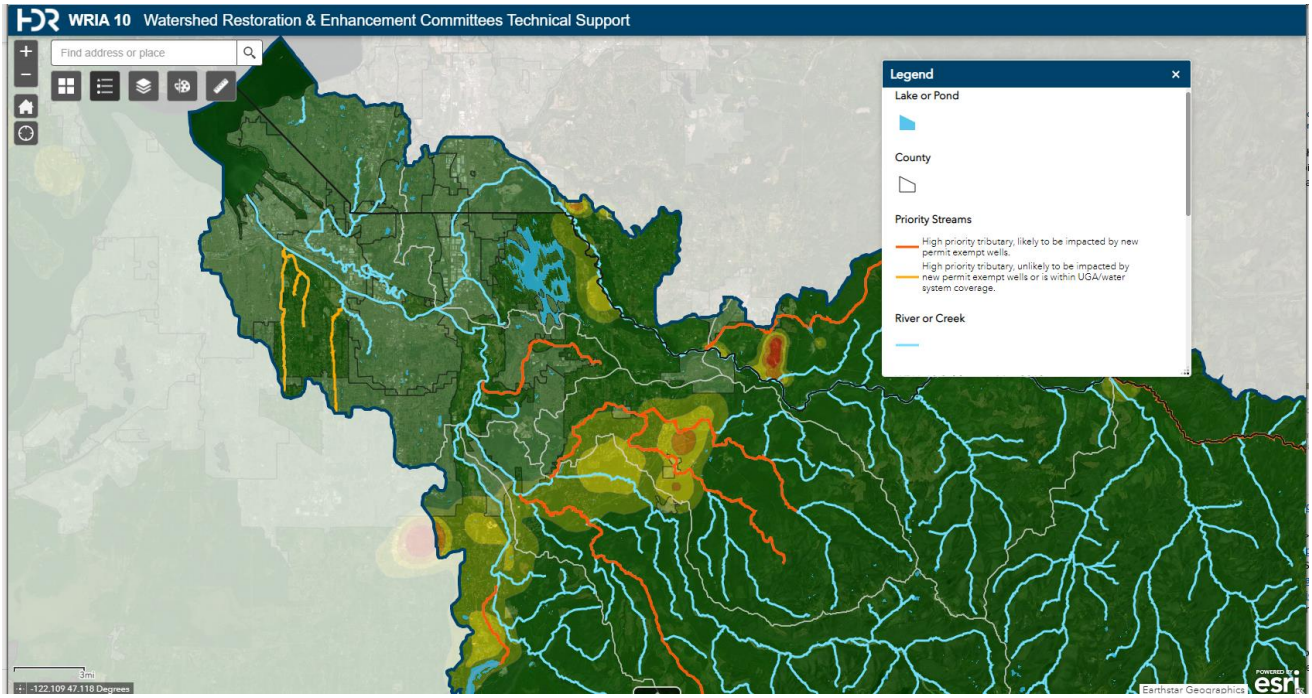


Figure 1. WRIA 10 permit exempt well potential growth and priority streams

Performance goals and measures.

This project would be measured by the number of functional raingardens or GSI projects installed within WRIA 10, which is planned to be 10 per year. The number may vary depending on factors such as finding suitable areas to retrofit, funding and capacity of project sponsors.

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

Projects that infiltrate water will increase groundwater recharge, provide more baseflow in summer and fall by increasing groundwater discharge, reduce summer and fall stream temperatures because of increased groundwater discharge and increase groundwater availability to riparian and near-shore plants.

The primary limiting factors in the Puyallup Watershed (Kerwin, 1999; Lead Entity, 2018) which would be addressed through this program include:

- Loss of riparian corridors, including marine riparian, and floodplain forests
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Identification of anticipated support and barriers to completion.

Pierce Conservation District is primary sponsor and supports this program. The primary barrier is the availability of funding for the construction of rain gardens and GSI projects. Other barriers include private landowner willingness and potentially a limited number of projects in basins with higher estimated growth in permit-exempt wells and priority streams.

Potential budget and O&M costs.

The construction cost for a rain garden or GSI project is $15-$30 per square foot of infiltration trench constructed. Assuming a 200 square foot infiltration trench, the construction cost would be $3,000 - $4,500 each. Additional costs for program management would be incurred. For planning purposes, a cost of $5,000 each is likely conservative. For construction of 10 per year, the annual cost would be about $50,000.

Anticipated durability and resiliency.

The projects would have lasting benefits. Pierce Conservation District and other entities will manage the implementation of rain gardens and GSI projects.

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

Pierce Conservation District would be the main project sponsor and would be ready to proceed immediately if the program were supported. Pierce Conservation District has been successfully installing rain gardens and GSI projects. If funding is increased, the primary barrier would be private landowner willingness to install projects

Sources of Information

Kerwin. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resources Inventory Area 10). Washington State Conservation Commission. Olympia, WA.

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June.

Appendix

Infiltration Volume Calculations

Estimated Water Offset for Typical Pierce Conservation District Raingarden Projects
December 28, 2020

Introduction

The purpose of this document is to estimate the water offset for future Pierce Conservation District (Pierce CD) rain garden projects. Calculations of the annual recharge are presented that are based upon hydrologic modeling performed by HDR for the Mason County Rooftop Infiltration Project (HDR, 2020). For these calculations it is assumed rain gardens will be installed on houses that are currently connected to a storm drainage system, so that the entire infiltration volume will be counted as a water offset. A lesser infiltration volume and water offset would be realized for houses that are not currently connected to a storm drainage system as roof downspouts may splash onto the ground and partially or totally infiltrate.

Calculations

Calculations are provided using a range of potential rain garden sizes. To allow an estimate of the potential water offset, an estimate of the average infiltration trench area and impervious area captured is required. Data from the Kitsap Conservation District (KCD) shows the average rain garden they have constructed since 2010 has an infiltration trench area of 200 square feet (sf) and captures 1,900 sf of impervious surface which are roofs, driveways and other impervious surfaces. They have constructed 320 rain garden projects since 2010. That is the best information we have on rain garden installations in the Puget Sound region.

To provide a range of potential Infiltration volumes are calculated using rain garden sizes of 100, 150, and 200 sf, as well as impervious surfaces of 1,600, 2,000 and 2,800 sf. The Mason County Rooftop Infiltration Project assumed 2,800 sf as the impervious surface that would be captured, based upon an average roof and driveway size. The infiltration rate used in the calculations corresponds to Group B soils as rain gardens use amended soils which are similar to Group B. The infiltration rate used for Group B soils is 2 inches/hour.

