To: WRIA 9 Watershed Restoration and Enhancement Committee

From: Stephanie Potts, Chair of WRIA 9 Committee

Date: September 11, 2020

Re: Review of WRIA 9 Compiled Draft Watershed Restoration and Enhancement Plan

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The WRIA 9 Chair is providing this memo to the WRIA 9 Committee as an update on the Draft WRIA 9 Watershed Restoration and Enhancement Plan and expectations for local entity review of the draft plan. The chair requests committee members review the enclosed draft plan, in coordination with relevant decision makers at their entity, and submit comments to the chair via the Comment Tracker by **Monday, October 19, 2020**. The chair will compile all comments received by this date for discussion with the Committee at the October 27 meeting.

Background and Scope of the Watershed Restoration and Enhancement Plan

In January 2018, the Legislature passed the Streamflow Restoration law, RCW 90.94, to help restore streamflow levels. Its purpose is to support robust, healthy, and sustainable salmon populations while providing water for homes in rural Washington. The law calls for local watershed planning and project implementation that improve streamflows. The Department of Ecology (Ecology) funds implementation through its competitive grant program.

Specifically, the law directs Ecology to convene Watershed Restoration and Enhancement Committees in eight watersheds surrounding Puget Sound. Each of these committees will develop a watershed restoration and enhancement plan (watershed plan). The watershed plan must identify projects that offset the potential impacts future permit-exempt domestic groundwater withdrawals will have on streamflows and provide a net ecological benefit (NEB) to the Water Resource Inventory Area (WRIA).

All members of the WRIA 9 Watershed Restoration and Enhancement Committee must approve the watershed plan prior to submitting the plan to Ecology for review. Ecology must complete its review by June 30, 2021. If it meets the requirements of the law and guidance, Ecology will adopt the plan.

Plan Review Process and Timeline

Ecology, the WRIA 9 Committee, and technical consultants have been developing the plan since October 2018. At the February 2020 meeting, WRIA 9 Committee members shared their local entity plan review and approval process. In February 2020, the WRIA 9 Committee also discussed expectations for local entity review and timeline for approval. Based on this information, the WRIA 9 Committee expects to complete the draft plan by the end of November 2020 in order to distribute to local entities for local approval. The law states that all members of the committee must approve the plan prior to adoption. The law also requires that Ecology adopt the watershed plan by June 30, 2021, so Ecology must begin review of approved plans in early 2021.

Committee members are expected to communicate frequently on committee decisions and progress to their decision-making bodies throughout the planning process. This includes thorough review and feedback of materials developed for the plan, such as technical memos and optional sections not required to be part of the plan. Reaching consensus on all plan components will be critical for final plan approval. Only plans approved by all members of the committee will move forward for Ecology review.

Draft Plan Contents

Ecology, in collaboration with the committee, prepared this compiled draft plan for review by committee members. Throughout the planning process, the chair distributed technical memos to the committee for comments and corrections. The technical memos describe the process, methods, and in some cases, the decision for technical components of the plan. Technical memos are included as appendices in the draft plan and summarized in the body of the plan. Chapters 5-7 are still in development with additional content added as decisions are made by the committee. Table 1 provides an overview of each chapter of the watershed plan and current status.

Table 1. WRIA 9 Chapter Overview and Status

Chapter	Overview	Status
1. Plan Overview	Ecology prepared standard language to provide an overview of water law and the streamflow restoration law. Ecology intends for consistency in the chapter 1 language across all eight watershed restoration and enhancement plans.	The committee has reviewed draft Chapter 1 and provided suggested changes. A revised and more complete draft Chapter 1 is included in the compiled plan.
2. Overview of the Watershed	This chapter provides an overview of geography and land uses, the relationship of this plan to other planning processes, and overview of fish presence and limiting factors, geology, hydrogeology, and streamflow.	The committee reviewed draft Chapter 2 and provided suggested changes. A revised draft Chapter 2 that includes additional information on fish presence and limiting factors is included in the compiled plan.
3. Subbasin Delineation	This chapter includes an overview of the method and results for dividing the WRIA into twelve subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets per Ecology guidance for determining Net Ecological Benefit.	The committee reviewed draft Chapter 3 and provided suggested changes. A revised draft Chapter 3 is included in the compiled plan.
4. Growth Projections and Consumptive Use	This chapter provides the projections for new domestic permit exempt well connections and their associated consumptive use for the 20-year planning horizon.	The committee reviewed draft Chapter 4 and provided suggested changes. A revised draft Chapter 4 is included in the compiled plan.
5. Projects and Actions	This chapter addresses projects and actions identified by the committee to offset consumptive use and achieve a net ecological benefit within the WRIA.	The committee has not yet reviewed this chapter. The committee is actively working to finalize the list of projects and actions to offset consumptive use and meet NEB. A draft of Chapter 5 is included in the compiled plan. Please thoroughly review the draft Chapter 5, including project descriptions and offset estimates.
6. Adaptive Management Recommendations	This chapter addresses optional components of the plan that the committee decided to include. Section 6.1 provides recommendations for plan implementation and adaptive management of the plan. As noted in Section 6.2, the Committee discussed policy recommendations but did not reach consensus on including them in the plan.	The committee reviewed and provided comments on draft Chapter 6. Comments are scheduled for discussion at the September committee meeting. Ecology made minor revisions and corrections based on the feedback from the committee. Ecology will make additional revisions following the September committee meeting.
7. NEB Evaluation	The committee has the option to include a net ecological benefit evaluation in the plan.	The committee is still discussing whether to include the optional Net Ecological Benefit evaluation and NEB statement in the watershed plan. An outline of the NEB Chapter is provided for the committee's review.

Watershed Restoration and Enhancement Plan
WRIA 9 – Duwamish-Green Watershed

Draft Plan
September 2020

DEPARTMENT OF ECOLOGY
State of Washington

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Acknowledgements

The authors of this report thank the following people for their contribution to this study:

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Executive Summary

[COMMENT: to be developed]

Chapter One: Plan Overview

[COMMENT: Added content in sections 1.1.1, 1.1.2, and 1.1.3. Ecology intends for consistency in the chapter 1 language across all eight watershed restoration and enhancement plans. Ecology requests that committee members do not revise the Chapter 1 language with the exception of 1) correcting information about the WRIA; or 2) requesting additional information for inclusion. Ecology will consider and respond to the requests to include additional information.]

1.1 Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 9 Watershed Restoration and Enhancement Plan is to offset the impacts of permit-exempt wells to streamflows. The plan is one requirement of RCW 90.94.030. The law clarifies how counties issue building permits for homes that use a permit-exempt well for a water source. Watershed restoration and enhancement plans must identify projects and actions to offset the potential consumptive impacts of new permit-exempt domestic groundwater withdrawals (PE wells) on instream flows over 20 years (2018-2038), and provide a net ecological benefit to the WRIA. The law requires that local watershed planning take place in 15 WRIAs across the state, including in the Duwamish–Green watershed (WRIA 9). The WRIA 9 watershed restoration and enhancement plan is coordinated with 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. 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 (Culhane et al. 1995). Projects and actions to offset new consumptive water use associated with permit-exempt domestic wells have become a focus to minimize future impacts to instream flows and restore streamflow.

[COMMENT: the following paragraph is language to include if the Committee votes to approve the final plan]. While this watershed plan is narrow in scope and is not intended to address all water uses or related issues within the watershed, successful completion of the plan by the WRIA 9 Committee represents a noteworthy achievement regarding a technically and politically complex issue. This achievement by the WRIA 9 Committee could indicate that more comprehensive, improved coordination of water resources for both instream and out of stream uses, and resultant improvements in overall watershed health in our WRIA, are also achievable.

This watershed plan is divided into 7 Chapters:

1. Overview of the plan purpose and scope and plan development process;
2. Overview of the watershed, including land use and salmon presence, other planning efforts, hydrology and hydrogeology;
3. Summary of the subbasins;

4. Permit-exempt well projections and consumptive water use estimates;
5. Description of the recommended projects and actions identified to offset future permit-exempt domestic water use in WRIA 9;
6. Explanation of recommended adaptive management and implementation measures; and
7. Evaluation and consideration of the net ecological benefits.

1.1.1 Legal and Regulatory Background for the WRIA 9 Watershed Restoration and Enhancement Plan

[New content]

In January 2018, the Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 (session law 2018 c 1). This law was enacted in response to the State Supreme Court's 2016 decision in Whatcom County vs. Hirst, Futurewise, et al. (commonly referred to as the "Hirst decision"). As it relates to this committee's work, the law, now primarily codified as RCW 90.94, clarifies how local governments can issue building permits for homes intending to use a permit-exempt well for their domestic water supply. The law also requires local watershed planning in 15 WRIAs, including WRIA 9.

1.1.2 Domestic Permit-Exempt Wells

[New content]

This watershed restoration and enhancement plan, the law that calls for it, and the Hirst decision are all concerned with the effects of new domestic permit-exempt water use on streamflows. Several laws pertain to the management of groundwater permit-exempt wells in WRIA 9 and are summarized in brief here for the purpose of providing context for the WRIA 9 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. It is important to note that 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, in order for an applicant to receive a building permit from their local government for a new home, the applicant must satisfy the provisions of RCW 19.27.097 for what constitutes evidence of an adequate water supply.

RCW 90.94.030 adds to the management regime for new homes using domestic permit-exempt well withdrawals in WRIA 9 and elsewhere. For example, local governments must, among other responsibilities relating to new permit-exempt domestic wells, collect a $500 fee for each building permit and record withdrawal restrictions on the title of the affected properties. Additionally, this law restricts new permit-exempt domestic withdrawals in WRIA 9 to a

maximum annual average of 950 gallons per days per connection, subject to the five thousand gallons per day and ½-acre outdoor irrigation of non-commercial lawn/garden limits established in RCW 90.44.050. Ecology has published its interpretation and implementation of RCW 19.27.097 and RCW 90.94 in Water Resources POL 2094 (Ecology 2019a). The WRIA 9 Committee directs readers to those laws and policy for comprehensive details and agency interpretations.

1.1.3 Planning Requirements Under RCW 90.94.030

[New content]

While supplementing the local building permit requirements, RCW 90.94.030(3) goes on to establish the planning criteria for WRIA 9. In doing so, it sets the minimum standard for Ecology's collaboration with the WRIA 9 Committee in the preparation of this watershed plan. In practice, the process of plan development was one of integration, collectively shared work, and a striving for consensus described in the WRIA 9 Committee's adopted operating principles, which are further discussed below and in Appendix D.

In addition to these procedural requirements, the law and consequently this watershed plan, is concerned with the identification of projects and actions intended to offset the anticipated impacts from new permit-exempt domestic groundwater withdrawals over the 20 year planning horizon 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 9 Committee's approach to selecting projects and actions, the law also speaks to "high and lower priority projects." The WRIA 9 Committee understands that, as provided in the Final Guidance on Determining Net Ecological Benefit (Ecology 2019), "use of these terms is not the sole critical factor in determining whether a plan achieves a NEB…and that plan development should be focused on developing projects that provide the most benefits…regardless of how they align with [these] labels" (page 12). [COMMENT: The following is language to include if appropriate] It is the perspective of the WRIA 9 Committee that this locally approved 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 (Committee) in the Duwamish-Green watershed for the sole purpose of developing a watershed restoration and enhancement plan (watershed plan) in collaboration with the WRIA 9 Committee. Ecology determined that the intent was best served through collective development of the watershed plan, using an open and transparent setting and process that builds on local needs.

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

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

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

The law requires that all members of the WRIA 9 Committee approve the plan prior to submission to Ecology for review. Ecology must then determine that the plan's recommended streamflow restoration projects and actions will result in a net ecological benefit to instream resources within the WRIA after accounting for projected use of new permit-exempt domestic wells over the 20 year period of 2018-2038.

1.3 Overview of the WRIA 9 Committee

1.3.1 Formation

The Streamflow Restoration law instructed Ecology to chair the WRIA 9 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.[1]

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

The law also required Ecology to invite local organizations representing agricultural interests, environmental interests, and the residential construction industry. Businesses, environmental groups, agricultural organizations, conservation districts, and local governments nominated interest group representatives. Local governments on the WRIA 9 Committee voted on the nominees in order to select local organizations to represent agricultural interests, the residential construction industry, and environmental interests. Ecology invited the selected entities to participate on the WRIA 9 Committee.

The WRIA 9 Committee members are included in Table 1. This list includes all of the members identified by the Legislature that agreed to participate on the WRIA 9 Committee.[2]

Table 1: WRIA 9 Entities and Membership

Entity Name	**Representing**
King County	County government
City of Auburn	City government
City of Black Diamond	City government
City of Enumclaw	City government
City of Kent	City government
City of Normandy Park	City government
City of Seattle	City government
City of Tukwila	City government
Muckleshoot Indian Tribe	Tribal government
Washington Department of Ecology	State agency
Washington Department of Fish and Wildlife	State agency
Covington Water District	Water utility
King County Agriculture Program	Agricultural interest
Master Builders Association of King and Snohomish Counties	Residential construction
Center for Environmental Law and Policy	Environmental interest group
WRIA 9 Watershed Ecosystem Forum – ex officio	Salmon Recovery Lead Entity
Tacoma Water – ex officio	Municipal water purveyor

The WRIA 9 Committee roster with names of representatives and alternates is available in Appendix C.

The WRIA 9 Committee invited the WRIA 9 Watershed Ecosystem Forum and Tacoma Water to participate as “ex officio” members. Although not identified in the law, the ex officio members

[1] There are no irrigation districts located in WRIA 9.
[2] The law did not require invited entities to participate, and some chose not to participate on the Committee.

provide valuable information and perspective as subject matter experts. The ex officio members are active but non-voting participants of the WRIA 9 Committee.

1.3.2 Committee Structure and Decision Making

The WRIA 9 Committee held its first meeting in October 2018. Between October 2018 and February 2021 [UPDATE LAST MEETING DATE, IF NEEDED], the WRIA 9 Committee held [ADD NUMBER] committee meetings open to the public. The WRIA 9 Committee met monthly or every other month, and as needed to meet deadlines.

The two and a half years of planning consisted of planning group formation, data gathering, and developing plan components. WRIA 9 Committee members had varying degrees of understanding concerning hydrogeology, water law, salmon recovery, and rural development. Ecology technical staff, WRIA 9 Committee members, and partners presented on topics to provide context for components of the plan.

In addition to playing the role of WRIA 9 Committee chair, Ecology staff provided administrative support and technical assistance, and contracted with consultants to provide facilitation and technical support for the WRIA 9 Committee. The facilitator supported the WRIA 9 Committee's discussions and decision-making. The technical consultants developed products that informed WRIA 9 Committee decisions and development of the plan. The technical consultants developed all of the technical memorandums referenced throughout this plan.

Cities had the option of participating in the Committee through a caucus, with one person attending the Committee meetings as the caucus representative. Black Diamond, Normandy Park, and Tukwila decided to form a cities caucus with the WRIA 9 Watershed Ecosystem Forum representative serving as the caucus representative. The caucus representative's attendance and vote represented the participation and vote of all members of the caucus. The caucus had one collective vote on decisions that did not require approval by all Committee members. For decisions that required approval by all Committee members (adopting or amending the operating principles, final plan approval), each caucus member voted individually.

The WRIA 9 Committee established a technical workgroup to support planning efforts and to achieve specific tasks. The workgroup was open to all WRIA 9 Committee members as well as non-Committee members that brought capacity or expertise to the Committee. The workgroup made no binding decisions, but presented information to the Committee as either recommendations or findings. The WRIA 9 Committee acted on workgroup recommendations, as it deemed appropriate.

During the initial WRIA 9 Committee meetings, members developed and agreed to operating principles.[3] The operating principles set forward a process for meeting, participation expectations, procedures for voting, structure of the WRIA 9 Committee, communication, and other needs in order to support the WRIA 9 Committee in reaching agreement on a final plan.

[3] Approved and signed operating principles can be found in Appendix D and on the WRIA 9 Committee webpage: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA09/WRIA9_approved_signed_operating_principles.pdf

This planning process, by statutory design, brought diverse perspectives to the table. The authorizing legislation requires all members of the Committee to approve the final plan prior to Ecology's review.[4] It was important for the Committee to identify a clear process for how it made decisions. The Committee strived for consensus for interim decisions because consensus on decisions during plan development served as the best indicator of the Committee's progress toward an approved plan. [COMMENT: The following is language to include if appropriate: Consensus was reached on all interim decisions. The chair and facilitator documented agreement and dissenting opinions, as outlined in the Committee's operating principles. The Committee did not make any decisions by two-thirds majority.]

The WRIA 9 Committee reviewed components of the watershed plan and the draft plan on an iterative basis. [COMMENT: The following is language to include if the Committee votes to approve the final plan: Once the WRIA 9 Committee reached initial agreement on the final watershed plan, broader review and approval by the entities represented on the WRIA 9 Committee was sought, as needed. The WRIA 9 Committee reached final agreement on the Watershed Restoration and Enhancement Plan on [THIS DATE] 2021.]

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

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 9

The Duwamish-Green watershed is one of the 62 designated major watersheds in Washington State, formed as a result of the Water Resources Act of 1971. The Duwamish-Green watershed is located in King County, Washington and is approximately 482 square miles in area. It includes all the lands drained by the Duwamish-Green River, including marine nearshore areas that drain directly to Puget Sound. WRIA 9 is bounded on the north by WRIA 8 (Cedar-Sammamish), on the west by Puget Sound, on the south by WRIA 10 (Puyallup-White), and on the east by WRIA 38 (Naches) and WRIA 39 (Upper Yakima).

The upper portion of the watershed contains Howard Hanson Dam, an earthen dam on the Green River constructed for flood control. The City of Tacoma operates a diversion facility approximately three miles downstream from Howard Hanson Dam for municipal water supply. Lower portions of the watershed contain Lake Sawyer and Lake Youngs. Numerous smaller lakes, ponds, and wetlands are present throughout the watershed. Over the last 200 years, construction of dams, levees and other flood control projects, and development of the Duwamish Estuary altered the watershed from its pre-development state (WRIA 9 Steering Committee 2005). The Duwamish River, and the lower portion of the Green River, have been extensively channelized.

The watershed includes one major river, the Duwamish-Green River. The Green River originates in the Cascade Range south of Snoqualmie Pass and flows in a generally northwest direction before becoming the Duwamish River at the historical confluence with the Black River near the City of Tukwila. The Duwamish River is highly channelized and flows northwest before discharging to Elliott Bay in the City of Seattle. The overall length of the Duwamish-Green river system is 93 miles. The mean annual flow in the Green River is 1,350 cubic feet per second measured near Auburn (U.S. Geological Survey 2020). Tributaries within the system include Coal Creek, Deep Creek, Newaukum Creek, and Soos Creek (Covington Creek and Jenkins Creek flow into Soos Creek).

2.1.1 Land Use in WRIA 9

The eastern or upland portion of the watershed extending from the Tacoma Headworks Diversion Dam on the west, to the eastern boundary of WRIA 9, is the Green River Municipal Watershed. Tacoma Public Utilities manages the Green River Municipal Watershed for municipal water supply under a Habitat Conservation Plan (Tacoma Public Utilities 2001) and a 1995 agreement with the Muckleshoot Indian Tribe. This portion of the watershed consists of forestland and has limited public access. Land uses shift to agriculture, suburban developments, and small urban centers such as Black Diamond and Enumclaw in the foothills of the Cascade Mountains. Extending from the cities of Auburn and Kent to the cities of Burien, Tukwila, Renton, and Seattle, the northwest portion of WRIA 9 is highly urbanized, characterized by a combination of residential, industrial, commercial, transportation, communication, and utility land covers. Approximately 30 percent of the watershed is within a city or designated urban growth area.

The Duwamish-Green watershed is one of the most heavily populated watersheds in Washington. Industry, agriculture, commercial facilities, individual residences, and municipalities compete for a limited water supply, causing a strain on water availability. These out of stream uses compete with instream water needs, including providing water for salmon and other aquatic resources.

2.1.2 Tribal Reservations and Tribal Treat Rights

[COMMENT: Ecology is working with the Muckleshoot Indian Tribe to update this section]

Federally Recognized Indian Tribes are sovereign nations with rights over natural resources, including enough water to fulfill the purposes of their reservations. Some of the ancestral lands and use areas of the people of the Muckleshoot Indian Tribe, and the lands of the Muckleshoot Indian Reservation are located in WRIA 9. The Muckleshoot Indian Tribe holds reserved treaty rights to fish, hunt and gather throughout WRIA 9 and claims the earliest (most senior) priority rights to water within the Duwamish-Green watershed. While unquantified, these may include federally reserved water rights intended to serve current and future uses of land reservations, and can extend to instream flows and minimum lake levels necessary to protect resources in all areas where Tribes have reserved rights. Treaty rights to fish can support claims for fish habitat, which may include stream flow. Nothing in this plan can alter tribal rights.

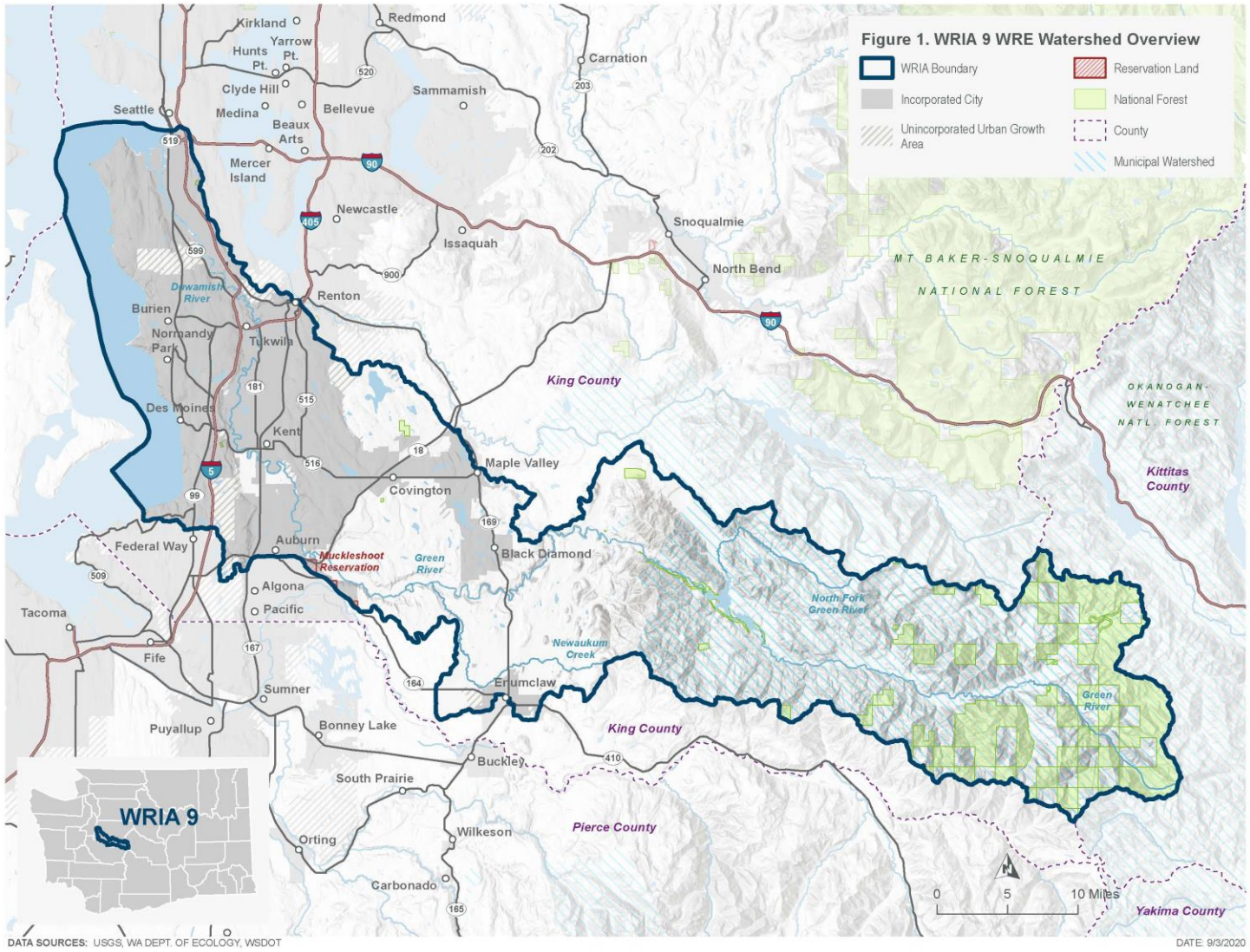


Figure 1: WRIA 9 WRE Watershed Overview

2.1.3 Salmonids in WRIA 9

The Duwamish-Green watershed is an important and potentially productive system for salmonids. Several tributaries provide spawning and rearing habitat for salmon, steelhead, and bull trout. These streams often experience low streamflows during critical migration and spawning time. In addition, levees, dams, migration barriers, and other flood control and navigation measures have further limited habitat along the river and tributaries. The quality and quantity of spawning and rearing habitat, water quality, including water temperature, and low streamflows all affect local salmon populations (WRIA 9 Steering Committee 2005).