HDR's hydrologic modeling estimated the average annual recharge for an infiltration trench that is 80 sf to be 0.14 acre-feet/year. That was part of their calculation of baseline conditions assuming a minimum trench size of 80 sf under current regulations. The modeling was performed using an annual average of 70 inches precipitation, which occurs in Mason County. The average annual recharge equates to 26 inches per year over the 2,800-sf impervious surface.

A larger infiltration trench will infiltrate more water; there is a proportional relationship between infiltration area and infiltration capacity. There is also a proportional relationship to the amount of runoff to the impervious area, assuming all the runoff is captured. A limit to the amount of infiltration is the volume of annual precipitation minus potential losses due to evaporation. To estimate the amount of water that will be infiltrated in a Pierce CD rain garden the HDR results were proportionally scaled up by the amount of infiltration area (100 – 200 sf) and scaled down by the amount of impervious area (1,600 – 2,800 sf). Those calculations are summarized in Table 1.

Table 1. Percentage Change in Infiltration Capacity and Corresponding Infiltration Volume

Impervious Surface Captured, sf	Infiltration Trench Size, sf/Infiltration Volume, acre-feet							
	80 (Mason County Study)		100		150		200	
	%	Volume	%	Volume	%	Volume	%	Volume
1,600	64%	0.090	80%	0.113	121%	0.169	161%	0.225
2,000	71%	0.100	89%	0.125	134%	0.188	179%	0.250
2,800	100%	0.140	125%	0.175	188%	0.263	250%	0.350

The equivalent values in terms of rainfall infiltrated is provided in Table 2.

Table 2. Volume of Rainfall Potentially Infiltrated

Infiltration Trench Size, sf			
80 (Mason County Study)	100	150	200
26 inches	32.7 inches	49.0 inches	65.3 inches

The calculations indicate that the rain gardens KCD is installing have, on average, the capacity to infiltrate 65.3 inches of precipitation, or 0.25 acre-ft per installation per year, based upon an infiltration trench size of 200 sf. The amount infiltrated is less than the capacity when precipitation is less than 65 inches.

The same calculation applies to Pierce County and demonstrates that the infiltration capacity of a 200 sf infiltration trench is not limited by the amount of precipitation that occurs in most areas of Pierce County, which is 40-50 inches per year. Table 3 provides infiltration volumes for varying precipitation volumes and an average impervious area of 2,000 sf. To be conservative, 10% loss due to evaporation or other losses are assumed.

Table 3. Estimate of Annual Volume Infiltrated for Pierce CD Rain Garden Projects

Average Annual Precipitation, inches	Annual Volume Infiltrated, Inches	Annual Volume Infiltrated, acre-feet
40	36	0.138
50	45	0.172
60	54	0.207

These volumes can be used as estimates of the water offset quantity for Pierce CD rain garden projects. The actual values will need to be tracked during implementation, but the quantities shown in Table 3 provide a planning-level estimate of water offsets from rain garden projects that capture 2,000 sf of impervious area and are constructed using a 200 sf infiltration trench is Group B soils. It is recommended that the average of the volume infiltrated between 40- and 50-inches annual precipitation be used for estimating water offsets in WRIA 10. That equals 0.15 acre-feet per rain garden.

References

HDR, 2020. Spreadsheet: WRIA14-Projects-Supplemental Data-RooftopRunoff_MGSFlood Results.xlsx. Accessed through Box at https://app.box.com/s/c2858d6mjdtoo41i4ahxqj55hz66mbzf

SWAN CREEK CHANNEL AND BANK STABILIZATION

Narrative description, including goals and objectives.

Pierce County Surface Water Management and the Puyallup Tribe propose to implement in-channel stabilization and restoration measures along Swan Creek, within the Lower Puyallup River sub-basin (WRIA 10). In the lower reaches of Swan Creek, the channel is incised and eroding the streambanks due to increased stormwater runoff, undersized culverts, and insufficient stormwater detention and loss of flood storage. This project proposes to use a combination of woody material, streambed gravel, and plantings to stabilize streambeds and banks and provide sediment recruitment capacity within the channel. The intention is to slow erosion and allow the channel to return to a more natural state. The proposed project reach begins immediately downstream of the 64th Street East culvert crossing and extends to Pioneer Way.

The goals of the project are as follows:

- Stabilize streambed and banks
- Provide sediment recruitment capacity

The objectives of the project are:

- Install woody material and riparian plantings
- Install streambed gravel

No estimate of the potential water offset was provided at this time as monitoring is proposed that would determine the offset.

Qualitative assessment of how the project will function.

The project will function by reducing stream power and streambed and streambank erosion.

Conceptual-level map of the project and location.

The proposed project is located along Swan Creek just downstream of the 64th St East culvert crossing at Pioneer Way. Figured 1 (Attached) shows the project location within the Swan Creek Watershed and Figure 2 shows an overview of the 90% design drawings. (The full set of design drawings are available on Box.)

Performance goals and measures.

Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to stream processes will occur in the project area downstream of the 64th street east culvert. The channel and habitat features improved as a result of this project will benefit a variety of salmonid species as described in the next paragraph. In the areas of Swan Creek downstream of this project, such as the floodplain, reduced sediment input from erosion will also improve habitat conditions and benefit salmonids.

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

Salmonids in Swan Creek will benefit from decreased stream power downstream of the culvert, reduced rates of erosion, increased riparian habitats, and cool temperatures associated with groundwater recharge. The most abundant salmonids in Swan Creek are chum and coastal cutthroat trout but the stream also supports Coho and Chinook in limited quantities; and steelhead are very rarely observed (Pierce County, 2015). Lamprey and sculpin are also present in the creek. The salmonids and other aquatic species in Swan Creek are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of instream habitat complexity and connectivity
- Loss of large wood
- Increase in river channelization
- Increase in sediment load
- Loss of channel (substrate) stability
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Streambank stabilization, woody material addition, and replacement of streambed gravel would address these limiting factors and slow down Swan Creek, decreasing sediment load to the downstream portion of the creek and improving channel stability. Increased riparian vegetation and instream wood would improve rearing habitat for fishes by providing protection from flood events and acting as riparian cover and rearing habitat. Invertebrates colonizing the edge habitat are also a prey source for juvenile salmonids. Creating a slower velocity system would make a greater range of sediment and substrate types available as spawning habitat and as habitat for non-salmonids. While the ESA-listed Chinook and steelhead species are not as commonly observed in Swan Creek as Chum, cutthroat trout, and coho, the exceptionally cold water in Swan Creek (Pierce County, 2015) may become increasingly important for these species when temperatures in other tributaries are warmer. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in Swan Creek. Addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in and around Swan Creek and is sponsored by the Puyallup Tribe and Pierce County and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity, and Metro Parks Tacoma. Swan Creek Park is one of Metro Parks Tacoma's capital improvement projects. The 2019 Master Plan for the park includes habitat restoration work, stormwater management, and public interest in salmon ecology and