The Soos Creek system, Newaukum Creek, and Crisp Creek are also important systems for both natural and hatchery salmon resources. The state's Soos Creek Hatchery is located near the mouth of the creek and has just undergone a major rehabilitation. The Keta Creek Hatchery is located on Crisp Creek and owned and operated by the Muckleshoot Indian Tribe, who work with WDFW and other tribes on fish propagation programs.

[New content added on salmon presence and current habitat conditions]

Salmon Presence (Fish Population and Life Histories)

The Duwamish-Green watershed has anadromous salmon runs that include four of the five Pacific salmon species (WDFW Salmonscape 2020, SWIFD 2020). Chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), Chum (*Oncorhynchus keta*), and Pink salmon (*Oncorhynchus gorbuscha*) migrate in and out of the Duwamish-Green watershed from Puget Sound. There is no established run of Sockeye salmon (*Oncorhynchus nerka*) within the watershed; however, stray individuals have been observed in the basin. Steelhead trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarkii clarkii*), rainbow trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) also inhabit the watershed.

The Puget Sound evolutionarily significant unit (ESU) of Chinook salmon was designated as threatened under the Endangered Species Act (ESA) on May 24, 1999. Designated critical habitat for Chinook salmon includes marine nearshore and freshwater habitats within WRIA 9 (70 FR 52630-52853). The Puget Sound distinct population segment (DPS) of steelhead trout was designated as threatened under ESA on May 7, 2007. Final designated critical habitat (DCH) for Puget Sound steelhead includes freshwater and estuarine habitat in Puget Sound, Washington (81 FR 9252-9325) including areas within WRIA 9. The Coastal-Puget Sound Distinct Population Segment (DPS) of bull trout was designated as threatened under ESA on December 1, 1999. Critical habitat has been designated for bull trout and includes both freshwater and saltwater aquatic habitat within WRIA 9 (75 FR 63897). Table 2 below lists the species present in the Duwamish-Green watershed and their regulatory status.

Table 2: Salmonids Present within the Duwamish-Green Watershed

Common Name	Scientific Name	Evolutionary Significant Unit	Critical Habitat	Regulatory Agency Status
Chinook salmon	*Oncorhynchus tshawytscha*	Puget Sound Chinook	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
Sockeye salmon	*Oncorhynchus nerka*	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

Table 3 below lists the run timing and life stages of anadromous salmon and trout present throughout the watershed. Watershed specific data concerning salmonid life history and timing was largely summarized from the 2000 King County Habitat Limiting Factors and Reconnaissance Assessment for Salmon Habitat (Kerwin 2000).

1 Table 3: Salmonid Life History Patterns within the Duwamish-Green Watershed

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
Sockeye[1]	Upstream migration													-Duwamish River -Lower Green River -Lower Middle Green River -Mid Middle Green River -Upper Middle Green River -Newaukum Creek -Soos Creek
	Spawning													
	Fry emergence													
	Juvenile rearing													
	Smolt outmigration													
Chinook (fall)	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Coho	Upstream migration													-Central Puget Sound -Duwamish River -Lower Green River -Lower Middle Green River -Mid Middle Green River -Upper Middle Green River -Upper Green River -Newaukum Creek -Soos Creek -Jenkins Creek -Covington Creek
	Spawning													
	Incubation													
	Juvenile rearing													
	Smolt outmigration													
Chum	Upstream migration													-Central Puget Sound -Duwamish River -Lower Green River -Lower Middle Green River -Mid Middle Green River -Upper Middle Green River -Upper Green River -Newaukum Creek -Soos Creek -Covington Creek
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Pink	Upstream migration													-Duwamish River

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
	Spawning									■	■			-Lower Green River -Lower Middle Green River -Mid Middle Green River -Newaukum Creek -Soos Creek
	Incubation	■	■	■	■	■					■	■	■	
	Juvenile rearing			■	■	■	■							
	Juvenile outmigration				■	■	■							
Bull trout[2]	Upstream migration							■	■	■				-Duwamish River -Lower Green River -Lower Middle Green River -Mid Middle Green River -Upper Middle Green River
	Spawning									■	■	■		
	Incubation	■	■	■	■	■	■	■	■	■	■	■	■	
Coastal Cutthroat trout[3]	Upstream migration	■	■	■	■	■	■	■	■	■	■	■	■	All
	Spawning	■	■	■	■	■	■	■	■	■	■	■	■	
	Incubation		■	■	■	■	■	■	■	■	■	■	■	
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration				■	■	■	■	■	■	■	■	■	
Steelhead trout (winter)	Upstream migration	■	■	■	■								■	-Central Puget Sound -Duwamish River -Lower Green River -Lower Middle Green River -Mid Middle Green River -Upper Middle Green River -Upper Green River -Newaukum Creek -Soos Creek -Jenkins Creek -Covington Creek
	Spawning		■	■	■	■	■							
	Incubation			■	■	■	■	■						
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration			■	■	■								
Steelhead trout (summer)	Upstream migration					■	■	■	■	■	■			-Duwamish River -Lower Green River -Lower Middle Green River -Mid Middle Green River -Upper Middle Green River -Soos Creek
	Spawning		■	■	■	■	■							
	Incubation			■	■	■	■							

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration					■	■	■						
Rainbow trout[4]	Spawning			■	■	■	■							-Lower Green River -Lower Middle Green River -Upper Middle Green River -Upper Green River
	Incubation				■	■	■	■						

Notes:

1. There is no established run of Sockeye within the Basin. This data reflects stray individuals observed within the basin. Information on sockeye life history specifically within the Green and Duwamish watershed is either unavailable or extremely limited. Sockeye life history patterns for the Puget Sound Region were used within this report (Gustafson et al. 1997).
2. Information on bull trout life history specifically within the Green and Duwamish watershed is either unavailable or extremely limited. Bull trout life history patterns for the Puget Sound Region were used within this report (King County 2000).
3. Information on coastal cutthroat trout life history specifically within the Green and Duwamish watershed is either unavailable or extremely limited. Coastal cutthroat trout life history patterns for the Puget Sound Region were used within this report (Johnson et al. 1999).
4. Information on rainbow trout life history specifically with the Green and Duwamish watershed is unavailable. Rainbow trout life history patterns for the Puget Sound Region were used within this report (Blanton et al. 2011).

Current Habitat Conditions

Habitat conditions within the Duwamish-Green watershed were abstracted from the 2000 King County Habitat Limiting Factors and Reconnaissance Assessment for Salmon Habitat (Kerwin 2000). The Duwamish-Green watershed has been severely impacted by a variety of land uses ranging from commercial forestry in the Upper Green River, a mix of a residential and agricultural land uses within the Middle Green River, to a mix of dense residential, industrial, and commercial development in the Lower Green River (King County 2000). Fundamental historical changes to WRIA 9 include the diversion of the White River from the Green River to the Puyallup River (1911), the diversion of the Black and Cedar Rivers from the Duwamish River to Lake Washington (1916), the filling, draining or dredging of the Duwamish estuary tidelands (1900-1940), the channelization and diking of the Duwamish-Green River (1945-2000), and the construction of the Howard Hanson Dam (1962).

The Habitat Limiting Factors and Reconnaissance Assessment (Kerwin 2000) lists the following primary limiting factors and impacts within the Duwamish-Green watershed:

- Dams and other fish passage barriers
- Loss of riparian habitat
- Excessive sedimentation
- Decreased water quality (pollution and elevated water temperatures)
- Altered stream hydrology
- Gravel starvation and scouring
- Disconnected floodplain habitat and loss of associated rearing habitats
- Introduction of non-native plant and animal species
- Altered hydrology and stream flows
- Loss of estuarine habitat
- Reduction of large woody debris and channel complexity
- Alteration/loss of marine nearshore habitat

Although there are some common issues across WRIA 9, habitat conditions vary within the watershed's subbasins and are described below.

Upper Green River

Areas around the Upper Green River have been extensively logged and the region is a mix of old-growth, second-growth, and recently logged areas. Logging practices around tributaries to the Upper Green River have resulted in reduced riparian habitat functions, creation of fish passage barriers, increased sedimentation, decreased water quality and altered stream hydrology. However, the Upper Green River represents relatively intact habitat compared to river reaches below the Howards Hanson Dam. The dam, located at RM 64.5, is a barrier to upstream fish migration, although some salmonids are manually transported above the dam, providing access to quality habitat upstream.

Upper Middle Green River, Mid Middle Green River, Lower Middle Green River

The Middle Green River was separated into three distinct subbasins separated by the river confluences with Newaukum and Franklin Creeks. The Middle Green River and its tributaries are mainly affected by residential and agricultural land uses. Levees and revetments have altered natural flow regimes, reduced side-channel and off-channel habitats, and constrained channel migration. Development has also created fish passage barriers, reduced in-channel large woody debris, increased impervious surfaces, and reduced and degraded riparian habitat.

Lower Green River

The Lower Green River subbasin combines the Lower Green River downstream from the Soos Creek confluence, the Black River, and Mill Creek. The Lower Green River is bordered by dense residential, commercial, and industrial development. Revetments and levees within the system have disconnected most side channels and tributaries from the active floodplain and degraded or eliminated riparian habitat.

Coal/Deep

The Coal/Deep subbasin combines the Coal Creek and Deep Creek watersheds and is characterized by a mixture of land uses including commercial forestry, rural residential development, and agriculture. Wildfires and commercial logging have degraded riparian habitat throughout the subbasin. Both creeks drain into small lakes without outlets; there is no surface water connection between this subbasin and the Green River. However, water likely seeps underground, and these lakes are considered important cold water sources to the Green River.

Newaukum Creek

The Newaukum Creek subbasin drains to the Green River and is dominated by agricultural development. The subbasin is an important source of spawning gravel to the mainstem Green River and supports healthy populations of Steelhead trout, and Coho and Chinook salmon. Intense agricultural development has severely degraded riparian habitat and eliminated off-channel and wetland habitat within the subbasin. Other stressors include a lack of large woody debris (LWD), numerous fish passage barriers, high levels of fecal coliform bacteria, high turbidity, and numerous bank modifications.

Covington Creek, Jenkins Creek, Soos Creek

The Covington Creek and Jenkins Creek subbasins both drain to the Soos Creek subbasin which drains to the Green River. These subbasins are characterized by a mix of agriculture, urban, suburban, and rural residential or commercial development. Fish passage barriers, low instream flows, and high water temperatures limit upstream migration of adult salmonids in these subbasins. Erosion and sedimentation problems have been identified across the subbasins. Although these subbasins have some of the largest wetland areas in the Green River basin, past and current trends of drainage and filling wetlands limits this potential off-channel habitat. Urbanization and development pressures are expected to increase demands on habitat within these subbasins.

Duwamish River

The Duwamish River subbasin includes the Duwamish River and Longfellow Creek. This subbasin has been highly impacted by residential, commercial, and industrial development resulting in poor habitat quality. Over 97 percent of the original wetlands and sub-tidal habitats associated with the estuary have been filled over the last 100 years. Decreased water quality and increased sedimentation are both issues within the Duwamish River and Elliot Bay.

Central Puget Sound

The Central Puget Sound subbasin includes marine nearshore areas and independent tributaries to Puget Sound within WRIA 9. This subbasin has been substantially impacted by residential, commercial and industrial development. Few natural areas or parks remain on the marine shoreline. Tidal flats and marshes have been filled or dredged. Salmonid habitat in these areas has been destroyed, altered, and degraded.

Priority Actions

The WRIA 9 Salmon Habitat Plan (WRIA 9 Steering Committee 2005) recommends a combination of projects and programs to protect, restore, rehabilitate, and substitute salmonid habitat and stream processes. Projects include excavating shallow water habitat in estuarine and marine nearshore habitats, installation of large woody debris in freshwater habitats, planting native vegetation and control of invasive weeds throughout the watershed, levee setbacks on the Green River mainstem, introduction of spawning gravel in the Green River mainstem, side channel reconnection, and the removal of bulkheads in marine nearshore habitats.

2.2 Watershed Planning in WRIA 9

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 9 for decades. A brief summary of broad watershed planning efforts as they relate to the past, present, and future water availability in the Duwamish-Green watershed is provided below.

2.2.1 Other Planning Efforts in WRIA 9

This watershed plan builds on many of the past efforts to develop comprehensive plans for the entire watershed. For example, the South Central Action Area Caucus Group (South Central LIO) developed an ecosystem recovery plan, as part of the Action Agenda for Puget Sound Recovery. The planning process to develop an ecosystem recovery plan is community based with engagement by local, state, and federal agencies. The approach is holistic, addressing everything from salmon to orca recovery, stormwater runoff, and farmland and forest conservation.

The WRIA 9 Watershed Ecosystem Forum is the Salmon Recovery Lead Entity, a collaboration of local government, state and federal agencies, non-profits, and businesses interests focused on improving watershed health and salmon habitat recovery. The Watershed Ecosystem Forum developed the Green/Duwamish and Central Puget Sound Salmon Habitat Plan in 2005. Since

2005, the WRIA 9 Watershed Ecosystem Forum has worked to implement the Salmon Habitat Plan (WRIA 9 Steering Committee 2005).

The South Central LIO and WRIA 9 Watershed Ecosystem Forum include many of the same organizations and individuals that participate in the WRIA 9 Watershed Restoration and Enhancement Committee. This history of collaborative planning and shared priorities has supported the success of the watershed restoration and enhancement plan development in WRIA 9.

Coordinated Water System Plans (CWSPs) are mandated by the Public Water System Coordination Act of 1977. King County passed ordinances ratifying four CWSPs (East King County, Skyway, South King County, and Vashon). These plans ensure 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 connection to a water system is available, or the new homes will need to rely on an alternative water source, most likely new permit-exempt domestic wells. Within their designated retail service area(s), water purveyors are given first right of refusal for new connections. The purveyor may decline to provide service if water cannot be made available in a 'reasonable and timely' manner. However, it can be the case that a new permit-exempt well is drilled without making any inquiries with the county or with the local water system.

2.2.2 Coordination with Existing Plans

Throughout the development of this watershed plan, Ecology streamflow restoration staff engaged with staff from the WRIA 9 Watershed Ecosystem Forum, South Central LIO, and the Puget Sound Partnership, providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. Throughout the planning process, the WRIA 9 Committee has coordinated closely with the WRIA 9 Watershed Ecosystem Forum, including inviting lead entity staff to join the WRIA 9 Committee as an ex officio member, and selecting habitat projects based on information from the Salmon Habitat Plan.

King County planning staff contributed to the plan development to ensure consistency with the county's Comprehensive Plan. The comprehensive plan sets policy for development, housing, public services and facilities, and environmentally sensitive areas, among other topics. The comprehensive plan identifies King County's urban growth areas, sets forth standards for urban and rural development, and provides the basis for zoning districts.

2.3 WRIA 9 Geology, Hydrogeology, Hydrology, and Streamflow

2.3.1 Geologic Setting

Understanding the geologic setting of WRIA 9 helps to characterize surface and groundwater flow through the watershed. The relationships between surface water flow and deeper groundwater are important to understanding how to manage surface water resources and can be helpful in identifying strategies to offset the impacts of pumping from permit-exempt wells.

Within WRIA 9, bedrock forms mountain ranges and uplands and generally consists of igneous and sedimentary rocks. Within drainages and lowland areas, bedrock is overlain by glacial and alluvial sediments (Washington State Department of Natural Resources 2020). A minimum of four major glaciations covered the lower portion of the watershed during the Pleistocene Epoch (about 11,700 years to 2.6 million years ago), the most recent occurrence being the Vashon Stade of the Frasier Glaciation (Jones 1998; Vaccaro et al. 1998; Booth et al. 2003). The present topography and drainage network in WRIA 9 was shaped during the advance and retreat of the Vashon ice sheet (Evans 1996). These processes resulted in glacially-derived ridges and lakes linked by drainage channels (Booth and Goldstein 1994; Evans 1996). Pleistocene-age glacial and interglacial processes resulted in the deposition of a complex assemblage of sedimentary deposits in lowland areas. These glacial deposits consist of glacial till, recessional and advance outwash, and glaciolacustrine deposits. Glacial till deposits generally consist of dense, silty sand with gravel and silt lenses. Outwash deposits generally consist of sand and gravel with locally abundant wood debris and peat. Glaciolacustrine deposits generally consist of silt and clay. This sequence of glacial deposits is hundreds to thousands of feet thick within the lower portions of the watershed (Jones 1996).

Recent alluvial deposits are generally associated with channel and overbank deposits from the modern Duwamish and Green Rivers and their tributaries. These sediments generally consist of stratified silt, sand, gravel, and minor amounts of clay.

Deposits associated with the Osceola Mudflow outcrop are found in the south-central portion of the watershed, near the Cities of Enumclaw and Auburn (Washington State Department of Natural Resources 2020). The Osceola Mudflow is a sequence of lahar deposits that originated in eruptions and avalanche events that occurred at Mount Rainer approximately 5,600 years ago (Vallance and Scott 1997) .

2.3.2 Hydrogeologic Setting

The U.S. Geological Survey identified six hydrogeologic units within the sequence of Puget Sound glacial and alluvial sediments within WRIA 9 (Vaccaro et al. 1998). The hydrogeologic units typically alternate between aquifer units and semi-confining to confining layers (aquitards which lack sufficient permeability to form aquifers).

Within the upper portion of the watershed, glacial and alluvial sediments occur within the Green River valley and drainages associated with area tributaries. Glacial and alluvial sediments are widespread within the lower portion of the watershed and reach thicknesses exceeding 2,000 feet (Jones 1996; Vaccaro et al 1998). Shallow glacial and alluvial aquifers are generally unconfined (under water-table conditions) except where overlain by low permeability confining layers (generally till or glaciolacustrine deposits). Transmissivity (a hydraulic property related to the rate of groundwater flow through an aquifer) and storativity (a hydraulic property related to the capacity of an aquifer to store/release water) of these aquifers vary significantly with depositional environment and are generally the highest in sands and gravels of glacial outwash and alluvial origin and lowest in fine-grained alluvial and glaciolacustrine deposits. Glacial and alluvial aquifers are characterized by a shallow depth to the groundwater table and, where applicable, a direct hydraulic connection with adjacent surface water.

Bedrock aquifers underlay the entire watershed. However, within the lower portions of the watershed, glacial and alluvial sediments are frequently hundreds of feet thick and bedrock aquifers are seldom targeted by water supply wells. Thickness of the glacial and alluvial hydrogeologic units generally thin to the east within WRIA 9. Much of the watershed southeast of Renton is underlain by relatively shallow and frequently outcropping bedrock.

Bedrock aquifers are generally of relatively low transmissivity and storativity. Wells completed within bedrock aquifers typically do not have high enough capacity for municipal use. However, they can be valuable aquifers for residential water uses, and in specific areas are an important target aquifer for permit-exempt wells.

Recharge to glacial, alluvial, and bedrock aquifers within WRIA 9 is primarily associated with precipitation, applied irrigation, septic systems, leakage from surface water within losing reaches (where streamflow infiltrates to groundwater), through leakage from adjacent aquifers, and mountain front recharge. Watershed aquifers discharge to water supply wells, adjacent aquifers, gaining reaches of streams, springs, wetlands, lakes, and Puget Sound. Summer base flows in WRIA 9 rivers and tributaries are sustained by groundwater (baseflow) on most of the lower-elevation tributaries.

Regionally, groundwater flow direction within watershed aquifers generally is perpendicular to the westerly slope of the Cascade Range, although groundwater flow in shallow aquifers is more influenced by surface topography and streamflow within the watershed and is directed to the northwest. This groundwater flow paradigm is complicated throughout the watershed by aquifer boundaries, aquifer heterogeneities, topography, the influence of gaining and losing stream reaches, well pumping, and other factors.

2.3.3 Hydrology and Streamflow

The Green River and its headwaters are located in a snowmelt transition region where the rivers are fed by both snowmelt and rainfall. Within low elevation portions of the watershed, mean annual precipitation ranges from about 30 to 40 inches per year. Mean annual precipitation increases with topographic elevation and can exceed 120 inches within the Cascade Range (MGS Engineering Service and Oregon Climate Service 2006). Most precipitation occurs during the late fall and winter. Precipitation is lowest during the summer when water demands are highest. During these low precipitation periods, streamflow is highly dependent upon groundwater inflow (baseflow).

WAC 173-509 set minimum instream flows for the Green River and closed tributaries to the Green River and other streams to further consumptive appropriations.

The U.S. Army Corps of Engineers operates Howard Hanson Dam and regulates flow in the Green River in coordination with the Green River Flow Management Committee (Tacoma Public Utilities 2001). The Green River Flow Management Committee consists of representatives from the Army Corps, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Muckleshoot Indian Tribe, Washington Department of Fish and Wildlife, Washington Department of Ecology, King County Department of Natural Resources, and Tacoma Water. A 1995 agreement between Tacoma and the Muckleshoot Indian Tribe includes provisions for instream flows (Tacoma

Water 2018). The City of Tacoma operates a diversion facility for municipal supply approximately three miles downstream from Howard Hanson Dam.