restoration. Community meetings emphasize the public interest in restoration work in Swan Creek, with one park user stating, “salmon are a user group!” (Metro Parks Tacoma, 2020). This proposed project furthers restoration actions undertaken and planned by Metro Parks Tacoma in the same area.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Lower Puyallup and Nearshore Estuary watersheds. Clear Creek (of which Swan Creek is a tributary) is identified as a high priority system. Three of the high priority actions within this area are directly addressed by this project: “Restore normal flow regimes,” “restore riparian function,” and “restore and protect rearing, foraging, osmoregulatory habitats for juvenile salmonids, particularly Chinook salmon” (Lead Entity 2018). There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

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

The funding requested to complete restoration treatments is approximately $3.7 million. No O&M costs have been identified.

Anticipated durability and resiliency

Streambank stabilization and instream wood placement projects are durable because they help restore natural processes to a reach of the stream. Given the changing climate conditions, that anticipates increases in precipitation, rain-on-snow events, and channel aggradation, stabilization and restoration projects that provide increased cover and habitat and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

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

Pierce County and the Puyallup Tribe are the project sponsors and are ready to implement the project as soon as funding is made available. The project could be implemented within 5 years, which accounts for design and construction.

Attachments

Figure 1. Swan Creek Bank Stabilization at 64th St Outfall Repair project location (annotated from Swan Creek Watershed Characterization and Action Plan)

Figure 2. Sheet 5 of 90% Design Drawings for Swan Creek Channel Restoration (Prepared by Natural Systems Design)

Documentation of sources, methods, and assumptions.

The following references were used:

Metro Parks Tacoma. 2020. Swan Creek Improvements. Accessed June 30, 2020. https://www.metroparkstacoma.org/project/swan-creek-improvements/

Pierce County. 2015. Swan Creek Watershed Characterization and Action Plan. Prepared by: Pierce County Surface Water Management. September 2015. Available from: https://www.piercecountywa.gov/ArchiveCenter/ViewFile/Item/4798

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Natural Systems Design. 2018. Basis of Design Report Swan Creek. Prepared for Puyallup Tribe of Indians.

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

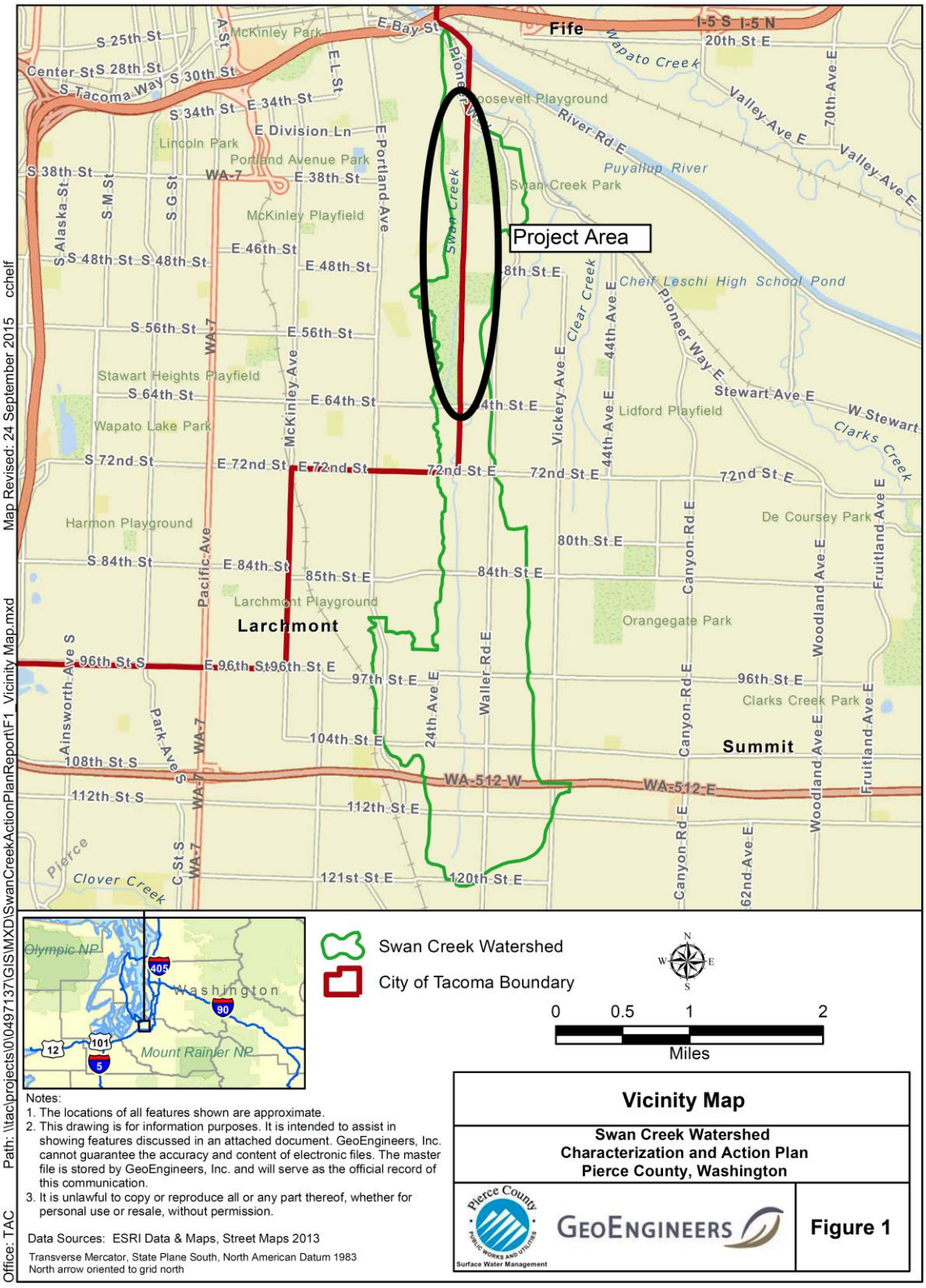


Figure 1. Swan Creek Project Vicinity Map. Source: Pierce County 2015.