Duwamish River and Green River streamflow conditions are summarized by the following:

- USGS stream gage 12105900 (Green River below Howard Hanson Dam): At this upper watershed location, mean daily discharge ranges from 270 cfs in August to 1,620 cfs in January (U.S. Geological Survey 2020).
- USGS stream gage 12113000 (Green River near Auburn): At this lower watershed location, mean daily discharge ranges from 311 cfs in August to 2,350 cfs in January, for the period from January 1962 through December 2019. This gage is one of the compliance points for instream flows in WAC 173-509, as well as the agreement between Tacoma Public Utilities and the Muckleshoot Indian Tribe. This is the furthest downstream gage not affected by tides.
- The USGS stream gage 12112600 (Soos Creek): This gage is on Big Soos Creek above the hatchery. Mean daily discharge ranges from 33 cfs in August to 253 cfs in January, for the period from October 1966 to July 2019.
- The USGS stream gage 12108500 (Newaukum Creek): This gage is on Newaukum Creek. For the period of record from July 1944 to September 2019 the mean daily flows were 19 cfs in August and 112 cfs in January.
- King County gages Jenkins Creek and Covington creeks (26A and 09A, respectively).

Anticipated future climate impacts will result in continued loss of snow in the Cascade Range, 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 9. These climate impacts are expected to drive changes in seasonal streamflows, increasing winter flooding, while intensifying summer low flow conditions. For the Green River, climate modeling predicts average minimum flows to be 16 percent lower (range: -21 to -7 percent) by the 2080s for a moderate warming scenario, relative to 1970 to 1999 (Mauger et al. 2015).

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally. Groundwater pumping may diminish surface water flows. Consumptive water use (that portion not returned to the immediate water environment) potentially reduces streamflow, both seasonally and as average annual recharge. A well drawing from an aquifer connected to a surface water body either directly or through an overlying aquifer can either reduce baseflow or increase the quantity of water leaking out of the river (Culhane et al. 1995).

Chapter Three: Subbasin Delineation

3.1 Introduction to Subbasins

Water Resource Inventory Areas are large watershed areas formalized under Washington Administrative Code for the purpose of administrative water management and planning. WRIAs encompass multiple landscapes, hydrogeologic regimes, levels of development, and variable natural resources. To allow for meaningful analysis of the relationship between new consumptive use and offsets per Ecology's Final NEB Guidance,[5] the WRIA 9 Committee divided WRIA 9 into subbasins. This was helpful in describing the location and timing of projected new consumptive water use, the location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. In some instances, subbasins did not correspond with hydrologic or geologic basin delineations (e.g. watershed divides).[6]

3.2 Approach to Develop Subbasins

The WRIA 9 Committee divided WRIA 9 into 12 subbasins for purposes of assessing consumptive use and project offsets. The WRIA 9 Committee based their subbasin delineation on existing subwatershed units. The Committee used King County drainage basin boundaries (King County 2018) and applied the following guiding principles to delineate subbasins:

- Use hydrologic boundaries;
- Combine King County drainage basins within the Urban Growth Area with lower expected growth of new homes using PE wells; and
- Delineate subbasins at a finer scale in the area of the watershed expected to have the most homes using PE wells (the Middle Green River).

The WRIA 9 subbasin delineations are shown on Figure 2 and summarized below in Table 4. A more detailed description of the subbasin delineation is in the technical memo available in Appendix E. The technical memo also describes other adjustments made to align the subbasin boundaries with the WRIA 9 planning boundary.

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

[6] 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).

Table 4: WRIA 9 Subbasins

Subbasin Name	**Primary Rivers and Tributaries**	**County**
Central Puget Sound	Streams draining directly to Puget Sound between the City of Federal Way and the City of Seattle, including Seola Creek, Salmon Creek, Miller Creek, and Des Moines Creek	King County
Duwamish River	Longfellow Creek and Duwamish River	King County
Lower Green River	Green River below river mile 32, including Black River and Mill Creek	King County
Soos Creek	Soos Creek	King County
Jenkins Creek	Jenkins Creek	King County
Covington Creek	Covington Creek	King County
Lower Middle Green River	Green River starting at river mile 32 to the confluence with Newaukum Creek	King County
Mid Middle Green River	Green River between the confluence with Newaukum Creek and confluence with Franklin Creek	King County
Upper Middle Green River	Green River between the confluence with Franklin Creek and Howard Hanson Dam	King County
Newaukum Creek	Newaukum Creek	King County
Coal/Deep Creek	Coal Creek and Deep Creek	King County
Upper Green River	Green River above Howard Hanson Dam	King County

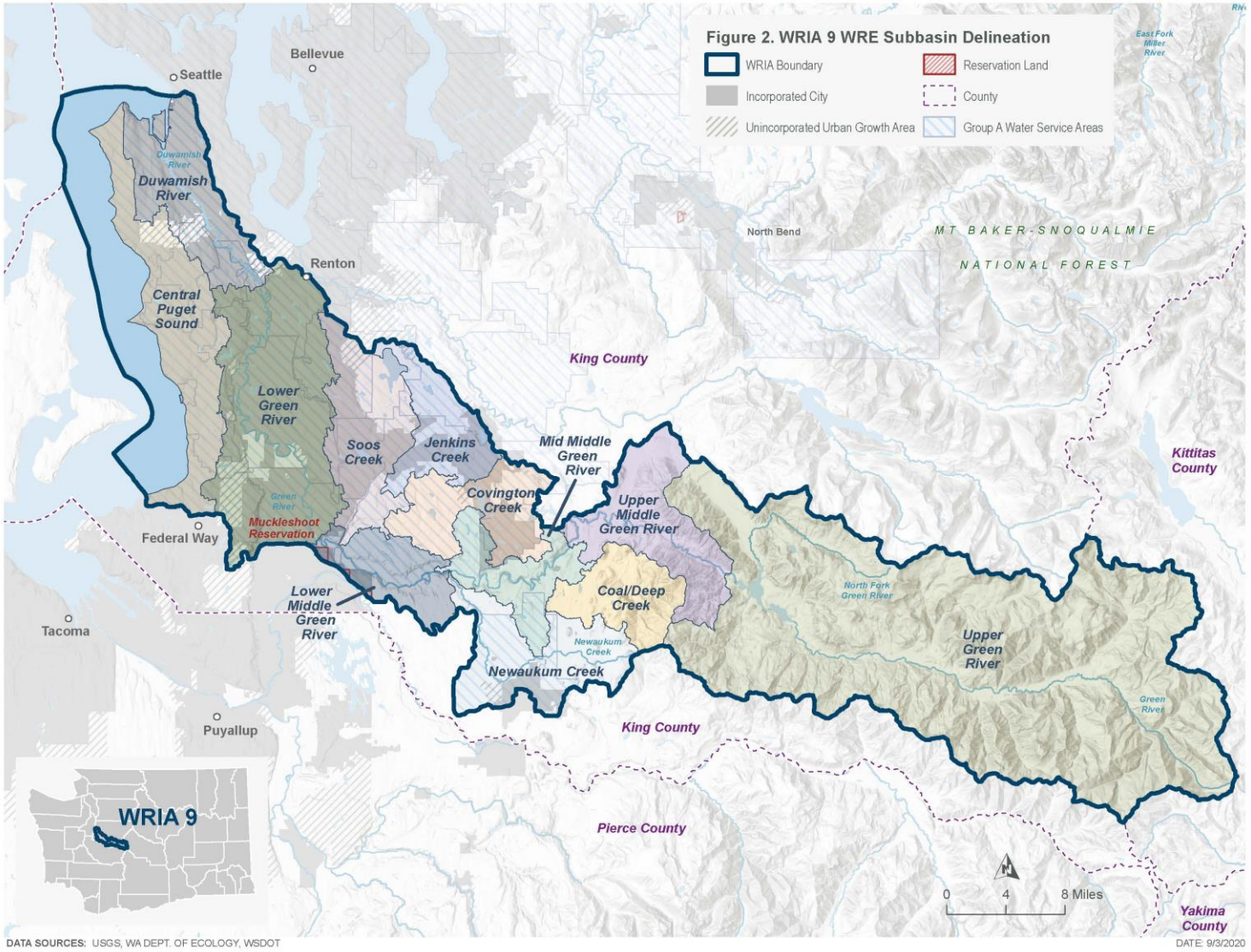


Figure 2: WRIA 9 WRE Subbasin Delineation

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" (pg. 7). This chapter provides the WRIA 9 Committee's projections of new domestic permit exempt well connections (hereafter referred to as PE wells) and their associated consumptive use for the 20-year planning horizon.[7] This chapter summarizes information from the technical memos (Appendices F and G) prepared for, and reviewed by, the WRIA 9 Committee.

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

The WRIA 9 Committee projects 632 PE wells over the planning horizon. Most of these wells are likely to be installed outside of the Urban Growth Area in the following subbasins: Soos Creek, Lower Middle Green River, Mid Middle Green River, Upper Middle Green River, and Newaukum Creek.

The WRIA 9 Committee developed a method that they agreed was appropriate to project the number of new PE wells over the planning horizon in WRIA 9, in order to estimate new consumptive water use. This method, referred to as the PE well projection method, is based on recommendations from Appendix A of Ecology's Final NEB Guidance (Ecology 2019). The following sections provide the 20-year projections of new PE wells for each subbasin within WRIA 9, the methods used to develop the projections (PE well projection method), and uncertainties associated with the projections.

4.2.1 Permit-Exempt Well Connections Projection by Subbasin

This WRIA 9 watershed plan compiles the King County PE well projection data at both the WRIA scale and by subbasin. The projection for new PE wells in WRIA 9 by subbasin is shown in Table 5 and Figure 3.

[7] New consumptive water use in this document is from projected new homes connected to permit-exempt domestic wells associated with building permits issued during the planning horizon. Generally, new homes will be associated with wells drilled during the planning horizon. However, new uses could occur where new homes are added to existing wells serving group systems under RCW 90.44.050. In this document the well use discussed refers to both these types of new well use. PE wells may be used to supply houses, and in some cases other Equivalent Residential Units (ERUs) such as small apartments. For the purposes of this document, the terms "house" or "home" refer to any permit-exempt domestic groundwater use, including other ERUs.

Table 5: Number of PE Wells Projected between 2018 and 2038 for the WRIA 9 Subbasins

Subbasins	King County	Urban Growth Areas	Total PE Wells per Subbasin
Central Puget Sound	0	0	0
Duwamish River	0	0	0
Lower Green River	0	4	4
Soos Creek	72	11	83
Jenkins Creek	44	1	45
Covington Creek	41	0	41
Lower Middle Green River	81	3	84
Mid Middle Green River	100	0	100
Upper Middle Green River	110	0	110
Newaukum Creek	102	1	103
Coal Deep Creek	62	0	62
Upper Green River	0	0	0
Totals	**612**	**20**	**632**

The total projection for WRIA 9 is 632 new PE wells. King County projects approximately 612 new PE wells over the planning horizon within WRIA 9 portions of unincorporated King County. The King County method did not account for potential PE wells in cities or UGAs so the WRIA 9 Committee completed an analysis of potential new PE wells within the UGAs and projected 20 new PE wells (UGA Well Log Spot Check).

4.2.2 Methodology

The WRIA 9 Committee conferred with King County to identify an appropriate method of projecting PE wells within its jurisdiction. King County used historical building data to project new potential PE wells, assuming the rate and general location of past growth will continue over the 20-year planning horizon. Using past building permits to predict future growth is one of the recommended methods in the Final NEB Guidance (Ecology 2019). Due to data availability, King County considered historical rates of connection to water service within water service area boundaries to estimate the number of homes that would be served by community

water systems and municipalities, and remove those from the PE well projection.[8] King County completed the analyses in-house and the methods are described in detail in Appendix F.

The WRIA 9 Committee also looked at potential PE wells within the UGAs using data from Ecology's Well Report Viewer database.

King County completed a PE Well Potential Assessment which identified potential parcels where development could occur within rural King County. The PE Well Potential Assessment results were used to assess whether a subbasin (as identified by the Committee) has the capacity to accommodate the number of PE wells projected over the 20-year planning horizon.

All methods are summarized in the sections below. The WRIA 9 Growth Projections Technical Memorandum provides a more detailed description of the analysis and methods (Appendix F).

King County PE Well Projection Methodology

King County used historical residential building permit and parcel data from 2000 through 2017 to project the number of new PE wells for the planning horizon in unincorporated King County (referred to as the past trends analysis). This data set considers economic and building trends over an 18-year period and the method assumes that past trends will continue.

King County projected the number of new PE wells over the planning horizon using the following steps:

1. Gather historical building permit and parcel data (2000–2017) for new residential structures.[9]
2. Assess the total number of permits and average number of permits per year for WRIA 9.
3. Link building permit and parcel data to determine water source for each building permit/parcel and separate into public, private, and other water source categories. Consider a building permit with water source listed as "private" as a PE well.
4. Calculate the number and percentage of building permits for each type of water source (public, private, or other) inside and outside water services areas by subbasin, and for the WRIA overall.

The WRIA 9 Committee used the King County past trends analysis to develop PE well projections by subbasin using the following steps:

5. Calculate the projected number of PE wells per year for each subbasin by multiplying the average number of building permits per year by the percentage of building permits

[8] Water service area boundaries include areas currently served by existing water lines and may also include areas not yet served by water lines. King County used historic rates of connection to water service to predict future rates of connection because King County does not have County-wide information on the location of water lines.

[9] King County used the time period 2000 through 2017 because those data were available. The building permit data for 2000 through 2017 includes both periods of high growth and periods of low growth. King County compared these data with information from the Vision 2040 regional plan and population data and is confident in using the average of this time period to project into the future.

per subbasin, and percentage of building permits using a private water source (well) per subbasin.

6. Multiply the projected number of PE wells per year per subbasin by 20 to calculate the total of PE wells projected over the 20-year planning horizon for each subbasin.
7. Add 6% to 20-year PE well projection per subbasin to account for gaps in the building permit and parcel data (6% error is based on the percentage of building permits with "other" as the water source).
8. Tabulate the total PE wells projected over the 20-year planning horizon, including the 6% error, for each subbasin and sum to get the total of PE wells projected over the 20-year planning horizon in rural unincorporated King County.

Urban Growth Area PE Well Projection Methodology

The King County PE well projection methods do not account for potential PE wells within cities or UGAs. However, the WRIA 9 Committee recommended looking at the potential for PE well growth within UGAs. The WRIA 9 Committee completed an analysis of potential PE well growth within the incorporated and unincorporated UGAs using data from Ecology's Well Report Viewer database (referred to as the UGA well log spot check).

The general method included using Ecology's Well Report Viewer database (1998–2018) to query water wells with characteristics of a domestic well[10] within UGAs. The Committee randomly reviewed a subset of the water well reports and calculated the number and percentage of each type of well (domestic, irrigation, other and incorrect) located within the UGAs. They then multiplied the percentage of wells identified as domestic (assumed to be PE wells) by the total number of wells located within UGAs to estimate the number of PE wells installed over the past 20-year period. The Committee also cross-checked the physical address of the wells with the UGA boundaries to determine which subbasin the domestic wells were located in. The Committee used the total number of domestic wells per subbasin over the past 20 years to project the number of PE wells located within the UGAs over the planning horizon for each WRIA 9 subbasin. A more detailed methodology is included in Appendix F.

King County PE Well Potential Assessment

King County completed an assessment of parcels available for future residential development in unincorporated King County (referred to as the PE well potential assessment). The Committee used the PE Well Potential Assessment to assess whether a subbasin has the capacity to accommodate the number of PE wells projected over the 20-year planning horizon.

King County used screening criteria to identify parcels with potential for future residential development by subbasin. The total number of parcels and dwelling units[11] (DUs) per subbasin

[10] Ecology's complete Well Report Viewer database was filtered for water wells 6 to 8 inches in diameter and greater than 30 feet deep, which are typical dimensions and depths for domestic wells. The Ecology Well Report Viewer database does not have the ability to filter for permit-exempt domestic wells.

[11] A dwelling unit is a rough estimate of subdivision potential based on parcel size and zoning (e.g. a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).

were determined and labeled as inside or outside the water district service boundaries. King County then projected the water source for each parcel (public water or PE well) based on historic rates of connection to water service inside water district service boundaries. King County used historic rates of connection to water service because the County does not have County-wide information on the location of water lines. The WRIA 9 Committee compared the 20-year PE well projection to the PE well potential assessment. In areas where the number of projected PE wells exceeded the potential parcels available, the Committee reallocated those PE wells to the nearest subbasin with parcel capacity and similar growth patterns. The WRIA 9 Committee redistributed 20 well from the Newaukum Creek subbasin to the Mid Middle Green River subbasin. A more detailed methodology and list of assumptions is included in Appendix F.

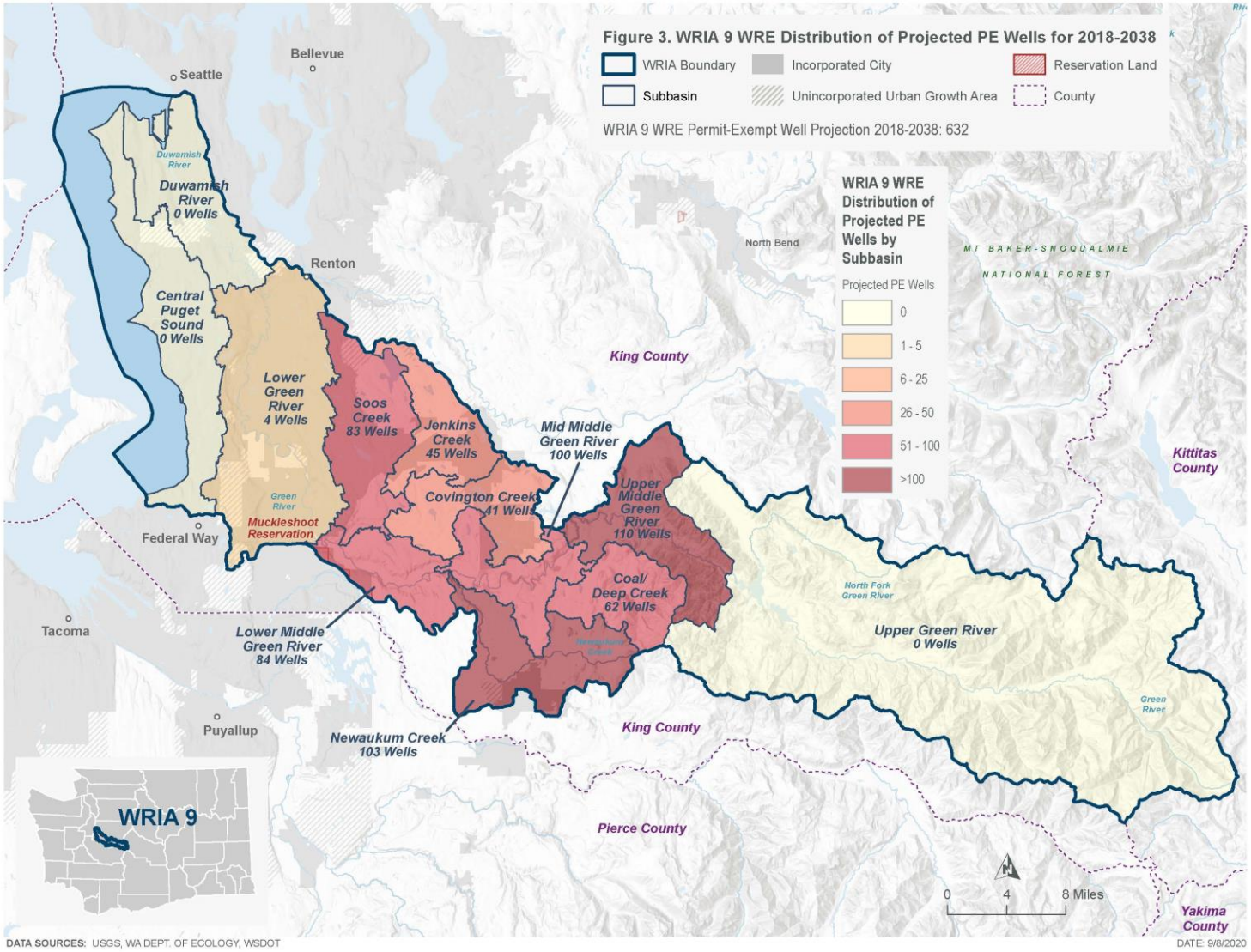


Figure 3: WRIA 9 WRE Distribution of Projected PE Wells for 2018-2038

4.3 Impacts of New Consumptive Water Use

The WRIA 9 Committee used the 20-year projection for WRIA 9 of new PE wells (632) to estimate the consumptive water use that this watershed plan must address and offset. The WRIA 9 Committee estimates 247.7 acre-feet per year (0.34 cfs) of new consumptive water use in WRIA 9. The WRIA 9 Committee developed a water offset target of [XX] acre-feet per year to account for uncertainties in the PE well projections and consumptive use estimate and address higher rates of water use that could result from climate change and changing development patterns.

[COMMENT: The sentence on the offset target is included as a placeholder. The WRIA 9 Committee has not decided on a safety factor or offset target at this time. If the Committee identifies an offset target or safety factor that is higher than the consumptive use estimate in order to address uncertainty, both the consumptive use estimate and safety factor/offset target will be described in the paragraph above.]

This section includes an overview of the methods used by the WRIA 9 Committee to estimate new consumptive water use (consumptive use) and an overview of the anticipated impacts of new consumptive use in WRIA 9 over the planning horizon. The WRIA 9 Consumptive Use Estimates Technical Memorandum provides a more detailed description of the analysis and alternative scenarios considered (Appendix G).

4.3.1 Methods 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. Also, the portion of water that is consumptive varies for indoor and outdoor water use. Appendix A of the Final NEB Guidance (Ecology 2019) describes a method (referred to as the Irrigated Area Method) which assumes average indoor use per person per day, and reviews aerial imagery to provide a basis to estimate irrigated area of outdoor lawn and garden areas. The Irrigated Area Method accounts for indoor and outdoor consumptive use variances by using separate approaches to estimate indoor and outdoor consumptive use.

To develop the consumptive use estimate, the WRIA 9 Committee used the Irrigated Area Method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance. This chapter provides a summary of the technical memo which is available in Appendix G.

Consistent with the Final NEB guidance (Appendix B, pg. 25), the Committee assumed 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 well locations and depths across varying hydrogeological conditions

The WRIA 9 Committee looked at other scenarios for estimating consumptive use, including (1) assuming each home has 0.5-acre irrigated lawn area (legal maximum per PE well[12]) and (2) assuming each home uses 950 gallons of water per day (legal withdrawal limit per PE well connection[13]). The Committee chose a consumptive use estimate based on the irrigated area method. The technical memo in Appendix G includes the additional consumptive use scenarios and results.

New Indoor Consumptive Water Use

Indoor water use refers to the water that households use in kitchens, bathrooms, and laundry (USGS 2012). The WRIA 9 Committee used the Irrigated Area Method and Ecology's recommended assumptions for indoor daily water use per person, local data to estimate the average number of people per household, and applied Ecology's recommended consumptive use factor to estimate new indoor consumptive water use (Ecology 2019). The assumptions the WRIA 9 Committee used to estimate household consumptive indoor water use are:

- 60 gallons per day (gpd) per person.
- 2.73 persons per household assumed for rural portions of King County.
- 10% of indoor use is consumptively used (or a consumptive use factor (CUF) of 0.10), based on the assumption that homes on PE wells are served by onsite sewage systems (septic). Onsite sewage systems return most wastewater back to the immediate water environment; a fraction of that water is lost to the atmosphere through evaporation in the drainfield.