JOVITA CREEK HABITAT PROJECT

Narrative description, including goals and objectives.

The City of Edgewood proposes to prepare a feasibility study to identify potential restoration actions in Jovita Creek, within the Lower White River sub-basin (WRIA 10). Recommended actions contained in the study would be implemented. This project area is Jovita Creek upstream of the culvert at Highway 167, up to 114th Ave E. Assessment efforts would focus on evaluating geomorphic impacts from Jovita Boulevard (which is adjacent to the stream), channel bed and bank restoration in the mainstem of Jovita Creek, and replacement of a fish passage barrier (culvert at 114th street) on a tributary to Jovita Creek. The feasibility study would result in identification of priority multi-benefit restoration project(s) that restore habitat and habitat forming processes while improving the flow of pedestrians and vehicles through the area by potentially changing the alignment of Jovita Blvd and completing a connection to the Interurban Trail that currently terminates at 114th Ave E.

The goal of the project is as follows:

- Evaluate stream processes in Jovita Creek and identify potential restoration actions.
- Implement restoration actions.
- Complete the Interurban Trail from 114th Ave E to West Valley Highway

The objectives of the project are:

- Complete a reach-scale feasibility study including an evaluation of the constriction caused by Jovita Boulevard and the fish passage barrier at 114th street.
- Identify and implement multi-benefit actions that would restore habitat and habitat-forming processes.

Qualitative assessment of how the project will function.

The feasibility study has no identified functions. The functions of restoration actions would depend on the type of restoration project implemented. One primary issue in Jovita Creek is channel confinement due to Jovita Boulevard, causing channel erosion from high velocities. Restoration actions that address this channel confinement would function by providing space for the creek to meander, wood to stabilize the creek bed and connection to the limited amount of off-channel habitat in the floodplain. There are no anticipated offset benefits related to the project because there are no identified permit exempt wells in the project area.

Conceptual-level map of the project and location.

The proposed project is located along Jovita Creek and its tributaries upstream of Highway 167, along approximately 1.0 stream miles of habitat. Figure 1 shows the approximate project location.

Figure 1. Jovita Creek Feasibility Study

Performance goals and measures.

The performance goals are to complete a reach-scale feasibility study of Jovita Creek and identify potential multi-benefit restoration projects. Performance measures for restoration projects would be determined once projects are identified.

Description of the anticipated spatial distribution of likely benefits.

Depending on the results of the feasibility study, benefits to stream processes may occur in the project area upstream of the culvert at highway 167. Salmonids in Jovita Creek and its tributaries have the potential to benefit from restoration actions.

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

Jovita Creek supports a variety of salmonid species including chum and coho salmon, steelhead, sea run cutthroat and resident trout as identified by WSDOT (2017). SalmonScape additionally identifies fall Chinook and pink salmon as potentially present in Jovita Creek (WDFW, 2020). The salmonids and other aquatic species in the Jovita Creek are subject to degraded ecosystems due to limiting factors present at the site.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), Jovita Creek has the following limiting factors:

- Loss of floodplain connectivity
- Loss of bank stability
- Loss of instream habitat complexity and connectivity due to loss of large wood
- Loss of side-channel habitat
- Loss of riparian habitat
- Loss of pool habitat
- Loss of sediment fines

- Loss of good water quality and quantity

Restoration projects would address these limiting factors by promoting the creation of a variety of habitat types and hydrologic features. Reducing or removing constraints, streambank stabilization, woody material addition, and replacement of streambed gravel would address these limiting factors. and slow down Jovita Creek, decreasing sediment load to the downstream portion of the creek and improving channel stability. Increased riparian vegetation and instream wood would improve rearing habitat for fishes by providing protection from flood events and acting as riparian cover and rearing habitat. Invertebrates colonizing the edge habitat are also a prey source for juvenile salmonids. Creating a slower velocity system would make a greater range of sediment and substrate types available as spawning habitat and as habitat for non-salmonids.

Replacing the culvert at 114th Street E. would additionally provide more access to habitat upstream of the culvert. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in Jovita Creek.

Along with the habitat restoration actions already undertaken in the Lower White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in the Lower White River sub-basin. The project is sponsored by the City of Edgewood and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Lower Puyallup Watershed (which includes the lower White River sub-basin). Jovita Creek is a tributary to the Milwaukee Canal, which drains to the Lower White River. The White River is identified as a high priority tributary in the Lead Entity Strategy. One of the high priority actions within this area are directly addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed” (Lead Entity 2018). This habitat restoration project would build upon previous work completed by Washington State Department of Transportation—the culvert where Jovita Creek passes under Highway 167 was replaced in 2016 to allow for improved fish passage into the upper portions of Jovita Creek (WSDOT, 2017). The previous culvert presented hydraulic barriers to fish passage, and the new culvert allows unimpeded access to 2.53 miles of habitat in Jovita Creek including the proposed project area. There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

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

No cost estimates for the feasibility study and projects that would be implemented are available. No O&M costs have been identified. A formal project description has not yet been written.

Anticipated durability and resiliency.

Habitat restoration projects are durable as they restore natural processes to a stream. Given changing climate conditions that are forecast to increase peak precipitation rates and erosion, channel bed restoration projects will retain sediment and reduce aggradation near the mouth of the creek where slopes are flatter.

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

The City of Edgewood is the project sponsor and is ready to implement the study as soon as funding is made available. The assessment would also include outreach to determine landowner willingness and potential for easements in the area of the potential projects. The study could be completed within 2 years of obtaining funding; the projects recommended for implementation will take longer, likely 10 years depending on availability of funding.

Documentation of sources, methods, and assumptions.

The following references were used:

Ecology, 2003. Mt. Baker-Snoqualmie National Forest, Upper White Watershed Sediment and Temperature TMDL for Aquatic Habitat. Submittal Report, Publication No. 03-10-032. Available from: https://fortress.wa.gov/ecy/publications/documents/0310032.pdf

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

WDFW, 2020. SalmonScape. Washington Geospatial Open Portal. Available from: http://geo.wa.gov/datasets/1e56a648718543ab952e75ff9971f086?fullScreen=true

WSDOT, 2017. Fish Passage Performance Report, 2016. June 30, 2017. Available from: https://www.wsdot.wa.gov/publications/fulltext/projects/FishPassage/2017FishPassageAnnualReport.pdf

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

City of Edgewood, 2020. Parks and Recreation: Interurban Trail. Available from: http://www.cityofedgewood.org/government/parks_and_recreation/interurban_trail_and_jovita_crossroads_trailhead_park.php

ENUMCLAW GOLF COURSE PROJECT

Narrative description, including goals and objectives.