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

60 gpd x 2.73 people per house x 365 days x .10 CUF

This results in an annual aggregated average of 0.0183 AF[14] (16.4 gpd or 0.000025 cfs[15]) indoor consumptive water use per day per well.

New Outdoor Consumptive Water Uses

Most outdoor water use is for irrigating 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 onsite sewage systems, but instead typically infiltrates into the ground or is lost to the atmosphere through evapotranspiration (Ecology 2019).

[12] Per RCW 90.44.050

[13] Legal withdrawal limits from PE wells in WRIA 9 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)

[14] 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. 1 acre-foot per year is equal to 893 gallons per day.

[15] 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. 1 cubic foot per second is equal to 646,317 gallons per day.

The WRIA 9 Committee used aerial imagery to measure the irrigated areas of 211 parcels in eight[16] WRIA 9 subbasins to develop an average outdoor irrigated area per subbasin. Parcels used for the irrigated footprint analysis were selected based on recent (2006-2017) building permits for new single-family residential homes not served by public water. All new home building permit sites in WRIA 9 were included in the analysis. The average irrigated area for 211 parcels, when aggregated across subbasins, was 0.30 acres per parcel.

The WRIA 9 Committee used the following assumptions, recommended in Appendix A of the Final NEB Guidance, to estimate household outdoor consumptive water use:

- The amount of water needed to maintain a lawn varies by subbasin due to varying temperature and precipitation across the watershed. The Committee used the Washington Irrigation Guide (WAIG) (NRCS-USDA 1997) station in Seattle-Tacoma, Kent, and surrounding stations to develop a weighted average crop irrigation requirement (IR) for turf grass in each subbasin (the WRIA average IR is 14.62 inches). This value represents the amount of water needed to maintain a green lawn.
- The irrigation application efficiency (AE) used for WRIA 9 was the Ecology-recommended value of 75%. This increases the amount of water used to meet the crop's irrigation requirement.
- Consumptive use factor (CUF) of 0.8, reflecting 80% consumption for outdoor use. This means 20% of outdoor water is returned to the immediate water environment.
- Outdoor irrigated area per subbasin based on the irrigated footprint analysis (the WRIA average irrigated area size is 0.30 acres per PE well).

IR by subbasin (inches) ÷ 0.75 AE x average irrigated area by subbasin (acres) x 0.80 CUF

First, water loss is accounted for by dividing the crop irrigation requirement by the application efficiency. Next, the total water depth used to maintain turf is multiplied by the area which is irrigated. Finally, the volume of water is multiplied by 80 percent to produce the outdoor consumptive water use. To convert the equation from inches to acre-feet, divide the result by 12.

The result is total outdoor consumptive water use per PE well per subbasin ranging from 0.19 AF per year in the Coal/Deep subbasin to 0.59 AF per year in the Lower Middle Green River subbasin. The outdoor consumptive use varies by subbasin due to differences in average outdoor irrigated area size and irrigation requirements across the watershed. This is an average for the year, however the Committee expects that more water use will occur in the summer than in the other months.

4.4 Consumptive Use Estimate for WRIA 9 and by Subbasin

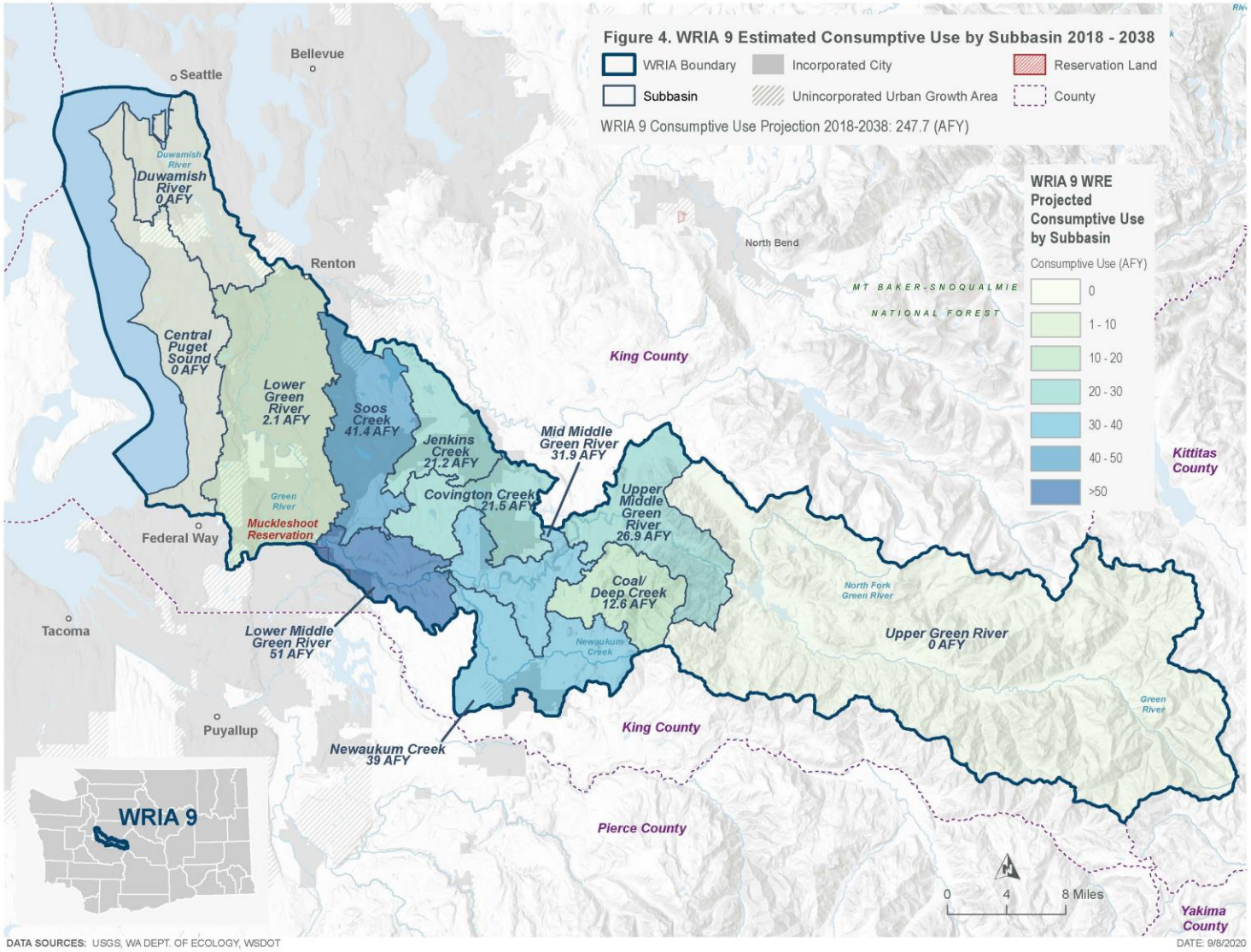
[16] The analysis covered 8 of the 9 subbasins in WRIA 9 with projected PE well connections. The Lower Green River subbasin (with 4 projected PE wells) did not have any recent building permits for sites without purveyor-provided water service, so the average irrigated area for the adjacent Soos Creek subbasin was applied to the Lower Green River subbasin for purposes of consumptive use estimates.

The total consumptive use estimate for WRIA 9 is 247.7 AF per year (0.34 cfs). The total consumptive use estimate for WRIA 9 is the number of PE wells projected by subbasin (see section 4.3) multiplied by the total indoor and outdoor consumptive use per PE well. Table 6 summarizes the estimated indoor and outdoor consumptive use by subbasin using the Irrigated Area Method. The highest consumptive use is expected to occur in the subbasin with the largest irrigated area per PE well and the most anticipated new PE wells, as presented in Figure 4.

Table 6: Consumptive Use Estimate Based on Irrigated Areas Method (1 Home + Subbasin Average Yard)

Subbasin	Projected PE wells	Average lawn size (acres)	Indoor CU per well (AF/yr)	Outdoor CU per well (AF/yr)	Total CU/year per well (AF/year)	Total CU 2018-2038 (AF/year)
Central Puget Sound	0	-	-	-	-	0
Duwamish River	0	-	-	-	-	0
Lower Green	4	0.3	0.0183	0.51	0.53	2.1
Soos Creek	83	0.3	0.0183	0.48	0.50	41.4
Jenkins Creek	45	0.3	0.0183	0.45	0.47	21.2
Covington Creek	41	0.4	0.0183	0.51	0.52	21.5
Lower Middle Green River	84	0.4	0.0183	0.59	0.61	51.0
Mid Middle Green River	100	0.3	0.0183	0.30	0.32	31.9
Upper Middle Green River	110	0.2	0.0183	0.23	0.24	26.9
Newaukum Creek	103	0.3	0.0183	0.36	0.38	39.0
Coal/Deep Creek	62	0.2	0.0183	0.19	0.20	12.6
Upper Green River	0	-	-	-	-	0
WRIA 9	**632**	**0.3**	**0.0183**	**0.42**	**0.43**	**247.7**

Note: Values in table have been rounded



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2 Figure 4: WRIA 9 Estimated Consumptive Use by Subbasin 2018-2038

4.5 Summary of Uncertainties and Scenarios

The methods described in Section 4.3 for projecting new PE wells include a number of uncertainties, which were discussed by the WRIA 9 Committee. The Committee recognized uncertainties as inherent to the planning process and addressed uncertainties where feasible. The uncertainties are shared here to provide transparency in the planning process and deliberations of the Committee.

Historical data on the number and location of PE wells within WRIA 9 was not available to inform PE well projections. Therefore, the WRIA 9 Committee relied on building permit data, and agreed on assumptions about the water source, in order to estimate the numbers of past and future PE wells.

Another example of uncertainty is that the County projected new PE wells within unincorporated areas and omitted PE wells installed within city limits, including PE wells installed for lawn watering purposes. Although most cities require new homes to connect to water systems, some allow exceptions if a connection is not available (for instance, if a home is more than 200 feet from a water line), or allow a home to install a PE well for outdoor water use. The WRIA 9 Committee addressed this uncertainty by including a projection for new PE wells within the UGAs.

King County relied on historical data and assumed that these historical building trends will continue into the future. However, water service areas and water lines continue to grow and expand. Water line data was not readily available in King County, so the WRIA 9 Committee was not able to compare actual water lines with the historical data to see if and how the water service has expanded. Additionally, future building trends may not mirror historical building trends as the county and cities continue to direct growth to urban areas (with access to public water service) to preserve rural and resource lands and protect critical areas.

RCW 90.94 requires counties to collect fees for new homes that rely on PE wells and provide a report and portion of those fees to Ecology. King County shared information on the fees collected since those requirements went into effect in January of 2018. King County reported 24 building permits with PE wells identified as the water source within the WRIA 9 portion of unincorporated King County between January 2018 and June 2020. Twenty-four new wells over the 30-month period averages to around 10 new PE wells per year. The WRIA 9 Committee projected approximately 32 new PE wells per year.

The Irrigated Area Method used to estimate consumptive use (described in Section 4.3.1) contains a number of uncertainties and limitations. Measurement of consumptive water use in any setting is difficult, and it is virtually impossible for residential groundwater use, which must account for both indoor and outdoor use. PE wells are generally unmetered, so supply to each home is usually unknown, let alone the amount that is lost to the groundwater system. Therefore, the WRIA 9 Committee was limited to estimating consumptive use based on projections of future growth, local patterns and trends in water use, and generally accepted and reasonable assumptions.

The outdoor consumptive use calculation contains the most uncertainty. In aerial photos used to calculate average irrigated area, many parcels did not demonstrate a clear-cut distinction

between irrigated and non-irrigated lawns and other landscaped areas. It appears that many homeowners irrigate enough to keep lawns alive but not lush (or comparable to quality of commercial turf grass). The WRIA 9 Committee addressed uncertainty and ensured consistency by applying conservative methods that err on the side of a higher irrigated area and having one GIS analyst evaluate all of the selected parcels in the WRIA. Assumptions for the aerial imagery analysis are described in detail in Appendix G.

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 (e.g., watering at rates that meet crop irrigation requirements per the WAIG). The irrigated area analysis demonstrated that many people irrigate their lawns enough to keep the grass alive through the dry summers, not at the levels that commercial turf grass requires. The method also assumes that residential pop-up sprinkler systems irrigate the lawns with an efficiency of 75%. In reality, households apply water to their lawns and gardens in many different ways, some more efficient than a 25% water loss. The WRIA 9 Committee discussed these uncertainties and scenarios and recognized that there is a range of water use across the watershed and individual PE well owners.

The consumptive use estimate assumes that current rural residential landscaping practices and outdoor water use will continue over the 20-year planning horizon. Because of uncertainty inherent in estimating growth patterns, domestic PE well pumping rates, and potential changes in outdoor watering practices, the WRIA 9 Committee determined that the conservative assumptions used to estimate consumptive use based on the Irrigated Area Method, and assumptions for outdoor water use in particular, are justified.

To further address uncertainty and have a point of comparison, the Committee developed two additional consumptive use scenarios. One additional scenario assumed each home has the legal maximum 0.5-acre irrigated lawn area per PE well and resulted in a consumptive use estimate of 398.4 acre-feet per year for WRIA 9. The second additional scenario assumed each home withdraws the legal limit of 950 gallons per day for indoor and outdoor use and resulted in a consumptive use estimate of 456.9 acre-feet per year for WRIA 9. The technical memo in Appendix G includes the additional consumptive use scenarios and results.

The Committee also compared the Irrigated Area method to local water purveyor data, taking into consideration several factors: customers connected to public water supply may have incentive to conserve water, in order to reduce their water bill; purveyor data represents total water use (not consumptive use) and does not separate indoor and outdoor water use to account for different consumptive use factors; and water purveyors also serve areas that are more dense and urban. Especially in portions of the watershed with older homes, homes and lawns are smaller and less water is used for irrigation; so a lower water use on average over the service area is expected. The technical memo in Appendix G includes the water purveyor data.

[COMMENT: If the Committee identifies an offset target that is higher than the consumptive use estimate in order to address uncertainty, the offset target and how it addresses uncertainty will be described in the paragraph below. Placeholder language is included for now.]

The WRIA 9 Committee developed a water offset target of [XX] acre-feet per year to account for uncertainties in the PE well projection and consumptive use, including higher rates of water use that could result from climate change and changing development patterns. The WRIA 9 Committee developed the water offset target by [add method and justification for the offset target].

The WRIA 9 Committee also included plan implementation and adaptive management recommendations to address uncertainties related to the consumptive use estimate and project implementation (see Chapter 6).

Chapter Five: Projects and Actions

[COMMENT: this is an initial draft of Chapter 5 and will benefit from Committee members' thorough review and input.]

5.1 Approach to identify and select projects

Watershed plans must identify projects that offset the potential impacts future PE wells will have on streamflows, and provide a net ecological benefit to the WRIA. This chapter provides recommendations from the WRIA 9 Committee for projects and actions to offset consumptive use and meet NEB. The projects are described in this chapter as water offset projects and habitat projects. Water offset projects have a quantified streamflow benefit and contribute to offsetting consumptive use. Habitat projects contribute toward achieving NEB by 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 is difficult to quantify with a high degree of certainty. Therefore, the Committee did not rely on habitat projects to contribute toward offsetting consumptive use, however recognized they are still of value and therefore should be included in the plan.

The WRIA 9 Committee identified priorities for project types and locations to guide decisions on which projects to include in the plan. The Committee identified water rights acquisitions projects as a priority for inclusion in the plan. The Committee prioritized those water offset projects in subbasins in the Middle Green area with higher projected PE wells and consumptive use: Soos, Jenkins, Covington, Lower Middle Green, Mid Middle Green, Upper Middle Green, and Newaukum. The Committee identified priority habitat projects in subbasins with both a higher potential impact from PE wells and critical salmon habitat needs: Lower Green, Soos, Lower Middle Green, Mid Middle Green, Upper Middle Green, and Newaukum.

To identify the projects summarized in this chapter, the WRIA 9 Committee assembled a project inventory to capture and track all project ideas throughout the planning process. The project inventory consisted of previously proposed projects as well as new project concepts and ideas.

Technical consultants supported the Committee's development of projects described in this chapter through researching project concepts, analyzing estimated water offset for projects, contacting project sponsors, and developing project descriptions. Initially, Ecology and the technical consultants identified projects with potential streamflow benefit from the WRIA 9 salmon recovery lead entity four-year workplans, the Puget Sound Action Agenda, streamflow restoration grant applications, and other ongoing planning efforts. These projects were assigned a project type consistent with the three project type examples listed in the Final NEB Guidance (Ecology 2019). These project types included: (a) water right acquisition offset projects; (b) non-acquisition water offset projects; and (c) habitat and other related projects. The WRIA 9 Committee also distributed a Call for Projects to request information on water offset and habitat projects at all stages of development from Committee members and partners in WRIA 9.

Non-acquisition water offset projects were underrepresented within the WRIA 9 project inventory, which consisted largely of habitat and other related projects. Development of new non-acquisition water offset projects with quantifiable streamflow benefits became necessary in order for the plan to achieve the consumptive use offset. These projects are largely centered around changes in how and when water is diverted, withdrawn, conveyed, or used to benefit streamflow and instream resources. Examples include streamflow augmentation and managed aquifer recharge projects.

Non-acquisition water offset project development occurred through three main phases: (1) initial identification through brainstorming sessions during technical workgroup and Committee meetings; (2) prioritization and further analysis; (3) and development of project descriptions for projects included in the plan. Project progression from one phase to the next occurred after the Committee agreed to move the project to the next phase. The non-acquisition water offset projects that the Committee selected for the plan are described below in section 5.2.1.

In a separate effort, Ecology contracted with Washington Water Trust (WWT) to identify opportunities for water right acquisition water offset projects within WRIA 9, including source switches to municipal water and reclaimed water. In coordination with the WRIA 9 Committee, WWT developed a water right selection criterion based on the unique local nature of water rights and water use in WRIA 9. 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 the Committee. WWT developed eleven water right acquisition project opportunity profiles for consideration by the Committee. The water rights acquisitions projects that the Committee selected for the plan are described below in section 5.2.1.

The technical workgroup initially developed a list of habitat projects by selecting projects that were in subbasins with higher projected PE wells and projects that are likely to have streamflow benefits. The technical workgroup recommended habitat projects to the Committee for review and the Committee decided to include those habitat projects in the plan. The habitat projects that the Committee selected for the plan are described below in section 5.2.2.

[COMMENT: the Committee is still discussing how to tier the project list. The tiering results will be included in the project tables once that is completed.]

After selecting projects to include in the plan, the Committee used the following criteria to organize the list into tiers to reflect [add explanation of tiering, for example: "the location of the project with respect to subbasin priorities, the likelihood that the project will be implemented, and certainty that benefits will occur." Add description of the tiers, for example "Tier 1 projects provide benefits to priority subbasins and are more likely to be implemented and provide benefits in the near-term. Tier 2 projects are in lower priority subbasins, or are expected take longer to implement, because they may still be conceptual or may need additional outreach to key stakeholders."] For water offset projects, this evaluation considered the following: magnitude of water offset benefit; timing of water offset benefit; location of water offset benefit with respect to water offset priority subbasins; certainty of implementation; certainty of benefit and effectiveness; resiliency; and durability. For habitat

projects, this evaluation considered the following: location of benefit with respect to water offset priority subbasins and habitat priority subbasins; projects which provide multiple benefits; certainty of implementation; certainty of benefit and effectiveness; resiliency; and durability. Since the projects were in different stages of development, with some still conceptual and some ready for implementation, the process to apply the tiering criteria and tier the project list was subjective. The Committee relied on the technical workgroup to develop a recommendation on tiering based on their knowledge of the proposed project as well as assumptions based on the design and performance of similar projects in the region. The tiering results are included in tables 7 and 8.

Water offset and habitat projects that the Committee selected to offset consumptive use and achieve NEB are summarized below in section 5.2.1 and 5.2.2. Detailed project descriptions and project profiles are included in Appendix H.

In addition to the water offset and habitat projects listed below, section 5.2.3 describes the types of projects that the Committee supports for further development and implementation in the future.

5.2 Projects and Actions

The projects presented below have water offset and/or ecological benefits and the WRIA 9 Committee identified these projects as contributing toward offsetting consumptive use and achieving NEB. The WRIA 9 Committee recommends implementation of all projects included in this chapter.

5.2.1 Water offset projects

[COMMENT: The WRIA 9 Committee is still working to finalize the water offset projects to include in the plan. The totals offset potential may change.]

Table 7 provides a summary of the eight water offset projects identified by the Committee to offset consumptive use and contribute toward NEB. The total offset potential for WRIA 9 is 1,196 - 1,409 AF per year. Offset benefits are anticipated in the subbasins listed in Table 7 as well as downstream of the respective project locations. Figure 5 is a map of the watershed that shows the location of the projects listed in Table 7.

The WRIA 9 Committee supports the acquisition of the valid quantity of water for the water right acquisition projects included in the plan. However, to estimate the offset potential for each water right acquisition project, the WRIA 9 Committee used the estimate generated by WWT for the consumptively used portion of the water right. The estimated return flow portion of the water right is not counted as an offset as that portion of water returns to groundwater. Before water rights are acquired and put into the Trust Water Rights Program, Ecology will conduct a full extent and validity analysis to determine the actual quantity available for acquisition and the consumptive use offset component. Since this analysis generally happens after the water right holder has agreed to sell, the Committee relied on the WWT evaluations to estimate the offset volumes listed in Table 7.

[Add additional sentence about the water offset project list and tiering, e.g. "The Tier 1 water projects included in the plan all have project sponsors and are in priority subbasins."]

A summary description for each project is provided below. More detailed water offset project descriptions are provided in Appendix H.

[COMMENT: The Committee is still discussing the water offset estimate to associate with the Green River MAR project. A range is included for now, from a low of 114 af/year for streamflow benefits from June through October, to a high of 327 af/year for year-round streamflow benefits.]

1 Table 7: WRIA 9 Water Offset Projects

Project Number	Project Name	Project Type	Subbasin(s)	Water Offset (Annual AF)	Project Sponsor	Estimated project cost	Project tier
9-D-W1	Tukwila Golf Course baseflow augmentation (pre-identified water right No. 4)	Water right acquisition	Duwamish	96	City of Tukwila		
Duwamish River Subbasin Subtotal				**96**			
9-LG-W2	Mill Creek Stormwater	Stormwater	Lower Green	25	King County		
Lower Green River Subbasin Subtotal				**25**			
9-S-W3	Soos Creek Park water right acquisition (pre-identified water right No. 5)	Water right acquisition	Soos	11	TBD		
9-S-W4	Pre-identified No. 6 water right acquisition	Water right acquisition	Soos	182	TBD		
Soos Creek Subbasin Subtotal				**193**			
9-C-W5	Pre-identified No. 2 water right acquisition	Water right acquisition	Covington	54	TBD		
9-C-W6	Covington Water District Managed Aquifer Recharge	Water storage and retiming - MAR	Covington	357	Covington Water District		
Covington Creek Subbasin Subtotal				**411**			
9-UMG-W7	Green River Managed Aquifer Recharge	Water storage and retiming - MAR	Upper Middle Green	114 - 327	Washington Water Trust		
Upper Middle Green River Subbasin Subtotal				**114 - 327**			
9-UG-W8	Tacoma Water Streamflow Augmentation and Eagle Lake Siphon	Streamflow augmentation	Upper Green	357	Tacoma Water		
Upper Green River Subbasin Subtotal				**357**			

Project Number	Project Name	Project Type	Subbasin(s)	Water Offset (Annual AF)	Project Sponsor	Estimated project cost	Project tier
WRIA 9 Total Water Offset (Cumulative from above)				**1,196 - 1,409**			
WRIA 9 Consumptive Use Estimate				**247.7**			

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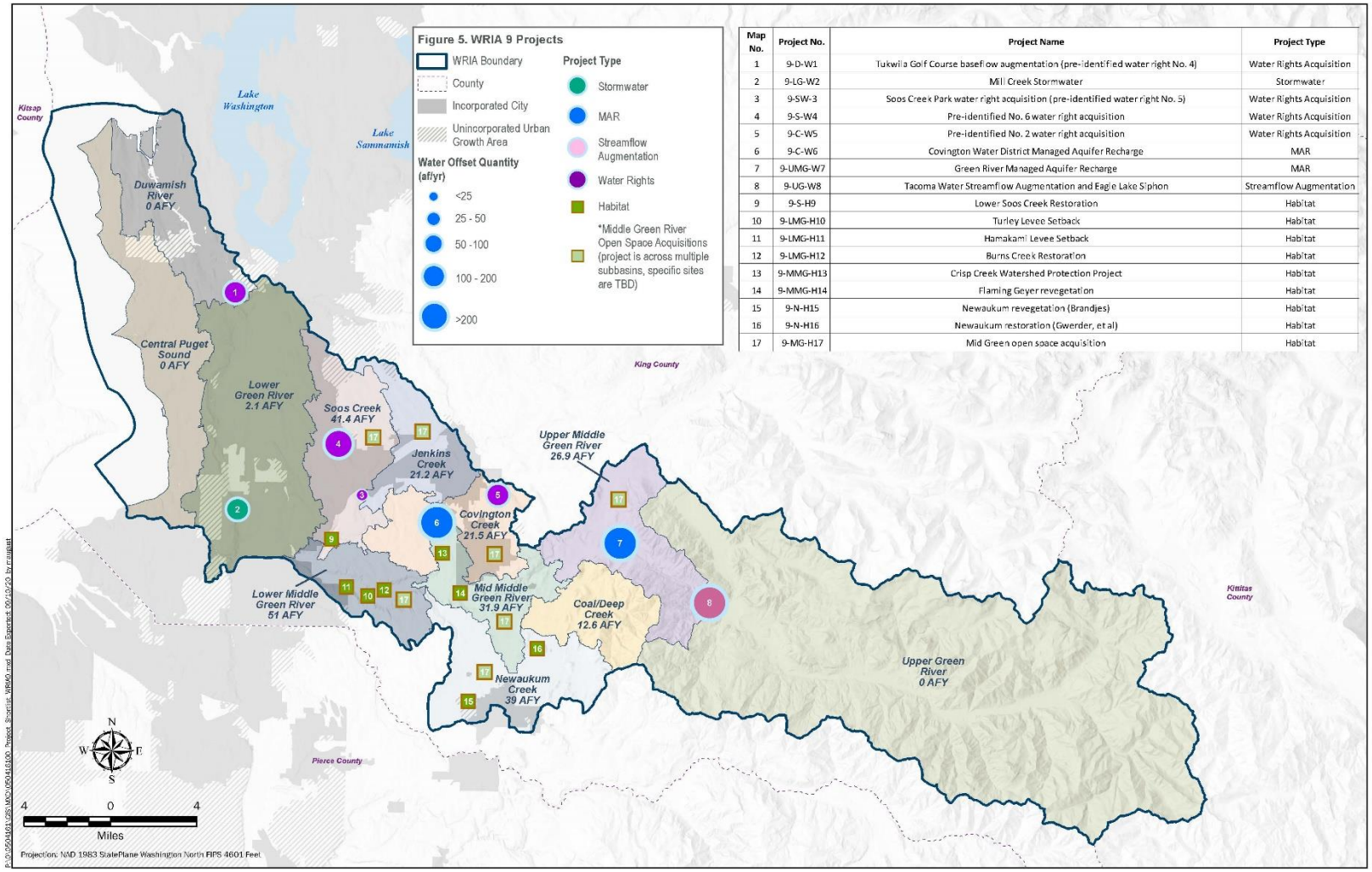

Map No.	Project No.	Project Name	Project Type
1	9-D-W1	Tukwila Golf Course baseflow augmentation (pre-identified water right No. 4)	Water Rights Acquisition
2	9-LG-W2	Mill Creek Stormwater	Stormwater
3	9-SW-3	Soos Creek Park water right acquisition (pre-identified water right No. 5)	Water Rights Acquisition
4	9-S-W4	Pre-identified No. 6 water right acquisition	Water Rights Acquisition
5	9-C-W5	Pre-identified No. 2 water right acquisition	Water Rights Acquisition
6	9-C-W6	Covington Water District Managed Aquifer Recharge	MAR
7	9-UMG-W7	Green River Managed Aquifer Recharge	MAR
8	9-UG-W8	Tacoma Water Streamflow Augmentation and Eagle Lake Siphon	Streamflow Augmentation
9	9-S-H9	Lower Soos Creek Restoration	Habitat
10	9-LMG-H10	Turley Levee Setback	Habitat
11	9-LMG-H11	Hamakami Levee Setback	Habitat
12	9-LMG-H12	Burns Creek Restoration	Habitat
13	9-MMG-H13	Crisp Creek Watershed Protection Project	Habitat
14	9-MMG-H14	Flaming Geyer revegetation	Habitat
15	9-N-H15	Newaukum revegetation (Brandjes)	Habitat
16	9-N-H16	Newaukum restoration (Gwerder, et al)	Habitat
17	9-MG-H17	Mid Green open space acquisition	Habitat

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2 Figure 5: WRIA 9 Projects

Duwamish River Subbasin

Project Name: Tukwila Golf Course Baseflow Augmentation (pre-identified water right No. 4) (9-D-W1)

Project Description: The Tukwila Golf Course Baseflow Augmentation project proposes to acquire one surface water claim and one surface water certificate in the Duwamish River subbasin for an estimated 96 AF annually of consumptively used water. The source for both the claim and certificate is the Duwamish River and the purpose of use for both is irrigation. The place of use associated with the water rights is a golf course.

The proposed project includes switching the source of irrigation water for the golf course to reclaimed water from the King County South Treatment Plant. Much of the basic infrastructure is already in place to connect the golf course to King County reclaimed water.

WWT utilized irrigation delineation analysis to estimate consumptive use of 96 AF per year. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Initial conversations have occurred between Ecology and the City of Tukwila regarding a transfer of this water right into the Trust Water Rights Program for permanent streamflow benefit. Additional information is included in the project description and water right project profile in Appendix H.

Lower Green River Subbasin

Project Name: Mill Creek Trib 51 Basin Retrofit (9-LG-W2)

Project Description: The Mill Creek Trib 51 Basin Retrofit project will help protect and restore water quality by reducing stormwater impacts from existing infrastructure and development within the basin. The Mill Creek Tributary 51 watershed is identified by Ecology's map of target watersheds for stormwater retrofit ("2015 Target Watersheds Stormwater Retrofit") as having an "integrity score" of 9-. This is the highest score possible and suggests that retrofit actions within the watershed will have a greater probability of contributing to the recovery and stability of a functioning aquatic ecosystem.

Performance goals and potential water offset volumes will be determined as specific project details are clarified. Infiltration retrofits or enhancements could be expected to redirect on the order of 10 to 100 acre-feet per year from surface runoff to groundwater, delaying contribution to streamflow.

Soos Creek Subbasin

Project Name: Soos Creek Park Water Right Acquisition (pre-identified water right No. 5) (9-S-W3)

Project Description: The Soos Creek Park Water Right Acquisition Project proposes to acquire one surface water certificate in the Soos Creek subbasin for an estimated 11 AF annually of consumptively used water. The source is an unnamed spring and the purpose of use is fish propagation and irrigation. This certificate refers to a surface water right that was temporarily donated (from 2020 to 2025) to the Trust Water Rights Program managed by Ecology. The place

of use associated with the water right was previously used as a park with ponds and irrigation. Current use appears to be park/open space without ponds or irrigation.

WWT utilized irrigation delineation analysis to estimate consumptive use of 11 AF per year. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Initial conversations have occurred between Ecology and King County regarding a transfer of this water right into the Trust Water Rights Program for permanent streamflow benefit. Additional information is included in the project profile in Appendix H.

Project Name: Pre-Identified Water Right No. 6 (9-S-W4)

Project Description: The Pre-Identified Water Right Project No. 6 proposes to acquire three groundwater certificates in the Soos Creek subbasin for an estimated 182 AF annually of consumptively used water. These certificates refer to groundwater rights associated with irrigation of a total of 120 acres. The place of use associated with the water right is a golf course. Water right documentation indicates that there are a total of four groundwater supply wells associated with these water right certificates.

WWT utilized irrigation delineation analysis to estimate consumptive use of 182 AF per year. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

WWT initiated outreach to this water right holder and, as of the time of this plan, did not receive a response. Additional information is included in the project profile in Appendix H.

Covington Creek Subbasin

Project Name: Pre-Identified Water Right No. 2 (9-C-W5)

Project Description: The Pre-Identified Water Right Project No. 2 proposes to acquire one surface water certificate in the Covington Creek subbasin for an estimated 54 AF annually of consumptively used water. The source is Ravensdale Lake and the purpose of use is industrial/processing of mineral products. The place of use associated with the water right is a former sand and gravel mining operation.

The water right holder considered donating this water right certificate to the Trust Water Rights Program three years ago but did not proceed. At that time, Ecology reviewed a beneficial use assessment conducted on behalf of the water right holder. Ecology confirmed the assessment, which specified an associated beneficial use of as much as 106 AF per year, with a consumptive portion of 54 AF per year.

Initial outreach was completed by the Washington Water Trust and the water right holder is open to further discussions. Additional information is included in the project profile in Appendix H.

Project Name: Covington Water District Managed Aquifer Recharge (9-C-W6)

Project Description: Covington Water District (CWD) is proposing the placement of a managed aquifer recharge (MAR) infiltration facility on their property in Covington, Washington. The

project concept includes diverting water annually from CWD's existing drinking water pipeline, which runs along the northern site boundary, between approximately November 1 and April 30 when water is available using existing water rights. Diverted water would be conveyed from CWD's existing pipeline and piped to a constructed MAR facility. This diverted water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to Covington Creek as re-timed groundwater baseflow. The goal of the project is to increase baseflow to Covington Creek, a tributary to Soos Creek and the Green River, by recharging the aquifer adjacent to the creek and providing additional groundwater discharge to the creek through MAR.

Initial calculations indicate the CWD MAR project could infiltrate approximately 357 AF annually. Additional information is included in the project description in Appendix H.

Upper Middle Green River Subbasin

Project Name: Green River Managed Aquifer Recharge (9-UMG-W7)

Project Description: The Green River MAR project concept includes diverting surface water annually from the Green River between approximately December 1 and May 15 when excess water is available. Diverted water would be conveyed through a collector well adjacent to the river (e.g. Ranney Collector well) or through an instream surface water intake and piped to a constructed MAR facility. This diverted surface water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges back to surface water as re-timed groundwater baseflow. The goal of the project is to increase baseflow to the Green River by recharging the aquifer adjacent to the river and providing additional groundwater discharge to the river through MAR.

Several potential sites were identified in WRIA 9, including the Tacoma Water Green River Filtration facility and Kanaskat-Palmer state park.

[Comment: The Committee is still discussing the water offset estimate to associate with the Green River MAR project. A range is included for now, from a low of 114 af/year for streamflow benefits from June through October, to a high of 327 af/year for year-round streamflow benefits.]

Initial calculations indicate the Green Water MAR project could infiltrate approximately 327 AF annually. The water offset estimate for the project is a range of 114 – 327 AF. Additional information is included in the project description in Appendix H.

Upper Green River Subbasin

Project Name: Tacoma Water Streamflow Augmentation and Eagle Lake Siphon (9-UG-W8)

Project Description: The Tacoma Water Streamflow Augmentation and Eagle Lake Siphon project would augment streamflow through the release of 2 cubic foot per second (cfs) of raw, untreated water for a period of 90 days (during the summer low-flow period) into the mainstem Green River using Tacoma Water's existing water rights. Tacoma Water envisions this could be done by requesting the Army Corps of Engineers release 2 cfs more water than what Tacoma Water withdraws as part of regular Howard Hanson Dam flow coordination. The

commitment to release an additional 2 cfs to the Green River would be contingent on Tacoma Water securing a water right for up to 1,000 acre-feet (AF) per year of dead storage out of Eagle Lake to use as needed.

This project is expected to improve streamflows in the Green River in summer when surface flows are generally lowest. The anticipated water offset is up to 357 AF per year. Additional information is included in the project description in Appendix H.

5.2.2 Habitat Projects

Table 8 provides a summary of nine habitat projects identified by the Committee to provide ecological benefits to WRIA 9. [Add additional sentence about the habitat project list and tiering, e.g.: "The habitat projects included in the plan are all Tier 1 projects because they are in priority subbasins, have project sponsors, and are expected to be implemented within the planning horizon."] More detailed habitat project descriptions are provided in Appendix H.

Although many of these projects have potential streamflow benefits, the Committee has elected not to quantify water offsets from habitat projects.

[COMMENT: **Project sponsors** – please review the information included for your projects and provide edits.]

1 Table 8: WRIA 9 Habitat Projects

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project Tier
9-S-H9	Lower Soos Creek Restoration	Stream, riparian, and wetland restoration on Lower Soos Creek, including wood placement.	Soos	Increase hydraulic diversity, restore native vegetation, restore water temperature, provide erosion abatement.	King County	$1.5 million	
9-LMG-H10	Turley Levee Setback	Acquire land, remove levee, and construct revetment away from river to create 40 acres of new floodplain habitat. Restoration includes installation of riparian plantings, large woody debris (LWD), and gravel substrate within river channel.	Lower Middle Green	Floodplain restoration, improve spawning and rearing habitat.	King County	$6 million	
9-LMG-H11	Hamakami Levee Setback	Acquire land, remove levee, and construct revetment away from river to create 35 acres of new floodplain habitat. Restoration includes installation of riparian plantings, LWD, and gravel substrate within river channel.	Lower Middle Green	Floodplain restoration, improve spawning and rearing habitat.	King County	$6 million	
9-LMG-H12	Burns Creek Restoration	Property acquisition, installation of LWD and riparian plantings. The estimated acreage of restored riparian zone: 28.	Lower Middle Green	Restoration of fish and wildlife habitat, wetlands, and water quality in an area which is very important for over-wintering salmon.	King County	$2 million	

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project Tier
9-MMG-H13	Crisp Creek Watershed Protection Project	Property acquisition of undeveloped forest lands to benefit the hydrologic integrity of the subbasin and protect the water supply and water rights for the Muckleshoot Indian Tribe's Keta Creek Hatchery.	Mid Middle Green	Protect hydrologic integrity of the basin.	Muckleshoot Indian Tribe		
9-MMG-H14	Flaming Geyer Revegetation	Restoration includes installation of riparian plantings, LWD and gravel substrate within river channel. The total project area proposed for restoration is approximately 42 acres.	Mid Middle Green	Increased shade will moderate water temperatures, reduce evaporation, and enhance fish habitat.	King County	$1.5 million	
9-N-H15	Newaukum Creek Revegetation through Riparian Revegetation and Beaver Colonization	Restoration along Newaukum Creek at three sites: Brandjes, Gaddy, and Gwerder. Removing structures and installation of riparian plantings. This project will plant native trees and shrubs across 61 acres of riparian zone/wetland habitat.	Newaukum	Maintain streamflows, moderate water temperature, reduce evaporation and create habitat.	King County		

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project Tier
9-N-H16	Newaukum Creek Tributary Restoration (Gwerder, et al)	Excavation and restoration of wetland and stream channels of Newaukum Creek. Includes installation of LWD and riparian vegetation. Total acreage proposed for riparian and wetland restoration is approximately 50 acres.	Newaukum	Maintain streamflows, moderate water temperature, reduce evaporation and create habitat.	King County		
9-MG-H17	Middle Green River Open Space Acquisitions	Property acquisitions to protect the hydrologic integrity of the basin. If acquired land was previously developed, structures would be removed including homes, septic systems, and wells.	Soos, Jenkins, Covington, Lower Middle Green, Mid Middle Green, Upper Middle Green, Newaukum	Protect hydrologic integrity of the basin.	King County		

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5.2.3 Prospective Projects and Actions

In addition to the projects described in this chapter, the WRIA 9 Committee supports projects and actions that achieve the following goals:

- Acquisitions of water rights to increase streamflows and offset the impacts of PE wells. Water rights should be permanently and legally held by Ecology in the Trust Water Rights Program to ensure that the benefits to instream resources are permanent.

  The WRIA 9 Committee acknowledges that all water rights transactions rely on willing sellers and willing buyers. The WRIA 9 Committee recognizes the importance of water availability for farmers and the limited available water supply within the Agricultural Production Districts. The WRIA 9 Committee supports the acquisition of irrigation water rights within designated Agricultural Production Districts if the properties underlying the water rights have access to an alternative water source, such as reclaimed water, that can be reliably supplied to the properties at a rate that is comparable to the cost of current irrigation management.

- Projects or programs that support connections to public water systems. Projects could provide financial incentives for homes using PE wells to connect to public water service and decommission the well; and/or provide financial support for water purveyors to extend water distribution systems further into their individual service areas, particularly where PE wells are concentrated or rapid rural growth is anticipated.

- Projects or programs that provide outreach and incentives to rural landowners with wells in order to lower indoor and outdoor water use through water conservation best practices, and comply with drought and other water use restrictions. Programs would encourage the following types of water conservation strategies and best practices: natural lawn care; irrigation efficiency; rainwater catchment and storage; drought resistant and native landscaping; smaller lawn sizes; forest, meadow and wetland conservation; indoor water conservation; and voluntary metering. Conservation and water use efficiency projects that involve water rights should permanently convey the saved water to Ecology to be held in the Trust Water Rights Program for instream flow purposes.

- Projects that beneficially switch the source of withdrawal from surface to groundwater, or other beneficial source exchanges such as a source switch to reclaimed water. The benefits of a source exchange project may depend on the connection between the sources, benefits to instream resources (e.g., a surface to groundwater source switch may have negative impacts on fish if the groundwater baseflow provides refuge areas in streams with high water temperature issues), and should take into consideration the possible consequences of unsustainable withdrawals from the affected aquifer.

- Projects that provide streamflow and habitat benefits by returning stream habitat to a more natural state, such as through levee setback or removal, river-floodplain restoration, and instream habitat restoration.

- Projects that contribute to offsetting consumptive use in the following subbasins with higher projected PE wells and consumptive use: Soos, Jenkins, Covington, Lower Middle Green, Mid Middle Green, Upper Middle Green, and Newaukum

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 Committee estimated 247.7 acre-feet per year of consumptive use from new PE wells over the planning horizon. [Note: Include the following if the Committee agrees to include a safety factor] The Committee developed an offset target of [XX] acre-feet per year to address uncertainty in the consumptive use estimate and ensure that projects and actions in the plan would offset consumptive use. The projects included in Table 7 provide an estimated offset of XX acre-feet per year and exceed the offset target.

A total of nine habitat projects have been identified by the Committee and are included in Table 8. Ecological benefits associated with these projects are myriad and 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.

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

[COMMENT: Ecology and the technical consultants are working to develop cost estimates for water offset projects based on information from applications for streamflow restoration grant funding, as well as other available project cost information.]

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, the Committee developed planning-level cost estimates for each of the water offset projects listed in Table 7. The Committee also included costs estimates for habitat projects in Table 8, when that information was readily available.

The estimated cost for implementing individual water offset projects range from XXX for YYY project to AAA for BBB project. The total estimated cost for implementing the water offset projects listed and described in this chapter is $XXXX.

The estimated cost for implementing individual habitat projects range from XXX for YYY project to AAA for BBB project. The total estimated cost for implementing the habitat projects listed and described in this chapter is $XXX.

5.3.3 Certainty of Implementation

[COMMENT: This section is still being developed. Please provide comments on what you would like to include in this section.]

The WRIA 9 Committee used a tiering process to identify the projects that are more likely to be implemented in the short term. Tier 1 projects are more likely to be implemented and provide benefits in the near-term. Tier 2 projects are in lower priority subbasins, or are expected take longer to implement, because they may still be conceptual or may need additional outreach to key stakeholders.

The WRIA 9 Committee also developed adaptive management recommendations to increase reasonable assurance that the projects and actions in the plan will be implemented.

Chapter Six: Adaptive Management and Implementation Recommendations

6.1 Plan Implementation and Adaptive Management Recommendations

The WRIA 9 Committee recommends an adaptive management process for implementation of the WRIA 9 watershed plan. Adaptive management is defined in the Final NEB Guidance as "*an interactive and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions*."

Adaptive management is intended to help address uncertainty, provide more reasonable assurance for plan implementation, and to ensure that 1) water use from new permit exempt (PE) wells is adequately offset, as required by RCW 90.94.030, and 2) implementation of the watershed plan produces a net ecological benefit to the watershed, as required by RCW 90.94.030. The periodic review in this adaptive management process will provide a verifiable process for plan monitoring and ensure transparency in plan implementation.

Existing Challenges

The WRIA 9 Committee identified the following challenges in the planning process and seeks to address these challenges through monitoring and adaptive management:

- The watershed plan includes projected, not actual, PE well water use by subbasin. Monitoring the number of new PE wells, actual PE well water use, and associated consumptive water use would provide data for comparison and adjustments, as needed, in planning for ongoing offsets to ensure the mandates of RCW 90.94 are being met.

- The watershed plan includes water offset and habitat projects, and estimated benefits associated with each, by subbasin. Measuring and tracking actual water offsets by subbasin, to the extent possible, can be used to verify intended streamflow 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 allow Ecology to update the water use estimates included in the plan and make updates when appropriate.

- Our global climate is changing. While the effects of climate change over the 20-year life of this plan cannot be precisely known, shifts in climatic conditions will influence the hydrologic regime in the watershed and will impact instream flows. Rainfall, snowmelt, and evapotranspiration have been identified as the primary natural mechanisms driving changes in groundwater storage. These mechanisms will be affected by a changing

climate. Air and water temperatures will increase and summer streamflows will be reduced. Groundwater pumping and indirect effects of irrigation and land use changes will impact groundwater resources and the availability for future water supply and instream flows. The Committee recognizes that a successful plan must acknowledge that climate is changing and include recommendations to ensure that the statutory requirements to offset water withdrawals by new PE wells and provide a net ecological benefit will be met under future climatic conditions. Monitoring actual water use and the amount of offset water actually generated will inform this determination.