The City of Enumclaw and the Puyallup Tribe propose to implement reach-scale stream restoration actions in Boise Creek, within the Middle White River sub-basin (WRIA 10). This project would move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course. Additionally, large woody material would be added to increase habitat complexity and channel roughness, diversifying habitats available to fish. The project is proposed to occur from river miles 3.7 to 4.2. A 30% design was completed for this project in 2010, and the proposed project would include finalizing the design and moving forward with construction.

The goals of the project are as follows:

- Improve habitat conditions in Boise Creek
- Address flooding on the golf course and nearby properties.

The objectives of the project are:

- Realign the creek with its historic channel.
- Restore habitat and increase channel roughness, diversifying instream fish habitat

Qualitative assessment of how the project will function.

The project will function by restoring the natural channel and improving habitat conditions, which will allow natural processes to develop in Boise Creek. A related project with water offset benefits would be the placement of water rights for a portion of the golf course in trust. Washington Water Trust estimated the offset benefits as 47 acre-feet and 0.2 cfs (90 gallons per minute).

Conceptual-level map of the project and location.

The proposed project is located along Boise Creek between river miles 3.7 and 4.2 and borders the Enumclaw Golf Course. The 30% designs (Attachment A) shows the project location and restoration plan. Figure 1 shows the vicinity of the project.

Figure 1. Enumclaw Golf Course Project Vicinity (circled in red, annotated from Watershed Restoration and Enhancement Committees Technical Support Web Map)

Performance goals and measures.

The performance goals are to complete final design of the project and implement reach-scale habitat restoration and channel realignment. Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river miles 3.7 to 4.2; habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph.

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

Boise Creek supports a variety of salmonid species and is one of the most productive salmon stream systems in the Puyallup/White River basin. No other stream in the basin, except for South Prairie Creek on the Puyallup River, is as productive in terms of both spawning density (number of spawners per mile) and total escapement size (Marks et al. 2013). Boise Creek continues to support steelhead as well as spring and fall Chinook (all ESA-listed), coho, pink, chum, sockeye and cutthroat trout. Bull trout have also been observed in the mouth of Boise Creek up to river mile (RM) 0.1 (RCO, 2020). The salmonids and other aquatic species in Boise Creek are subject to degraded ecosystems due to limiting factors present at the site.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), Boise Creek has the following limiting factors:

- Loss of floodplain connectivity

- Loss of bank stability
- Loss of instream habitat complexity and connectivity due to loss of large wood
- Loss of side-channel habitat
- Loss of riparian habitat
- Loss of pool habitat
- Loss of substrate fines
- Loss of good water quality and quantity

This project will benefit all life stages of salmonids present. Adults will have greater cover, depth and cooler fall water temperatures. Eggs and alevins will benefit through improved survival rates associated with improved channel stability and greater channel length, which reduces average velocity and therefore lessens scour losses and retains more variety in substrate size. Juveniles will benefit from the additional habitat length, cover, channel complexity and reduced summer rearing temperatures that will provide a new norm and greater overall habitat suitability. Coho and steelhead which reside for over 1 year in freshwater will be the two species most likely to benefit from these improvements. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in Boise Creek.

Along with the habitat restoration actions already undertaken in the Middle White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

The project is supported by King County and the Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Middle Puyallup Watershed (which includes the middle White River sub-basin). Boise Creek is identified as a high priority tributary in the Lead Entity Strategy. Two of the high priority actions within this area are directly addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed,” and “increase large wood inputs” (Lead Entity 2018). This habitat restoration project would build upon previous design work completed in 2010 (RCO, 2020; Attachment A).

There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

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

The funding requested to complete final design and implement restoration treatments is approximately $2.3 million. The project can likely be implemented within the next five years provided funding is available.

No O&M costs have been identified as the project should not pose any maintenance obligations.

Anticipated durability and resiliency.

This project is anticipated to be durable because it would restore the stream to its historic channel. Habitat improvements would increase floodplain connection. Given the changing climate conditions, that anticipates increases in peak precipitation, rain-on-snow events, and channel aggradation, floodplain reconnection projects that provide the river with more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

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

The Puyallup Tribe is the project sponsor and is ready to implement the project as soon as funding is secured, and property owner permissions are obtained. The construction season would need to be coordinated with the Enumclaw Golf Course, which is owned by the City of Enumclaw.

Attachments

Attachment A: 30% Design of Boise Creek Golf Course Restoration Plan is in the Box folder with this project description.

Documentation of sources, methods, and assumptions.

The following references were used:

Washington Water Trust. 2020. WRIA 10 Water Rights Final Report Update. Presentation to WRIA 10 Workgroup on July 1, 2020.

Washington Water Trust, McCormick Water Strategies, and BlueWater GIS. 2020. WRIA 10 Puyallup-White Priority Water Rights Projects Report. Prepared for: WRIA 10 Workgroup. June 29, 2020.

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

Marks, E. L., R.C. Ladley, B.E. Smith, A.G. Berger, J.A. Paul, T.G. Sebastian and K. Williamson. 2013. 2012-2013 Annual Salmon, Steelhead, and Bull Trout Report: Puyallup/White River Watershed--Water Resource Inventory Area 10. Puyallup Tribal Fisheries, Puyallup, WA

RCO, 2020. Project Search. Middle Boise Creek Restoration. Available from: https://secure.rco.wa.gov/prism/search/ProjectSnapshot.aspx?ProjectNumber=16-1552

GREENWATER PHASE 4 IMPLEMENTATION

Narrative description, including goals and objectives.

South Puget Sound Salmon Enhancement Group proposes to implement reach-scale restoration actions in the Greenwater River, within the Upper White River sub-basin (WRIA 10), between river mile 2 and 4 to restore instream complexity and floodplain connectivity. This proposed phase 4 project builds upon work completed in 2010, 2011, and 2014 (phases 1-3) on upper sections of the Greenwater River between river mile 6 and 8. During these projects, 17 log jams were installed and 1 mile of road was removed from the floodplain. As part of the proposed phase 4 project, more road and fill would be removed and additional structures would be installed in the 2-mile project reach, increasing the functional habitat on the Greenwater River. These structures will provide relatively stable, instream structure currently lacking in the Greenwater system due to a legacy of aggressive timber harvest practices between the late 1950s to early 1970s.