- Projects identified in the plan are expected to increase groundwater storage, augment streamflows, and provide aquatic habitat benefits. Water offset projects should be monitored in order to ensure that they continue to function as designed, and generate instream water to offset new PE wells, under a changing climate. Habitat projects should be analyzed for their resilience to changing conditions. [Include the following sentences, if the Committee agrees to include a safety factor: "The WRIA 9 Committee chose to apply an overall safety factor to address these concerns, particularly as related to the estimate of the amount of consumptive water use to be offset. However, the safety factor does not address the possibility that a project might fail to meaningfully function under changed conditions."] The adaptive management recommendations in this plan will help to monitor and assess the validity of the projections identified, to determine whether projects are functioning as designed even under climate change conditions, and to allow for course corrections where needed.

To address the above challenges, the WRIA 9 Committee recommends the following adaptive management strategies.

6.1.1 Tracking and Monitoring

The WRIA 9 Committee recommends that the Washington Department of Ecology (Ecology) monitor watershed plan implementation, in consultation with the Washington Department of Fish and Wildlife (WDFW), and King County. Specifically, the Committee recommends that Ecology, in consultation with WDFW and King County, review actions resulting from watershed plans to ensure the mandates of RCW 90.94 are being met, including;

- Track annual new permit-exempt wells by subbasin;
- Track project implementation and the actual amount of offset water generated, or reasonably certain to be generated, by subbasin; and
- Develop a process to adaptively manage implementation if Net Ecological Benefit is not being met as envisioned by the watershed plan.

Tracking streamflow restoration projects and new domestic permit-exempt 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, and
- provide a template for adaptively managing emergent restoration needs.

The WRIA 9 Committee recommends WDFW, in collaboration with Ecology and the Recreation and Conservation Office (RCO), pilot the Salmon Recovery Portal (https://srp.rco.wa.gov/about), managed by RCO, for tracking streamflow restoration projects and new domestic permit-exempt wells. To improve harmonization of streamflow restoration with ongoing salmon recovery efforts, local salmon recovery Lead Entity Coordinators shall be consulted prior to entering streamflow restoration projects into the portal. University of Washington data stewards will be employed to conduct data entry, quality assurance, and quality control.

Using the Salmon Recovery Portal to track streamflow restoration projects and new domestic permit-exempt wells will:

- Provide a centralized database that includes project status and costs, sources of funding, and project sponsors.
- Facilitate project reporting and public outreach.
- Encourage collaboration and coordination between projects by geographic area.

Table 9 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 9: Implementation of Tracking and Monitoring Recommendation

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

6.1.2 Oversight and Adaptation

The WRIA 9 Committee recommends Ecology complete a watershed plan implementation report (report) approximately every five (5) years (in 2027, 2032, 2037, and 2042), detailing the successes, challenges, and gaps related to implementation of the watershed plan. The report

should include information on whether the watershed plan is on track to achieve the expected net ecological benefit and water offsets as well as streamflow conditions, including identifying subbasins with known impacts that have not yet implemented water offset or habitat projects. In addition, the report should include an estimate of the anticipated costs required to implement water offset projects in subbasins with an offset deficit (subbasins with more consumptive use impacts than offsets). The report should also include information on any discretionary programs that were implemented, including for example, water conservation education and outreach, incentives for public water service connections, and voluntary PE well metering.

Ecology's report should include recommendations to adjust the projects and actions if the adopted goals of the watershed plans are not on track to being met in the plan's 20-year timeframe. A notice of action to adjust the plan should be sent to members of the WRIA 9 Committee to comment. However, members of the WRIA 9 Committee are not expected to reconvene after approving the plan. Final adjustments and amendments shall be at the sole determination of Ecology after public input.

The report should be sent to all members of the WRIA 9 Committee, King County Council, 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 permit-exempt water use.

Table 10 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 10: Implementation of Oversight and Adaptation Recommendation

Action	**Entity or Entities Responsible**	**Funding Considerations**
Develop and distribute Watershed plan implementation report, including any recommended adjustments to projects and actions	Ecology	Ecology may need additional funding to support development of the report.
Revise Streamflow Restoration Grant Guidance to prioritize projects in watersheds that have not offset permit-exempt water use	Ecology	No additional funding is needed.

6.1.3 Funding

The WRIA 9 Committee recommends funding plan implementation and adaptive management from a variety of sources including the Washington State Legislature, Salmon Recovery, cities, counties, and grants. Funding and staffing at local, county and state levels is likely to see continued shortfalls due to COVID-19 related impacts over the next several years. The Committee urges a collaborative approach to fund Ecology and WDFW to ensure plan implementation and monitoring, streamflow health, water offsets, net ecological benefit, and full compliance with the mandates found in RCW 90.94.

6.2 Policy and Regulatory Recommendations

The Streamflow Restoration law lists optional elements committees may consider including in the plan to manage water resources for the WRIA or a portion of the WRIA (RCW 90.94.030(3)(f)). The WRIA 9 Committee initially identified potential policy and regulatory recommendations to include in the plan. After iterative rounds of discussion, the Committee did not have full support for including policy and regulatory recommendations in the plan.

Chapter Seven: Net Ecological Benefit

[COMMENT: The committee is still discussing whether to include the optional Net Ecological Benefit evaluation and NEB statement in the watershed plan. An outline of the NEB Chapter is provided for the committee's review.]

7.1 Water Offsets

- Compare the total WRIA offset to the total WRIA consumptive use estimate
- Compare the total WRIA offset to the safety factor/offset target if applicable.
- Determine if the watershed plan has succeeded in offsetting the impacts at the WRIA level.
- Compare the offset to the consumptive use estimate by subbasin.
- State how these projects provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA boundary.
- State how adaptive management provides additional certainty, if applicable.

Table 11: Summary of WRIA 9 Water Offset Projects

Project Number	Project Name	Project Short Description (one sentence)	Subbasin	Estimated Water Offset Benefits (AF/YR)	Project Included in Offset Calculations/NEB Analysis
1	Project A		A	50	No
2	Project B		A	160	Yes
3	Project C		B	150	Yes

[NOTE: Some projects that are in the plan may be very general and the Committee can decide not to count them toward net ecological benefit, e.g. a project to encourage PE well users to connect to water service]

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

Subbasin	Offset Project Totals (AF/YR)	Permit-Exempt Well Consumptive Use (AF/YR)	Difference (AF/YR)
A	210	170	**40**
B	150	152	**-2**

Subbasin	Offset Project Totals (AF/YR)	Permit-Exempt Well Consumptive Use (AF/YR)	Difference (AF/YR)
C	0	50	**-50**
D	165	97	**68**
All	140		**140**
TOTAL	**665**	**469**	**196**

7.2 Habitat Benefits

- Summarize types of projects and anticipated benefits and limiting factors addressed.
- Summarize the distribution of projects among the subbasins and the streams that will benefit.
- State how these projects provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA boundary.

Table 13: Summary of WRIA 9 Habitat Improvement Projects

Project Number	Project Name	Project Short Description (one sentence)	Subbasin	River Miles Benefitted	Other Benefits with Quantifiable Metric (e.g. structures per mile)	Limiting Factor(s) Addressed	Project Included in NEB Analysis
1			A				
7			B				
8			C				
9			C				
10			D				

7.3 Adaptive Management and Policy Recommendations

If applicable, reference Chapter 6 and how that increases certainty of achieving NEB.

7.4 NEB Evaluation Findings

Include a clear statement of the Committee's finding that the combined components of the watershed plan do or do not achieve a NEB. For example: "The WRIA X Committee finds that this watershed plan achieves a net ecological benefit, as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019)."

Appendix

WRIA 9 Duwamish-Green Watershed

Draft Plan
September 2020

Appendix A – References

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Appendix B – Glossary

Table 14: Acronyms and Definitions

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

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

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

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

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

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

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

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

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

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

Foster Pilots and Foster Task Force: To address the impacts of the 2015 Foster decision, Chapter 90.94 RCW established a Task Force on Water Resource Mitigation and authorized the Department of Ecology to issue permit decisions for up to five water mitigation pilot projects. These pilot projects will address issues such as the treatment of surface water and groundwater appropriations and include management strategies to monitor how these appropriations affect instream flows and fish habitats. The joint legislative Task Force will (1) review the treatment of

surface water and groundwater appropriations as they relate to instream flows and fish habitat, (2) develop and recommend a mitigation sequencing process and scoring system to address such appropriations, and (3) review the Washington Supreme Court decision in Foster v. Department of Ecology. The Task Force is responsible for overseeing the five pilot projects. (ECY)

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

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

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

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

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

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

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

Impact: For the purpose of streamflow restoration planning, impact is the same as new consumptive water use (see definition below). As provided in Ecology WR POL 2094 "Though the statute requires the offset of 'consumptive impacts to instream flows associated with permit-exempt domestic water use' (RCW 90.94.020(4)(b)) and 90.94.030(3)(b)), watershed

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

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

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

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

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

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

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

purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or other natural or manmade factors affecting its survival. (USFWS)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

RCW 90.54 (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 "surfboard", 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)

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

Table 15: WRIA 9 Committee Roster

WRIA 9 (as of 11/1/19) Entity Representing	**Primary Representative**	**First Alternate**
City of Auburn	Lisa Tobin	Jeff Tate
City of Black Diamond (cities caucus)	Barb Kincaid	Mayor Benson
City of Enumclaw	Scott Woodbury	Chris Searcy
City of Kent	Evan Swanson	Shawn Gilbertson
City of Normandy Park (cities caucus)	Mark Hoppen	
City of Seattle	Kathy Minsch	Susan Saffery
City of Tukwila (cities caucus)	Mike Perfetti	Ryan Larson
King County	Josh Kahan	Joan Lee
Muckleshoot Indian Tribe	Henry Martin	Carla Carlson
Covington Water District	Tom Keown	Steve Lee
Washington Department of Fish and Wildlife	Stewart Reinbold	Larry Fisher
Master Builders Association of King and Snohomish Counties	Jennifer Anderson	Gina Clark
King County Agriculture Program	Rick Reinlasoder	Melissa Borsting
Center for Environmental Law and Policy	Trish Rolfe	Dan Von Seggern
Washington State Department of Ecology	Stephanie Potts	Stacy Vynne McKinstry
WRIA 9 Watershed Ecosystem Forum, ex officio	Matt Goehring (cities caucus rep)	Doug Osterman
Tacoma Water, ex officio	Greg Volkhardt	Tyler Patterson

Appendix D – Operating Principles

The approved and signed operating principles can be found online:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA09/WRIA9_approved_signed_operating_principles.pdf

Appendix E – Subbasin Delineation Memo

The Subbasin Delineation Memo can be found online:

https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA09/PLAN/WRIA%209-WREC-SubbasinDelineationMemo_Final-20200820.pdf

Appendix F – Draft Growth Projections Memo

The Draft Growth Projections Technical Memo can be found online:

https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA09/202002/WRIA9-WREC-GrowthProjectionsMemo-FinalDraft-20200221.pdf

Appendix G – Draft Consumptive Use Memo

The Draft Consumptive Use Technical Memo can be found online:

https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA09/202002/WRIA9-WREC-ConsumptiveUseEstimatesMemo-FinalDraft-020200221.pdf

Appendix H – Projects

Tukwila Golf Course Baseflow Augmentation (9-D-W1)

WRIA 9 - DRAFT Project Description

September 8, 2020

Project Name

Tukwila Golf Course Baseflow Augmentation

WRIA 9 WRE Subbasin

Duwamish River

Water Offset

96 acre-feet/year

Project Status

This project is in the conceptual development stage. The WRIA 9 WREC is generally in support of this project but ranks it lower in priority over water right acquisition and other non-acquisition water offset projects higher in the basin due to its location low in the watershed and within a tidally influenced portion of the Duwamish River.

Narrative Description

Foster Golf Links is an 18-hole 77-acre golf course with 1.1 miles of left bank river frontage and 0.5 miles of right bank river frontage within the City of Tukwila, Washington (herein designated the City). The project is located within the Duwamish River subbasin.

The City holds a water right that authorizes the diversion of water from the Duwamish River for the purpose of golf course irrigation. Washington Water Trust estimates a consumptive use of 96 AF/yr based on turfed acreage and standard assumptions for turf irrigation requirement and irrigation efficiency (Hatch et al. 2020). The proposed project would include permanently transferring the existing water right into the Trust Water Rights Program for streamflow augmentation and switching the source of irrigation water for the golf course to reclaimed water from the King County South Treatment Plant. Much of the basic infrastructure is already in place to connect the golf course to King County reclaimed water.

This project is expected to improve baseflows in the Duwamish River, particularly during the summer when golf course irrigation demand is at its highest, and natural river flows are at their lowest. This could be particularly beneficial to later out-migrating juvenile Chinook as well as yearling Coho, Steelhead, Bull Trout and resident trout.

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

The City's water right portfolio for Foster Golf Links (Washington State Department of Ecology, 1974 and 1982) consists of the following:

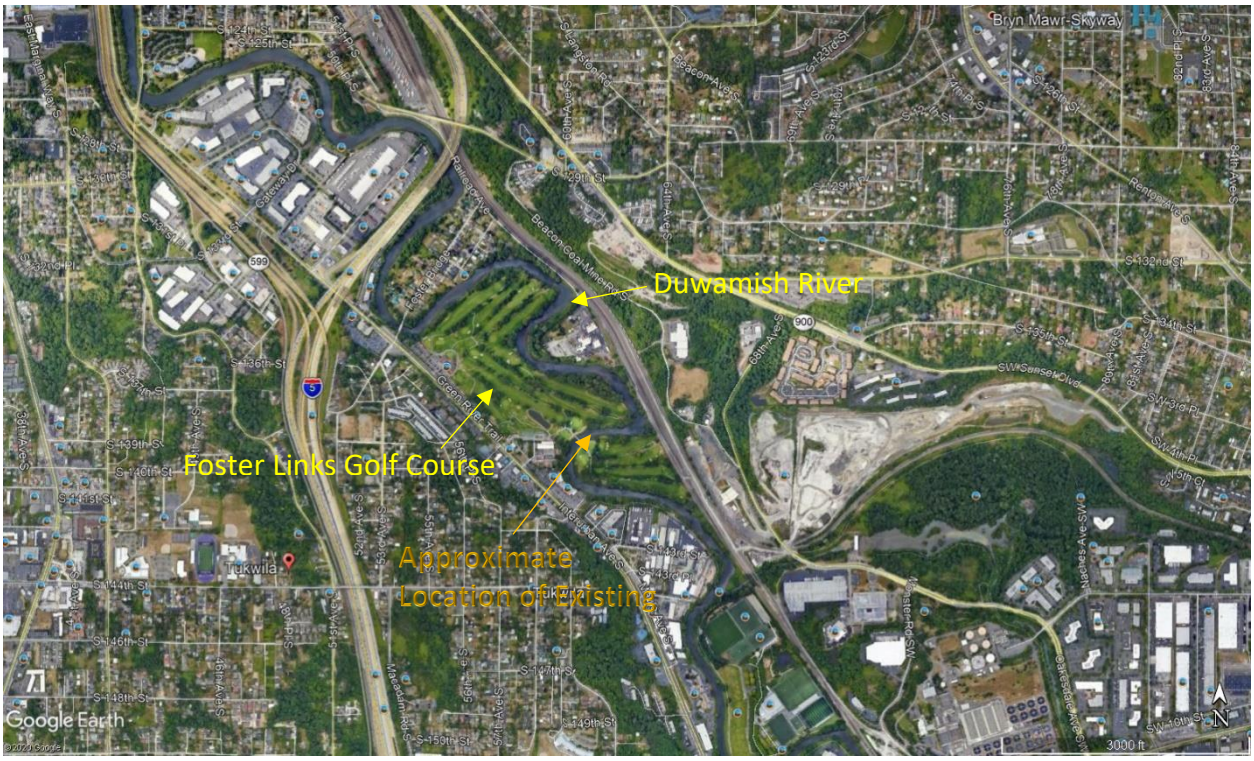
- Claim S1-060591CL – This water right claims a withdrawal from the Duwamish River of an instantaneous quantity (Qi) of 300 gallons per minute (gpm) or 0.668 cubic feet per second (cfs). This claim also specifies an annual quantity (Qa) of 350 AF/yr.
-
- Certificate S1-23433C – This certificate authorizes withdrawal from the Green River and specifies a Qi of 1.78 cfs and a Qa of 104 AF/yr.

Conceptually, the project will include permanently placing the existing irrigation water right in trust for streamflow augmentation purposes and switching the source of irrigation water to King County reclaimed water. Based on consumptive use estimates provided by Washington Water Trust, the consumptive use associated with golf course irrigation is approximately 96 AF/yr.[17]

The water right is not subject to the minimum flow requirements of Chapter 173-509 of the Washington Administrative Code (WAC) because the diversion is located within the tidally influenced estuary of the Duwamish River.

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

Foster Golf Links is located at 13500 Interurban Avenue South in Tukwila, Washington. The property consists of two parcels identified as King County Tax Parcel Numbers 0003000049 and 3779200255. The project site is shown in relation to surrounding physical features on the below conceptual-level map.



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

Description of the anticipated spatial distribution of likely benefits.

The spatial distribution of streamflow benefits is anticipated to consist of the Duwamish River downstream of the existing diversion location.

Location relative to future PE well demand

There is no forecast consumptive use for the WRIA 9 delineated Duwamish River subbasin (GeoEngineers 2020).

Performance goals and measures.

The performance goals are to increase streamflow within the Duwamish River by terminating the diversion of Duwamish River flow for irrigation of Foster Golf Links. Performance can be directly measured by the reduction in diversion rate and volume.

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

The Duwamish River is inhabited by sockeye, fall chinook, Coho, chum, pink, bull trout, coastal cutthroat trout, and winter and summer steelhead trout (WDFW 2020a and 2020b).

Identification of anticipated support and barriers to completion.

This project is believed to be in alignment with the goals of the Streamflow Restoration law (Ecology, 2019). Source switch projects and water right acquisitions are identified project types that could address the new consumptive water use and achievement of Net Ecological Benefit (NEB).

King County reclaimed water supply will need to remain consistently available when needed for irrigation.

Barriers to completion could include the following:

- Public/user perception of reclaimed water.
- Annual rate costs for reclaimed water.
- Legal and other concerns regarding the City of Tukwila switching from surface water to reclaimed water and transferring the water right to permanent trust.
- Unknown effects of reclaimed water on irrigation equipment and water.

Potential budget and O&M costs.

The primary costs associated with this source switch are: (1) the costs associated with extending reclaimed water conveyance to Foster Golf Links and; (2) the purchase of reclaimed water from King County.

Reclaimed water infrastructure already extends to the golf course property.

Purchase of reclaimed water from King County would be ongoing and dependent on the negotiated rate. Assuming a rate of $0.26 per hundred cubic feet, which was the average reclaimed water rate in Florida in 2005 (King County Department of Natural Resources and Parks, 2008), the potential annual cost for usage of 30 million gallons would be approximately $10,400.

The water rights owned by the City that could be released as a component of this project have value. For context, WestWater Research (2019) tabulated 11 water right sales in the State of Washington during the period from 2010 to 2017. The unit price per AF/yr ranged from $1,500 to $6,505. For the City's water right portfolio[18], this equates to the following:

- For Claim S1-060591CL and its Qa of 350 AF/yr, the corresponding value would be in the range of $525,000 to $2,276,750.
- For Certificate S1-23433C and its Qa of 104 AF/yr, the corresponding value would be in the range of $156,000 to $676,520.

Anticipated durability and resiliency.

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

- The new water source would be reliable and not subject to interruption.
- The conveyance would be precisely maintained through engineering controls and conveyed with minimal loss to the end user.
- Seasonal streamflow variation and/or groundwater table fluctuation would have negligible impact on project function.
- Land use changes would have negligible impact on project function.
-

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

- The new source will not be impacted by drought or other climatic conditions.
- The project conveyance can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage likely would not impact project function and the anticipated water offset.
- Sea level increase would not impact project function.

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

The identified project sponsor is the City of Tukwila. The sponsor contact is Mike Perfetti, Habitat Project Manager. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, and assumptions.

GeoEngineers, Inc. and NHC. 2020. WRIA 9 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. February 21, 2020.

[18] An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Hatch, J.M., McCormick, J., and K. Gaut. 2020. WRIA 9 Green-Duwamish Priority Water Right Projects Report. Prepared for WRIA 9 Water Resources Enhancement Committee. July 17.

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

Washington State Department of Ecology. 1974. State of Washington Department of Ecology Water Right Claim. Claim Number S1-060591CL. January 31.

Washington State Department of Ecology. 1982. State of Washington Department of Ecology Certificate of Water Right. Certificate Number S1-23433C. August 16.

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

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

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

WestWater Research. 2019. Valuation of a proposed water release agreement. Final report prepared by WestWater Research, Boise, Idaho for the Washington Department of Ecology and Seattle City Light. January 26.

Mill Creek Trib 51 Basin Retrofit (9-LG-W2)

WRIA 9 - DRAFT Project Description

June 29, 2020

Project Status:

King County is conducting a retrofit planning project in the Mill Creek Tributary 51 drainage basin west of Auburn. The project will identify potential stormwater retrofit sites and select one concept to advance to 90% design.

Project Name

Mill Creek Tributary 51 Stormwater Retrofit

Narrative Description

This project will help protect and restore water quality by reducing stormwater impacts from existing infrastructure and development within the basin. The Mill Creek Tributary 51 watershed is identified by Ecology's map of target watersheds for stormwater retrofit ("2015 Target Watersheds Stormwater Retrofit") as having an "integrity score" of 9-. This is the highest score possible and suggests that retrofit actions within the watershed will have a greater probability of contributing to the recovery and stability of a functioning aquatic ecosystem

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

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

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

Add map of watershed.

Description of the anticipated spatial distribution of likely benefits.

Primary benefits expected for Mill Creek Tributary 51. Benefits may carry down to Mill Creek.

Performance goals and measures.

To be determined.

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

Coho, chum, and winter steelhead have been observed spawning in Mill Creek. Juvenile Coho, chum, winter steelhead, cutthroat, and Chinook have been captured in the creek (Kerwin and Nelson, 2000). The Lower Green River Baseline Habitat Survey Report (Anchor Environmental, 2004) provides detailed information about fisheries habitat conditions in the Mill Creek area.

Identification of anticipated support and barriers to completion.

To be determined.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

To be determined.

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

King County is the likely project sponsor. Project has not yet been identified and would not be implemented until 2022 at the earliest.

Documentation of sources, methods, and assumptions.

To be determined.

Pre-Identified No. 5 (9-S-W3)

WRIA 9 Project Opportunity Profile

Project Summary

FLOW BENEFIT: Additional 0.10 cfs in 2.1 miles in Big Soos Creek and 30 miles in Green River.