The goal of the project is as follows:

- Rehabilitate lost processes that are provided by large instream wood accumulations, which benefits adult spawning and juvenile rearing salmon populations on the Greenwater River.

The objectives of the project are:

- Remove relic logging roads, fill, and armor restricting floodplain processes.
- Install mid-channel and floodplain structures.

Qualitative assessment of how the project will function.

The project will function by creating large stable structures that will trap mobile debris and sediment, increase floodplain connectivity and off channel habitat, increase number of pools with overhead cover, decrease median substrate size, and overall improve spawning and rearing conditions for salmonids in the Greenwater River. The proposed structures will accelerate and maintain system-wide natural processes while providing habitat for fish. Removing roads, fill, and armor will additionally allow natural processes to develop in a large floodplain. There are no anticipated offset benefits related to the project because there are no identified permit exempt wells in the project area. Additionally, the potential for the project to increase groundwater recharge has not been estimated.

Conceptual-level map of the project and location.

The proposed project is located along the Greenwater River between river miles 2 and 4. Figure 1 shows the approximate project location and the previous phases of the project.

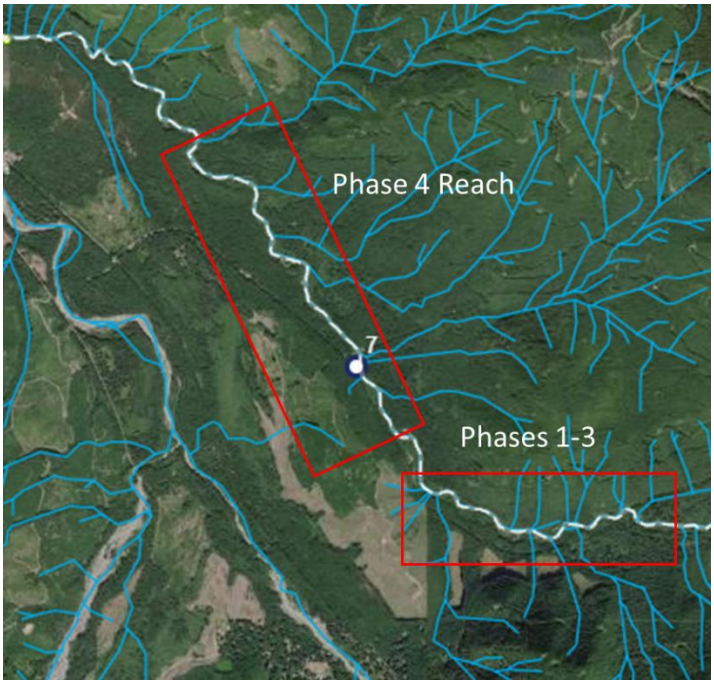


Figure 1. Greenwater Phase 4 Implementation Project (annotated from Watershed Restoration and Enhancement Committees Technical Support Web Map)

Performance goals and measures.

The performance goals are to complete a reach-scale assessment of river miles 2 to 4 of the Greenwater River and implement restoration treatments including road and fill removal and log jam installation . Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river mile 2 and 4; side channel and other habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph. Salmonids in the Greenwater River and in the White River will benefit from increased habitat and reduced peak flow and sediment input.

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

The Greenwater River supports a variety of salmonid species including Endangered Species Act-listed Chinook, Steelhead, and Bull Trout. Other anadromous salmonid species on the Greenwater River that would benefit from this project include Coho, Pink salmon, and coastal cutthroat trout. The White River supports an early returning population of White River spring Chinook which spawn in the upper and lower White River and is the most distinctive Chinook stock in central and south Puget Sound (NMFS, 2007). The USFWS has also identified five local bull trout populations within the Puyallup basin, one of which occurs in the Greenwater River. The salmonids and other aquatic species in the Greenwater River are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone
- Loss of off-channel and side-channel habitat
- Loss of instream habitat complexity and connectivity
- Loss of large wood
- Increase in river channelization
- Increase in sediment load
- Loss of channel (substrate) stability
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Removal of the existing road, fill, and armor, and installation of logjams would address these limiting factors by promoting the creation of a variety of habitat types and hydrologic features. Side channels, backwater channels, and off-channel habitat would develop because the jams would be placed strategically to promote lateral migration of the river. These habitats provide protection from flood events and act as riparian cover and rearing habitat, which supports juvenile salmonids and provides areas for fry to colonize. Coho salmon may also spawn in low velocity side channels. Deep complex pools would also be created. These provide cover and prey availability during migratory periods for adult salmonids and cover for juveniles when log jams are present. Deep pools are also generally colder than other in-water environments, providing appropriate temperatures and acting as a refuge. Shallow edge habitat would also be created when areas of fill and road are removed. These provide shade and function as cover and rearing habitat for fry and juvenile salmonids. Invertebrates colonizing the edge habitat are also a prey source for juveniles. Removal of the road and fill will also increase the sinuosity of the river, creating a slower velocity system where a greater range of sediment and substrate types are available due to the complexity of habitats present. Spawning salmonids (Chinook, steelhead, and Coho) would benefit from a range of substrate sizes. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in the Greenwater River.

Along with the habitat restoration actions already undertaken in the Greenwater River and Upper White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project. And, for ESA-listed ESUs, restoring these areas would contribute to the VSP parameters of abundance, productivity, spatial structure, and diversity.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in the Greenwater River and Upper White River sub-basin. The project is sponsored by South Puget Sound Salmon Enhancement Group and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Upper Puyallup Watershed (which includes the upper White River sub-basin). The Greenwater River is

identified as a high priority tributary. Three of the high priority actions within this area are addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed,” “address failing roads to reduce sediment load,” and “increase large wood inputs (Lead Entity 2018). The WRIA 10/12 Lead Entity Strategy additionally states that this type of action will provide the greatest restoration benefit to Puyallup/White River Chinook abundance. In addition, The Puget Sound Salmon Recovery Plan specifically calls out the Greenwater River as a key area to increase protection and restoration. As a priority action for White River spring Chinook it identifies, “large woody debris [and] riparian restoration projects in the Upper White… including the Greenwater River and Huckleberry Creek restoration projects” (NMFS 2007). Pierce County (2012, 2018) also identifies the reach of the project as a priority area within their Flood Hazard Management Plan and completed a channel migration zone study within the reach of the project in 2017.

There are few anticipated barriers to completing this project given that three phases of the project have already been implemented.

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

The funding requested to complete reach-scale assessment efforts, inventory existing wood loading rates, assess habitat quantity and quality, map geomorphic features, assess hydraulic conditions, and implement restoration treatments based on these analyses is approximately $1,500,000.

No O&M costs have been identified as the project should not pose any maintenance obligations. The project reach is on Muckleshoot Indian Tribe property and the entire Greenwater Valley through the project reach is protected under a riparian reserve designation.

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. Instream wood placement projects are also durable; they support natural processes and encourage accumulation of smaller debris. Given the changing climate conditions, that anticipates receding glaciers, and increases in precipitation, rain-on-snow events, and channel aggradation, floodplain reconnection and instream placement projects that provide the river with more room to meander and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

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

South Puget Sound Salmon Enhancement Group is the project sponsor and is ready to implement the project as soon as funding is made available. The project can likely be implemented within the next five years provided funding is available.

Documentation of sources, methods, and assumptions.

The following references were used:

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Pierce County. 2018. Rivers Flood Hazard Management Plan 2017-2018 Update. Prepared by: Pierce County Public Works and Utilities Surface Water Management Division. Available: https://www.piercecountywa.org/1837/Rivers-Flood-Hazard-Management-Plan

Pierce County. 2012. Final Environmental Impact Statement for: Rivers Flood Hazard Management Plan. Prepared by: Pierce County Public Works and Utilities Surface Water Management Division. Available: https://www.piercecountywa.org/1837/Rivers-Flood-Hazard-Management-Plan

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

Recreation and Conservation Office. 2020. PRISM Project Search: Greewanter River Restoration Phase 3. Accessed June 24, 2020. https://secure.rco.wa.gov/prism/search/ProjectSnapshot.aspx?ProjectNumber=12-1288

WEST FORK WHITE FLOODPLAIN PROJECT

Narrative description, including goals and objectives.

South Puget Sound Salmon Enhancement Group proposes to implement reach-scale floodplain restoration actions in the West Fork White River, within the Upper White River sub-basin (WRIA 10). This project would complete assessment, feasibility, design, and construction of a floodplain restoration project on the lower 6 miles of the West Fork White River. Initial efforts would focus on a reach-scale assessment of the lower White River from river miles 2.4 to 5.7. Assessment efforts would evaluate geomorphic threats from a road (which is adjacent to the stream) to floodplain processes, instream flow velocities, and habitat structure and the assessment efforts would prescribe and implement restoration treatments to remove fill and armor and restore habitat and habitat forming processes.

The goal of the project is as follows:

- Rehabilitate lost processes that are provided by floodplain reconnection.

The objectives of the project are:

- Complete a reach-scale assessment including an evaluation of threats from an adjacent road.
- Remove fill and armor from the floodplain.
- Restore habitat and habitat-forming processes.

Qualitative assessment of how the project will function.

The project will function by removing fill and armor, which will allow natural processes to develop in a large floodplain. There are no anticipated offset benefits related to the project because there are no identified permit exempt wells in the project area. Additionally, the potential for the project to increase groundwater recharge has not been estimated.

Conceptual-level map of the project and location.

The proposed project is located along the West Fork White River between river miles 0 and 6, with an initial focus on river miles 2.4 to 5.7. Figure 1 shows the approximate initial project location.

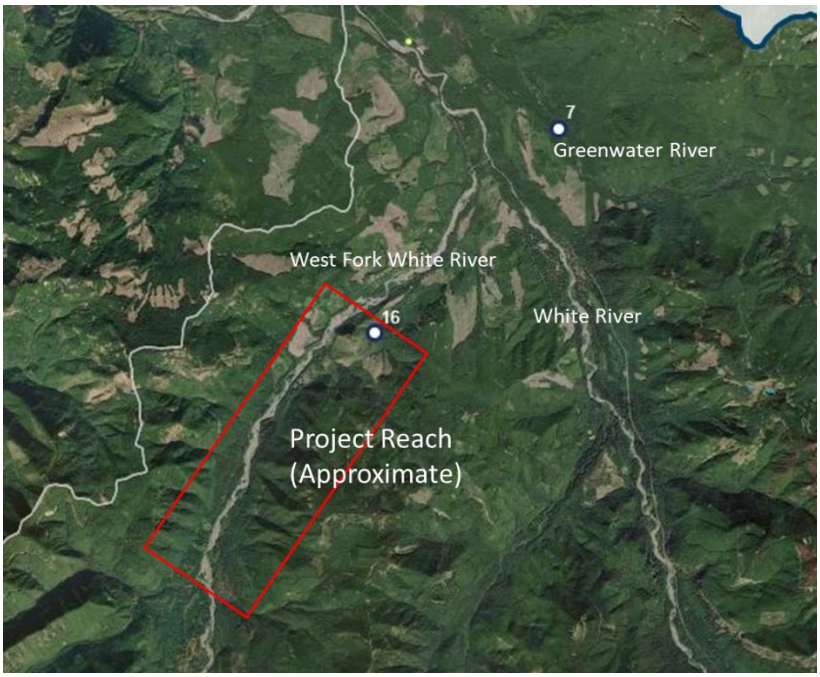


Figure 1. West Fork White Floodplain Project (annotated from Watershed Restoration and Enhancement Committees Technical Support Web Map)

Performance goals and measures.

The performance goals are to complete a reach-scale assessment of river miles 2.4 to 5.7 of the West Fork White River and implement restoration treatments including fill and armor removal. Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river miles 2.4 to 5.7; side channel and other habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph. Salmonids in the West Fork White River and in the White River will benefit from increased habitat and reduced peak flow and sediment input.