PRIORITY SUBBASIN: Soos Creek Subbasin

ESTIMATED OFFSET: 11 afy consumptive

SUBBASIN CONSUMPTIVE USE ESTIMATE: 41.4-60 afy consumptive in Big Soos Creek

PRIORITY DATE(S): 04/24/1959

WRIA 9 INSTREAM FLOW RULE (1980): There is a surface water closure on all tributaries to the Green River.[19]

ESA LISTED FISH: Puget Sound Chinook Salmon (Threatened) and Puget Sound Steelhead (Threatened) and Bull Trout (Threatened)

OUTREACH STATUS: Interested

Project Description

The Pre-Identified No. 5 water right was included in the WRIA 9 water rights analysis at Ecology's request and WREC review. The land underlying the water right was formerly used as a park with ponds and irrigation, while currently appears to continue to be used as a park/open space without ponds and irrigation. The property is located approximately 5.5 miles southeast of Kent, WA. There is one surface water right associated with this project that was temporarily donated from 2020 to 2025 to the Trust Water Rights Program (TWRP) managed by Ecology.

Watershed

Big Soos Creek is part of the Soos Creek subbasin. Big Soos Creek flows into Lower Middle Green River at approximately RM 30. Big Soos Creek is closed to future surface water appropriations but does not have an instream flow established in Chapter 173-509 WAC.

[19] WAC 173-509-040

Land Use & Ownership

According to the King County Assessor, the current land use is Vacant Single Family. The property is zoned Rural Area 5, one dwelling unit per 5 acres. The land underlying Pre-Identified No. 5 includes one parcel under public ownership for the period of King County online parcel data record, while a second parcel has been under public ownership since 2015. There is only one landowner and water right holder that manages two adjacent parcels, totaling approximately 64 acres. A review of the WSDA 2019 Agricultural Land Use map, identifies commercial tree as the crop type on the properties. This assessment does reflect the prior use of the park as a commercial Christmas tree farm until converted to the current use as public park in 2015. Yet, the land use is currently a park. Irrigation delineation estimates as much as 0.9 irrigated acres in 2013 and 2019, Table 14. It is possible that the irrigated areas were covered by tree canopy, the difference of estimated irrigated acres between years analyzed maybe explained as the result of the timing of the aerial photograph, specific water use practices or from sufficient causes for non-use (RCW 90.14.140), which would be best understood through direct conversation with the water user.

Table 16: Delineated irrigation in each year (2013, 2015, 2017, 2019)

Year	Total Irrigated Acres (Med/High Confidence)
2013	0.9
2015	0
2017	0
2019	0.9

Water Right

Table 17: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Certificate	20 afy	0.10 cfs	4/24/1959	Fish Propagation and Irrigation	10	Unnamed Springs

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

Water Right History:

The original certificate was issued for fish propagation and irrigation from unnamed surface water springs feeding nearby Big Soos Creek. This water right has a priority date of 4/24/1959, listed purpose of use of irrigation with a Qi of 0.10 cfs and 20 acre-feet per year as the Qa. In 2020, the water right holder donated the entire the water right, accepted by Ecology, into the TWRP through 2025.

Metering Records:

Metering records are not available in the Ecology Water Resources Explorer database or in the water right record. Instead, a detailed beneficial use assessment was found in the file record.

Conclusion

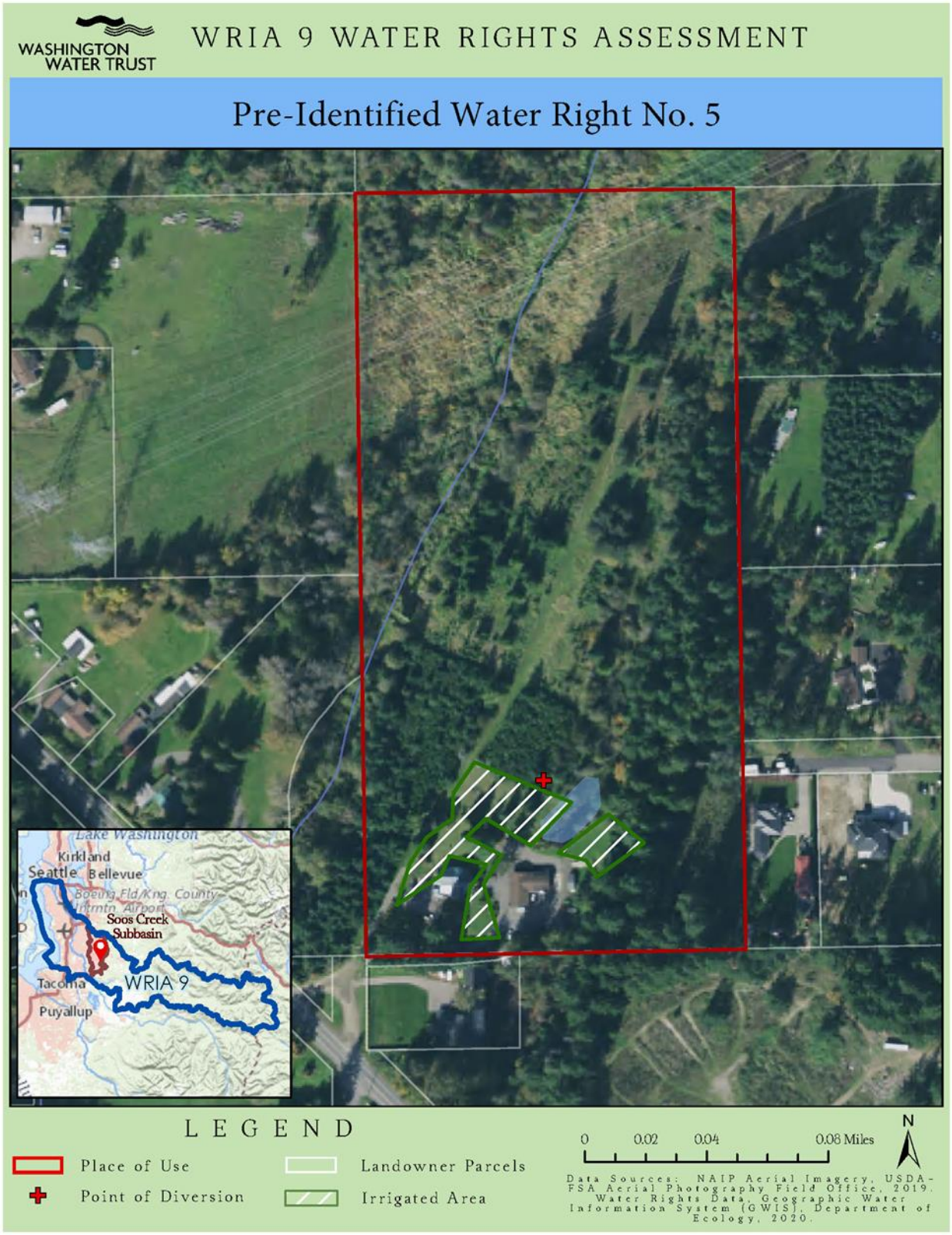
This project was identified by Ecology and the WREC as a potential acquisition opportunity. The current land use is Vacant Single Family. Four years of irrigation delineations were undertaken (2013, 2015, 2017, 2019) which estimate as much as 0.9 irrigated acres on these parcels; however, according to the file record it appears that this water right is subject to a Chapter 90.14 RCW nonuse exemption and actual historic irrigation was in the 7-10 acre range. An estimate of crop consumption was developed based on the Washington Irrigation Guide, Appendix A, Kent, WA station using pasture/turf crop irrigation requirement as the surrogate baseline crop (17.06 inches/acre) using an assumed sprinkler irrigation application efficiency of 75%, a consumptive application factor of 10%, resulting in a total consumptive use of 85%.

- Based on an irrigation assumption of 7 acres and assuming turf and sprinkler irrigation application, 11 afy consumptive is the estimated quantity[20]
- Based on an irrigation assumption of 10 acres and assuming turf and sprinkler irrigation application, 16 afy consumptive is the estimated quantity.

The Pre-Identified No. 5 water right priority date of 4/24/1959, is senior to the establishment of the Green-Duwamish River Basin Instream Resources Protection Program in 1980, but junior to the administrative closure of all tributaries of Green River dated 08/19/1953.

[20] This is only an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition. If the prior use was commercial tree farm, the anticipated consumptive use is likely lower than this estimate.

1 Figure 6: Project Map

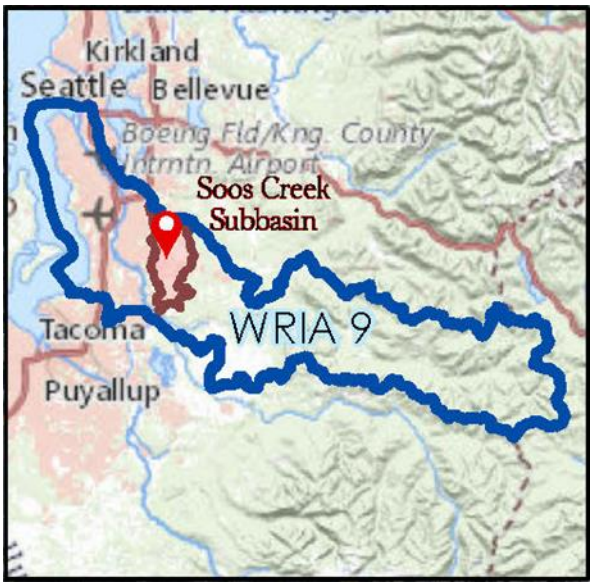


2

Pre-Identified No. 6 (9-S-W4)

WRIA 9 Project Opportunity Profile

Project Summary



FLOW BENEFIT: Additional 1.147 cfs in 7.5 miles in Big Soos Creek and 30 miles in Green River.[21]

PRIORITY SUBBASIN: Soos Creek Subbasin

ESTIMATED OFFSET: 182 afy consumptive

SUBBASIN CONSUMPTIVE USE ESTIMATE: 41.4-60 afy consumptive in Big Soos Creek

PRIORITY DATE(S): 8/09/1965, 7/17/1967 and 7/01/1974

WRIA 9 INSTREAM FLOW RULE (1980): There is a surface water closure on all tributaries to the Green River.[22]

ESA LISTED FISH: Puget Sound Chinook Salmon (Threatened) and Puget Sound Steelhead (Threatened) and Bull Trout (Threatened)

OUTREACH STATUS: Initial

Project Description

The Pre-Identified No. 6 water right was included in the WRIA 9 water rights analysis at Ecology request to review golf courses and tree farms utilizing water rights within the urban growth areas of priority subbasin. The land underlying the water right, is currently a golf course and community. The property is located approximately 3.5 miles east of Kent, WA. There are three ground water rights associated with this project.

Watershed

Big Soos Creek is part of the Soos Creek subbasin. Big Soos Creek flows into Lower Middle Green River at approximately RM 30. Big Soos Creek is closed to future surface water appropriations but does not have an instream flow established in Chapter 173-509 WAC.

[21] Dependent on hydraulic continuity.
[22] WAC 173-509-040

Land Use & Ownership

According to the King County Assessor, the current land use is Golf Course. The property zoning is governed by the City of Kent. The land underlying Pre-Identified No. 6 appears as three parcels under the same ownership and that ownership has not changed during the period of King County online parcel data record. There is only one landowner and water right holder that manage three adjacent parcels, totaling approximately 138 acres. A review of the WSDA 2019 Agricultural Land Use map, identifies turf grass as the crop type on the properties. Irrigation delineation estimates as much as 113.0 irrigated acres in 2019, Table 16.

Table 18: Delineated irrigation in each year (2013, 2015, 2017, 2019)

Year	Total Irrigated Acres (Med/High Confidence)
2013	109.7
2015	108.5
2017	108.5
2019	113.0

Water Right

Table 19: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Certificate	40 afy	0.223 cfs	8/09/1965	Irrigation	20	Groundwater
Certificate	80 afy	0.813 cfs	7/17/1967	Irrigation	80	Groundwater
Certificate	40 afy	0.111 cfs	7/01/1974	Irrigation	20	Groundwater

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

Water Right History:

The three certificates were issued for the development of a golf course community. These water rights have priority dates of 8/09/1965, 7/17/1967 and 7/01/1974, listed purpose of use as irrigation from groundwater on all three certificates, with a cumulative 1.147 cfs (515 GPM) as the

Qi and 160 afy as the cumulative Qa. It is assumed that all three water rights are additive to one-another, but a more complete review of the file in coordination with the landowner will confirm precise water right relationships.

Well Information:

According to water right documents and file records, there are a total of four wells associated with the appurtenant water rights. Well No. 1, is constructed with an 8-inch casing, completed to a depth of 174 feet below ground surface on 7/28/1967. Well No. 2, is constructed with an 8-inch casing, completed to a depth of 170 feet below ground surface on 7/28/1967. Well No. 3, is constructed with a 10-inch casing, completed to a depth of 170 feet below ground surface on an unspecified date. Well No. 4, is constructed with a 8-inch casing, completed to a depth of 159 feet below ground surface on 2/05/1996.

Metering Records:

Metering records are not available in the Ecology Water Resources Explorer database or in the water right record.

Conclusion

This project was identified by Ecology and the WREC as a potential acquisition opportunity. The current land use is Golf Course. Four years of irrigation delineations were undertaken (2013, 2015, 2017, 2019) which estimate a maximum of 113 irrigated acres in 2019 on these parcels. An estimate of crop consumption was developed based on the Washington Irrigation Guide, Appendix A, Kent, WA station using pasture/turf crop irrigation requirement as the surrogate baseline crop (17.06 inches/acre) using an assumed sprinkler irrigation application efficiency of 75%, a consumptive application factor of 10%, resulting in a total consumptive use of 85%.

- Based on the highest delineation, which quantified 113 acres of irrigation and assuming turf and sprinkler irrigation application, 182 afy consumptive is the estimated quantity available for trust water transaction. The delineation estimate was used for the offset estimate.[23]
- Based on the water rights, which total an additive 120 acres of irrigation and assuming turf and sprinkler irrigation application, 193 afy consumptive is the estimated quantity available for trust water transaction.

The Pre-Identified No. 6 water rights with priority dates of 8/09/1965, 7/17/1967 and 7/01/1974, are senior to the establishment of the Green-Duwamish River Basin Instream Resources Protection Program in 1980, but junior to the administrative closure of all tributaries of Green River dated

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

8/19/1953. If the golf course is to continue to operate, there would need to be a source switch. The viability of a switch to reclaimed, municipal or another system is unknown.

1 Figure 7: Project Map

2

Pre-Identified No. 2 (9-C-W5)

WRIA 9 Project Opportunity Profile

Project Summary

FLOW BENEFIT: Additional 2.7 cfs in 3.5 miles of Covington Creek tributaries (Ravensdale Lake/Creek and Lake Sawyer), 6 miles of Covington Creek, 2.5 miles of Big Soos Creek, and 30 miles of Green River.

PRIORITY SUBBASIN: Covington Creek Subbasin

ESTIMATED OFFSET: 54 afy consumptive

SUBBASIN CONSUMPTIVE USE ESTIMATE: 21.5-29.6 afy consumptive in Covington Creek

PRIORITY DATE: 6/02/1967

WRIA 9 INSTREAM FLOW RULE (1980): There is a surface water closure on all tributaries to the Green River.[24]

ESA LISTED FISH: Puget Sound Chinook Salmon (Threatened),Puget Sound Steelhead (Threatened), Bull Trout (Threatened)

OUTREACH STATUS: Initial

Project Description

The Pre-Identified No. 2 water right was included in the WRIA 9 water rights analysis at Ecology request and WREC review. The land and appurtenant water right are part of a former sand and gravel mining operation. The parcels comprising the property underlying the water right, appear to have been in the same ownership since the late 1990's according to the King County online parcel data record. The water right holder had considered a trust water donation 3 years ago but did not proceed. Washington Water Trust has initiated outreach to the water right holder.

Watershed

Ravensdale Lake/Creek is a part of the Covington Creek subbasin. Ravensdale Lake/Creek drains into Lake Sawyer, Lake Sawyer is the headwaters of Covington Creek, which Covington Creek flows into Big Soos Creek, and Big Soos Creek joins the Lower Middle Green River at approximately RM

[24] WAC 173-509-040

30. Covington Creek and tributaries have a closure to future surface water appropriations but do not have an instream flow established in Chapter 173-509 WAC.

Land Use & Ownership

According to the King County Assessor, the current land uses under the place of use are Mining/Quarry/Ore Processing, Single Family and Vacant Land, Mobile Home and Vacant Commercial. The properties are zoned Rural Area 10, one dwelling unit per 10 acres, Mineral and Forest. The land underlying Pre-Identified No. 2 appears to have been in the same ownership since the late 1990's according to the King County online parcel data record. There are four landowners and water right holders that manage 5 parcels, totaling approximately 163 acres. Review of aerial imagery shows approximately 24 acres of what appears to be leech ponds active until approximately 2014, following 2014 the prevalence of vegetation may indicate inactivity at the site, but approximately 6 acres of driveways and gravel piles appear active with little to no vegetative cover.

Water Right

Table 20: Current Water Rights

Document Type	Qa	Qi	Priority Date	Purpose of Use	WR Acres	Source
Certificate	744 afy	2.7 cfs	6/02/1967	Industrial/Processing mineral products	-	Ravensdale Lake

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

Water Right History:

The original certificate was issued for "processing mineral products" from Ravensdale Lake. This water right has a priority date of 6/02/1967, listed purpose of use as processing mineral products, with 2.7 cfs identified as the Qi and 744 afy as the Qa.

Metering Records:

Metering records are not available in the Ecology Water Resources Explorer database or in the water right record. At the time of Ecology's site visit in 2017 a meter was installed but it appears that data was not obtained or available.

Conclusion

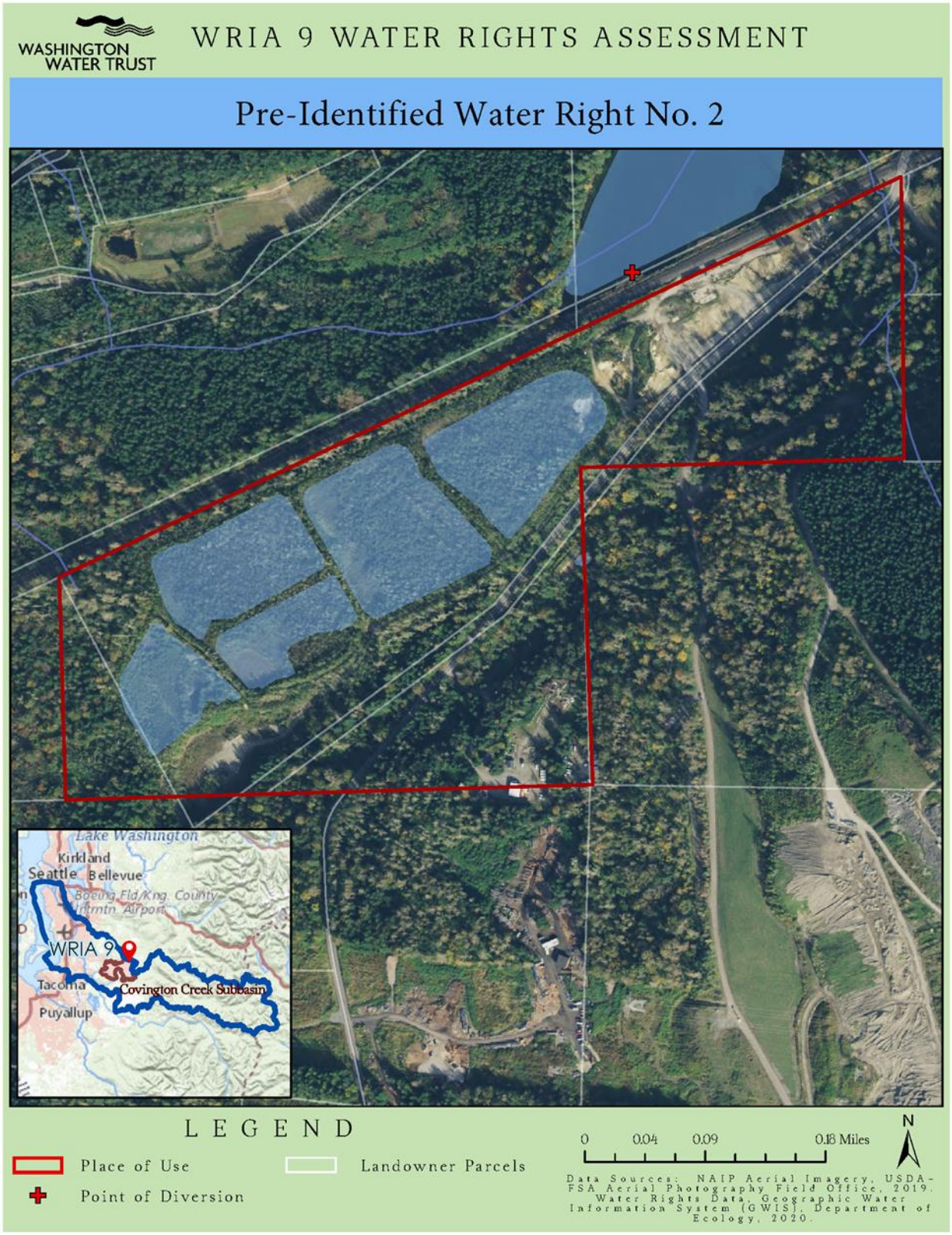
This project was identified by Ecology and the WREC as a potential acquisition opportunity. The current land uses are Mining/Quarry/Ore Processing, Single Family and Vacant Land, Mobile Home and Vacant Commercial. Due to the year-round industrial nature of this water right, the actual fact pattern of beneficial use and products produced dictate quantification of consumptive use. This water right holder had considered participating in a trust water right donation 3 years ago but did not proceed. At that time, Ecology had opportunity to review a beneficial use assessment conducted on behalf of the water right holder by a consultant in 2017, and confirmed the estimates provided at that time.

- Based on a beneficial use assessment produced by a 3rd-Party consultant and confirmed by Ecology staff, it was determined that there was as much as 106 afy of beneficial use of water with 54 afy consumptive use in 2017.[25]

The Pre-Identified No. 2 water right priority date of 6/02/1967, is senior to the establishment of the Green-Duwamish River Basin Instream Resources Protection Program in 1980 but junior to the administrative closure of all tributaries of Green River dated 08/19/1953.

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

1 Figure 8: Project Map



2

Covington Water District MAR (9-C-W6)

WRIA 9 - DRAFT Project Description

September 3, 2020

Project Name

Covington Water District Managed Aquifer Recharge (MAR)

WRIA 9 WRE Subbasin

Covington Creek

Water Offset

~357 acre-feet/year (AF)

Project Status

The Covington Water District (CWD) has expressed interest in pursuing a Managed Aquifer Recharge (MAR) project on CWD owned property and are interested in including this project in the WRIA 9 Watershed Restoration and Enhancement Plan.

Narrative Description

CWD is proposing the placement of a MAR infiltration facility on their property in Covington, Washington. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to Covington Creek, a tributary to Soos Creek and the Green River, above what occurs under existing conditions. The project concept includes diverting water annually from CWD's existing drinking water pipeline, which runs along the northern site boundary, between approximately November 1 and April 30 when water is available using existing water rights. Diverted water would be conveyed from CWD's existing pipeline and piped to a constructed MAR facility. This diverted water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to Covington Creek as re-timed groundwater baseflow. The goal of the project is to increase baseflow to Covington Creek by recharging the aquifer adjacent to Covington Creek and providing additional groundwater discharge to the stream through MAR.