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

The West Fork White River supports a variety of salmonid species including Endangered Species Act-listed Chinook, Steelhead, and Bull Trout. Other anadromous salmonid species on the West Fork White River that would benefit from this project include Coho, Pink salmon, and coastal cutthroat trout. The White River supports an early returning population of White River spring Chinook which spawn in the upper and lower White River and is the most distinctive Chinook stock in central and south Puget Sound, and this population may spawn in the West Fork White River (NMFS, 2007). The USFWS has also identified five local bull trout populations within the Puyallup basin, one of which occurs in the West Fork White River and Upper White River (NMFS, 2007). The salmonids and other aquatic species in the West Fork White River are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone
- Loss of off-channel and side-channel habitat
- Loss of instream habitat complexity and connectivity
- Loss of large wood
- Increase in river channelization
- Increase in sediment load
- Loss of channel (substrate) stability
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Removal of the existing fill and armor would address these limiting factors by promoting the creation of a variety of habitat types and hydrologic features. Side channels, backwater channels, and off-channel habitat would develop because the river would be allowed to move laterally within the floodplain. These habitats provide protection from flood events and act as riparian cover and rearing habitat, which supports juvenile salmonids and provides areas for fry to colonize. Coho salmon may also spawn in low velocity side channels. Shallow edge habitat would also be created where areas of fill are removed. These provide shade and function as cover and rearing habitat for fry and juvenile salmonids. Invertebrates colonizing the edge habitat are also a prey source for juveniles. Removal of the armor and fill will also increase the sinuosity of the river, creating a slower velocity system where a greater range of sediment and substrate types are available due to the complexity of habitats present. Spawning salmonids (Chinook, steelhead, and Coho) would benefit from a range of substrate sizes. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in the West Fork White River.

Along with the habitat restoration actions already undertaken in the Upper White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project. And, for ESA-listed ESUs, restoring these areas would contribute to the VSP parameters of abundance, productivity, spatial structure, and diversity.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in the Upper White River sub-basin. The project is sponsored by South Puget Sound Salmon Enhancement Group and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Upper Puyallup Watershed (which includes the upper White River sub-basin). The West Fork White River is identified as a high priority tributary. Two of the high priority actions within this area are directly

addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed,” and “address failing roads to reduce sediment load.” Additionally, lateral channel migration has the potential to recruit nearby trees and address a third high priority action: “increase large wood inputs” (Lead Entity 2018). The WRIA 10/12 Lead Entity Strategy additionally states that this type of action will provide the greatest restoration benefit to Puyallup/White River Chinook abundance. The Puget Sound Salmon Recovery Plan also calls out the Upper White River sub-basin as a priority area for White River spring Chinook and suggests actions such as “large woody debris [and] riparian restoration projects in the Upper White River” (NMFS 2007). There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

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

The funding requested to complete reach-scale assessment efforts, evaluate geomorphic threats natural processes, and prescribe and implement restoration treatments based on these analyses is approximately $3,000,000.

No O&M costs have been identified as the project should not pose any maintenance obligations. The initial project reach is on National Forest property. The entire West Fork White River through the national forest is protected under a riparian reserve designation (Ecology 2003).

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. Given the changing climate conditions that anticipates receding glaciers, increases in precipitation and rain-on-snow events, and channel aggradation, floodplain reconnection projects that provide the river with more room to meander and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

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

South Puget Sound Salmon Enhancement Group is the project sponsor and is ready to implement the project as soon as funding is made available. The overall project can likely be implemented within the next five years provided funding is available.

Documentation of sources, methods, and assumptions.

The following references were used:

Ecology, 2003. Mt. Baker-Snoqualmie National Forest, Upper White Watershed Sediment and Temperature TMDL for Aquatic Habitat. Submittal Report, Publication No. 03-10-032. Available from: https://fortress.wa.gov/ecy/publications/documents/0310032.pdf

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

Appendix I – Washington Water Trust Report

WRIA 10 Puyallup-White Priority Water Right Projects Report is available on the WRIA 10 webpage: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA10/Final%20Plan/Appendix%20J%20Washington%20Water%20Trust%20Report.pdf.

Appendix J – Priority Streams for Water Right Acquisitions

Proposed Selection for WR review	STREAM NAME	Tributary to	High Priority Tributary in WRIA 10/12 Salmon Recovery Strategy	Subbasin	PE Well Projection	Spawning Reach	Fish Utilization
X	Boise Creek	White River	X	Middle White	81	Lower 4.5 miles	CH, CO, PK, ST, SK, BT (NON-SPAWNING)
X	Fennel Creek	Puyallup River	X	Lower Puyallup	102	Lower 2 miles	CH, CO, PK CM, ST, BT (NON-SPAWNING)
X	Greenwater River	White River	X	Upper White	12	throughout	CH, CO, PK, ST, BT (NON-SPAWNING)
X	South Prairie Creek - ask to combine with Wilkeson Creek	Carbon River	X	South Prairie Creek	167	Lower 15 miles	CH, CO, PK, CM, ST, BT (NON-SPAWNING)
X	Wilkeson Creek - ask to combine with South Prairie	South Prairie Creek	X	South Prairie Creek	167	Lower 6.2 miles	CH, CO, PK, CM, ST
X	Voights Creek	Carbon River	X	Carbon	109	Lower 0.5 miles	CH, CO, PK, ST
X	Kapowsin Creek/Ohop Creek	Puyallup River	X	Upper Puyallup	165	all 3.6 miles	CH, CO, PK, ST, BT (NON-SPAWNING)
X	Rody Creek	Clarks Creek	X	Lower Puyallup	102	Lower 0.6 miles	CO, PK, CM
X	Clear Creek (tribs: Canyon Creek, Squally Creek, Swan Creek)	Puyallup River	X	Lower Puyallup	102	RM 1.7 - 1.9	CH, CO, CM, PK, ST, BT (NON-SPAWNING)
	Clearwater River	White River	X	Middle White	81	Lower 3.6 miles	CH, CO, PK, ST, SK, BT (NON-SPAWNING)
	Meeker Creek	Clarks Creek	X	Lower Puyallup	102	lower 0.2 miles	CM, CO
	Salmon Creek/Salmon tributary	White River		Lower White	52	Lower 0.5 miles/Lower0.13 miles	CH, CO, PK, CM
	Hylebos Creek	Puget Sound		Commencement bay (P.S)	102		CH, CO, CM, PK
X	Wapato/Simons Creek	Puget Sound		Lower Puyallup	102		CM, CO, ST
	Canyonfalls Creek	Puyallup River		Lower Puyallup	102	Lower 0.5 miles	CH, CO, CM, PK, ST, BT (NON-SPAWNING)
	Fox Creek	Puyallup River		Upper Puyallup	165	Lower 1 miles	CH, CO, PK, ST
X	Horsehaven Creek	Puyallup River		Upper Puyallup	165	unknown	CM, ST, CO
							CH: CHINOOK, **CO**: COHO, **CM**: CHUM, **SK**:SOCKEYE **PK**: PINK, **ST**: STEELHEAD, **BT**: BULL TROUT

High Priority trib/likely to be impacted by new permit exempt wells
High priority trib, unlikely to be impacted by new permit exempt wells or within UGA/water system coverage
Not a high priority tributary in the Strategy

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