The proposed project site is a 54-acre undeveloped property owned by CWD located west of Lake Sawyer in the WRIA 9 Covington Creek subbasin. The site is currently covered by forest and vegetation. The property is located in Section 9, Township 21 North, Range 6 East (Willamette Meridian) and is bounded to the north by Kentlake High School, Druids Glen golf course to the west, and Covington Creek to the east and south.

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

The proposed MAR facility will result in streamflow benefits to Covington Creek by diverting and temporarily storing excess water into the shallow alluvial aquifer. The project is currently conceptual but CWD anticipates the ability to divert water from their existing water supply and water rights at a rate of approximately 1 cubic foot per second (cfs) for up to six months (November 1 through April 30). The goal is to increase streamflow. The proposed MAR facility will infiltrate potable water into the shallow aquifer and provide increased baseflow to Covington Creek and its tributaries. The anticipated offset

volume for this project is 357 acre-feet (AF) per year. The offset volume is calculated based on the quantity of water infiltrated annually, as described below.

United States Geologic Survey mapping in the area suggests that glacial outwash plain deposits are present at the proposed location (Mullineax 1965). United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil maps indicate the site is underlain by Everett very gravelly sand loam (EvC) soils with an average saturated hydraulic conductivity (Ksat) of 3.97 inches per hour (USDA 2020). For planning purposes, Ksat is assumed to be equivalent to infiltration rate. Site-specific data were not available so a safety factor of two was applied to the raw Ksat value to derive a corrected infiltration rate of 1.95 inches per hour. Assuming water will be diverted between November 1 and April 30 every year (180 days), the annual diversion volume is estimated to be 357 AF per year using Equation 1:

Annual Volume = Diversion Rate x Duration of Diversion Equation 1

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

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

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

The approximate site location is shown below.

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in Covington Creek. Based on the estimated diversion volume, it is possible that streamflow benefits could also be observed in Soos Creek.

Location relative to future PE well demand

The consumptive use estimate for the WRIA 9 Covington Creek subbasin is 21.5 AF per year (GeoEngineers 2019).

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to Covington Creek by infiltrating 357 AF per year through the MAR facility to improve baseflow in the Covington Creek. The increase in baseflows should reduce water temperatures in Covington Creek.

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

The Covington Creek subbasin is inhabited by Coho, fall chinook, fall chum, coastal cutthroat, and winter steelhead (WDFW 2020a and 2020b).

Identification of anticipated support and barriers to completion.

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

The barriers to completion include funding for construction and O&M costs. In addition, the water available for diversion from CWD's existing pipeline is treated drinking water. It is anticipated that water quality will be evaluated and a geochemical compatibility analysis will be conducted to ensure no water quality degradation, and/or water will be treated to mitigate any environmental impacts.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

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

- The water source would be reliable, based on a certificated water right, and the seasonal storage volume should always be available.
- The rate of diversion would be precisely maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The subject river reach is perennially gaining and the anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that significantly reduces the project offset.
- Land use changes external to the project site would have negligible impact on project function.

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

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

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

CWD is the project sponsor. Sponsor contact: Steve Lee, Engineering Manager. The sponsor is willing to proceed with scoping, reconnaissance, and project management support. Implementation will be dependent on several factors, including funding.

Documentation of sources, methods, and assumptions.

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

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

GeoEngineers, Inc. (GeoEngineers). 2020. WRIA 9 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. February 2020.

Mullineaux, D.R. 1965. Geologic Map of the Black Diamond Quadrangle, King County, Washington. USGS Geologic Quadrangle Map GQ-407, Scale 1:24,000.

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

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

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

Tacoma Green River MAR (9-UMG-W7)

WRIA 9 – DRAFT Project Description

September 3, 2020

Project Name

Tacoma Green River Managed Aquifer Recharge (MAR)

WRIA 9 WRE Subbasin

Upper Middle Green River

Water Offset

~327 acre-feet/year (AF)

Project Status

The WRIA 9 WREC is interested in quantifying the water offset potential of Managed Aquifer Recharge (MAR) sites previously identified by Ecology. This project description was completed for review by the WRIA 9 Technical Workgroup.

Narrative Description

One of the potential MAR sites identified by Ecology is located on Tacoma Water property near Palmer, Washington. The site is located approximately ½-mile downstream of Tacoma Water's Green River Filtration Facility. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to the Green River above what occurs under existing conditions. The project concept includes diverting surface water annually from the Green River between approximately December 1 and May 15 when excess water is available. Diverted water would be conveyed through a collector well adjacent to the river (e.g. Ranney Collector well) or through an instream surface water intake and piped to a constructed MAR facility. This diverted surface water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges back to surface water as re-timed groundwater baseflow. The goal of the project is to increase baseflow to the Green River by recharging the aquifer adjacent to the Green River and providing additional groundwater discharge to the river through MAR.

The site is located in the WRIA 9 Upper Middle Green River subbasin and is currently covered by forest and vegetation. The site is located in Section 13, Township 21 North, Range 7 East (Willamette Meridian) and is bounded to the north by SE Green River Headworks Road, to the south by Burlington Northern Santa Fe railroad by forest to the east and west.

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

The proposed MAR facility will result in streamflow benefits to the Green River by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but, for planning purposes, we anticipate the ability to divert surface water from the Green River at a rate of approximately 1 cubic foot per second (cfs) for up to five and a half months (December 1 through May 15) when excess water is available in the Green River for beneficial use. The goal is to increase streamflow. The anticipated offset volume for this project is 327 acre-feet (AF) per year. The offset volume is calculated based on the quantity of water infiltrated annually, as described below.

Washington Geologic Survey mapping in the area suggests that alluvium aquifer material should be present at the proposed location (Jones 1999). United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil maps indicate the site is underlain by Udifluvent gravelly sandy loam soils with an average saturated hydraulic conductivity (Ksat) of 3.97 inches per hour (USDA 2020). For planning purposes, Ksat is assumed to be equivalent to infiltration rate. Site-specific data were not available so safety factor of two was applied to the raw Ksat value to derive a corrected infiltration rate of 1.98 inches per hour. Assuming water will be diverted between December 1 and May 15 every year (165 days), the annual diversion volume is estimated to be 327 AF per year using Equation 1:

Annual Volume = Diversion Rate x Duration of Diversion (days) Equation 1

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

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

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

The site location is shown below.

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the mainstem of the Green River and in downstream subbasins.

Location relative to future PE well demand

The consumptive use estimate for the WRIA 9 Upper Middle Green River subbasin is 26.9 AF per year (GeoEngineers 2019). This project would also contribute to offsetting 85 AF per year of estimated consumptive use in the following downstream subbasins: Mid Middle Green, Lower Middle Green, Lower Green, and Duwamish.

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the Green River by infiltrating 327 AF per year through the MAR facility to improve baseflow in the Green River. The performance measures will be an increase in baseflow in the Green River.

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

The Green River is inhabited by sockeye, fall chinook, Coho, chum, bull trout, and winter and summer steelhead (WDFW 2020a and 2020b).

Identification of anticipated support and barriers to completion.

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

Ecology conducted outreach to Tacoma Water regarding the location of this project on their Green River filtration facility and Tacoma Water expressed support for the project concept.

The barriers to completion include funding for construction and O&M costs, and obtaining a water right from the Green River or the adjacent aquifer for beneficial use at the MAR facility.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

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

- The water source would be reliable, based on a certificated water right, and while interruptible, the seasonal storage volume should always be available.
- The rate of diversion would be precisely maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).

- The subject river reach is perennially gaining and the anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that significantly reduces the project offset.
- Land use changes external to the project site would have negligible impact on project function.

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

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

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

Washington Water Trust is a potential project sponsor.

Documentation of sources, methods, and assumptions.

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

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

GeoEngineers, Inc. (GeoEngineers). 2020. WRIA 9 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. February 2020.

Jones, M.A. 1999. Geologic Framework for the Puget Sound Aquifer System, Washington and British Columbia. USGS Professional Paper PP-1424-C, scale 1:100,000.

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

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

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

Kanaskat Palmer MAR (9-UMW-W7)

WRIA 9 – DRAFT Project Description

September 3, 2020

Project Name

Kanaskat Palmer Managed Aquifer Recharge (MAR)

WRIA 9 WRE Subbasin

Upper Middle Green River

Water Offset

~327 acre-feet/year (AF)

Project Status

The WRIA 9 WREC is interested in quantifying the water offset potential of Managed Aquifer Recharge (MAR) sites previously identified by Ecology. This project description was completed for review by the WRIA 9 Technical Workgroup.

Narrative Description

One of the potential MAR sites identified by Ecology is located on Washington State Parks and Recreation property within Kanaskat-Palmer State Park near Palmer, Washington. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to the Green River above what occurs under existing conditions. The project concept includes diverting surface water annually from the Green River between approximately December 1 and May 15 when excess water is available. Diverted water would be conveyed through a collector well adjacent to the river (e.g. Ranney Collector well) or through an instream surface water intake and piped to a constructed MAR facility. This diverted surface water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges back to surface water as re-timed groundwater baseflow. The goal of the project is to increase baseflow to the Green River by recharging the aquifer adjacent to the Green River and by providing additional groundwater discharge to the river through MAR.

Kanaskat-Palmer State Park occupies approximately 320 acres in the WRIA 9 Upper Middle Green River subbasin and is currently covered by forest and vegetation. The site property is located in Section 10, Township 21 North, Range 7 East (Willamette Meridian) and is bounded to the north by the Green River and surrounded by forest in all other directions.

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

The proposed MAR facility will result in streamflow benefits to the Green River by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but we anticipate the ability to divert surface water from the Green River at a rate of up to approximately 1 cubic foot per second (cfs) for up to five and a half months (December 1 through May 15) when excess water is available in the Green River for beneficial use. The goal is to increase streamflow. The anticipated offset volume for this project is 327 acre-feet (AF) per year. The offset volume is calculated based on the quantity of water infiltrated annually, as described below.

Washington Geologic Survey mapping in the area suggests that terrace gravel and stratified drift deposits (Qt) are present at the proposed location (Vine 1969). United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil maps indicate the site is underlain by Barneston gravelly ashy coarse sandy loam with an average saturated hydraulic conductivity (Ksat) of 12.4 inches per hour (USDA 2020). For planning purposes, Ksat is assumed to be equivalent to infiltration rate. Site-specific data were not available so a safety factor of two was applied to the raw Ksat value to derive a corrected infiltration rate of 6.2 inches per hour. Assuming water will be diverted between December 1 and May 15 every year (165 days), the annual diversion volume is estimated to be 327 AF per year calculated by Equation 1:

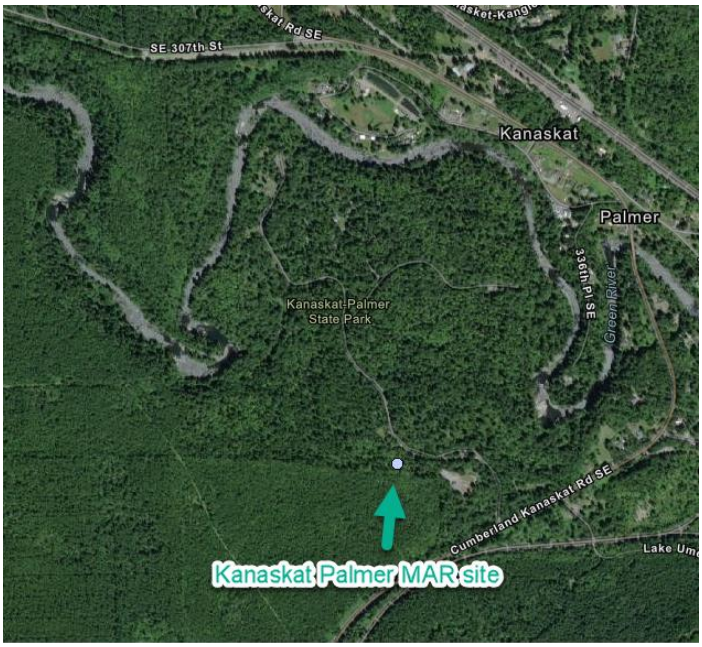
Annual Volume = Diversion Rate x Duration of Diversion
Equation 1

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

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

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

The site location is shown below.



Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the mainstem of the Green River.

Location relative to future PE well demand

The consumptive use estimate for the WRIA 9 Upper Middle Green River subbasin is 26.9 AF per year (GeoEngineers 2019). This project would also contribute to offsetting 85 AF per year of estimated consumptive use in the following downstream subbasins: Mid Middle Green, Lower Middle Green, Lower Green, and Duwamish.

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the Green River by infiltrating 327 AF per year through the MAR facility to improve baseflow in the Green River. The performance measures will be an increase in baseflow in the Green River.

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

The Green River is inhabited by sockeye, fall chinook, Coho, chum, bull trout, and winter and summer steelhead (WDFW 2020a and 2020b).

Identification of anticipated support and barriers to completion.

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

The barriers to completion include funding for construction and O&M costs and obtaining a water right from the Green River or the adjacent aquifer for beneficial use at the MAR facility. Outreach to the landowner (Washington State Department of Parks and Recreation) should be conducted to evaluate their level of support for the project.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

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

- The water source would be reliable, based on a certificated water right, and while interruptible, the seasonal storage volume should always be available.
- The rate of diversion would be precisely maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate would be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- The subject river reach is perennially gaining and the anticipated range in regional groundwater elevation fluctuation would not impact the groundwater flow field in a manner that significantly reduces the project offset.
- Land use changes external to the project site would have negligible impact on project function.

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

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

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

Washington Water Trust is a potential project sponsor.

Documentation of sources, methods, and assumptions.

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

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

GeoEngineers, Inc. (GeoEngineers). 2020. WRIA 9 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. February 2020.US Department of Agriculture (USDA). 2020. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Vine, J.L. 1969. Geology and Coal Resources of the Cumberland, Hobart, and Maple Valley Quadrangles, King County, Washington. USGS Professional Paper PP-624, scale 1:24,000.

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

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

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

Tacoma Water Streamflow Augmentation and Eagle Lake Siphon (9-UG-W8)

WRIA 9 - DRAFT Project Description

August 21, 2020

Project Name

Tacoma Water Streamflow Augmentation and Eagle Lake Siphon

WRIA 9 WRE Subbasin

Upper Green River

Water Offset

Up to 357 acre-feet per year (AF/yr)

Project Status

The WRIA 9 Technical Workgroup discussed this project at the August 11 meeting and recommends the project for discussion by the WRIA 9 Committee.

Narrative Description

This project would augment streamflow through the release of 2 cubic foot per second (cfs) of raw, untreated water for a period of 90 days (during the summer low-flow period) into the mainstem Green River using Tacoma Water's existing water rights. If this project is constructed, Tacoma Water envisions this could be done by requesting the Army Corps of Engineers release 2 cfs more water than what Tacoma Water withdraws as part of regular Howard Hanson Dam flow coordination.

The commitment to release an additional 2 cfs to the Green River would be contingent on Tacoma Water securing a water right for up to 1,000 acre-feet (AF) per year of dead storage out of Eagle Lake to use as needed. This commitment would also be contingent on securing grant funding to construct the Eagle Lake Siphon project and any additional infrastructure required. This project is expected to improve streamflows in the Green River in summer when surface flows are generally lowest.

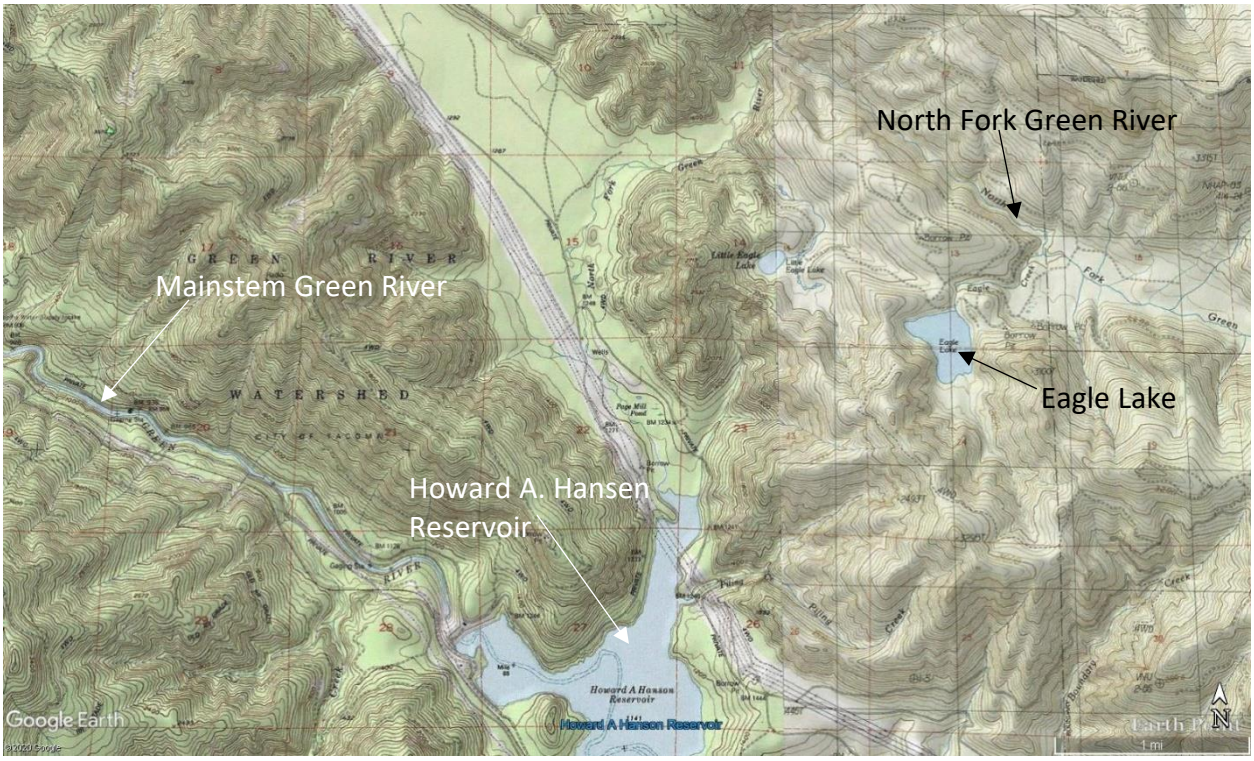
Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The proposed streamflow augmentation project will result in benefits to the Green River by releasing an additional 2 cfs of water from behind Howard Hanson Dam for a period of 90 days. The anticipated offset volume for this project is 357 AF per year using Equation 1:

$$\text{Annual Volume} = \text{Release Rate} \times \text{Duration of Diversion (days)} \qquad \text{Equation 1}$$

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

The project site is shown in relation to surrounding physical features on the below conceptual-level map.



Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the mainstem of the Green River within the following subbasins: Upper Green River, Upper Middle Green River, Mid Middle Green River, Lower Middle Green River, Lower Green River, and the Duwamish River.

Location relative to future PE well demand

There is no forecast consumptive use for the WRIA 9 delineated Upper Green River subbasin (GeoEngineers 2020). The downstream subbasins that the project benefits have a combined consumptive use estimate of 126.4 acre-feet per year.

Performance goals and measures.

The performance goals are to increase streamflow within the Green River by releasing 2 cfs of additional water during the summer low flow period. The performance measures will be an increase in streamflow in summer in the Green River.

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

The Green River is inhabited by sockeye, fall chinook, Coho, chum, bull trout, and winter and summer steelhead trout (WDFW 2020a and 2020b).

Identification of anticipated support and barriers to completion.

Tacoma Water has agreed to sponsor and commit to this project with the following conditions:

1. This commitment would be contingent on Tacoma Water securing a water right for up to 1000 AF per year of dead storage out of Eagle Lake to use as needed.
   •
2. This commitment would be contingent on securing grant funding to construct the Eagle Lake Siphon project and any additional infrastructure required.

Potential budget and O&M costs.

To be determined.

Anticipated durability and resiliency.

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

- The project would be actively managed by Tacoma Water.
- The water source would be reliable and not subject to interruption.
- The project relies primarily on infrastructure that is already in place and maintained for the purposes of flood control and drinking water storage.
- The rate of release would be maintained through engineering controls and conveyed with minimal loss to the river.
- Seasonal streamflow variation would have negligible impact on project function.
- Land use changes would have negligible impact on project function.
  •

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

- The ability to use water from dead storage in Eagle Lake will increase resiliency to drought or other climatic conditions.

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

The identified project sponsor is Tacoma Water. The sponsor contact is Greg Volkhardt, Water Division Manager. The sponsor is willing to proceed with scoping, reconnaissance, and project management support. Implementation will be dependent on several factors including funding.

Documentation of sources, methods, and assumptions.

GeoEngineers, Inc. and NHC. 2020. WRIA 9 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. February 21, 2020.

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

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

Lower Soos Creek Restoration (9-S-H9)

WRIA 9 - DRAFT Project Description

July 25, 2020

Project Name
Lower Soos Creek Restoration

WRIA 9 WRE Subbasin
Soos Creek

Project Status
The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description
This project includes land acquisition, design and permitting, and restoration actions along Lower Soos Creek, a tributary to the Green River, east of Auburn, Washington. Collectively, these proposed actions will improve the aquatic, riparian and wetland habitat. The project is located within the WRIA 9 Soos Creek subbasin.

This proposed restoration actions include acquiring land adjacent to the stream, removing structures from floodplain, placing large woody debris (LWD) in the stream channel and wetlands and revegetating the stream and wetland areas with native trees and shrubs. These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Sockeye, Bull Trout and resident Cutthroat Trout that utilize the Green River as rearing habitat. Chinook, Steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
The proposed project will restore three miles of stream. Installation of LWD has several ecological functions including managing flows, creating deeper pools that provide refugia for fish, preventing bank erosion, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Planted native trees and shrubs will provide instream shade to protect salmon and other fish species that utilize this habitat.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features on the attached Site Plan.

Description of the anticipated spatial distribution of likely benefits.
This project involves restoration of aquatic, riparian and wetland habitats along three miles of Lower Soos Creek within the Soos Creek subbasin east of Auburn, Washington.

Performance goals and measures.
Acres acquired, structures removed, large logs installed instream, and number of trees and shrubs planted.

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Sockeye, Bull Trout and resident Cutthroat Trout that utilize Lower Soos Creek and the Green River. Chinook, Steelhead, and Bull Trout are priority species, protected under the ESA. Specifically, salmonids have been documented as using this stream section for spawning and rearing. LWD and riparian plantings will directly benefit prey availability, spawning success as well as survival of pre-migrant and out-migrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

The acquisition and restoration efforts will be supported by King County, WDFW, and NGOs such as the Green River Coalition, Soos Creek Area Response, and Friends of Soos Creek. The only barrier to completion pertains to a lack of funding.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels, design and permit, and revegetate stream and wetland areas is anticipated to be approximately $1.5 million.

Anticipated durability and resiliency.

Once the native plants are installed, irrigation and maintenance will be required to ensure plant survival and to manage non-native/invasive plant species. Monitoring plant survival, native plant/shrub cover and non-native invasive plant cover will be performed for a minimum of five years post-project implementation.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, uncertainties, and assumptions.

The only uncertainty pertains to landowner willingness to sell land and fund to implement projects.

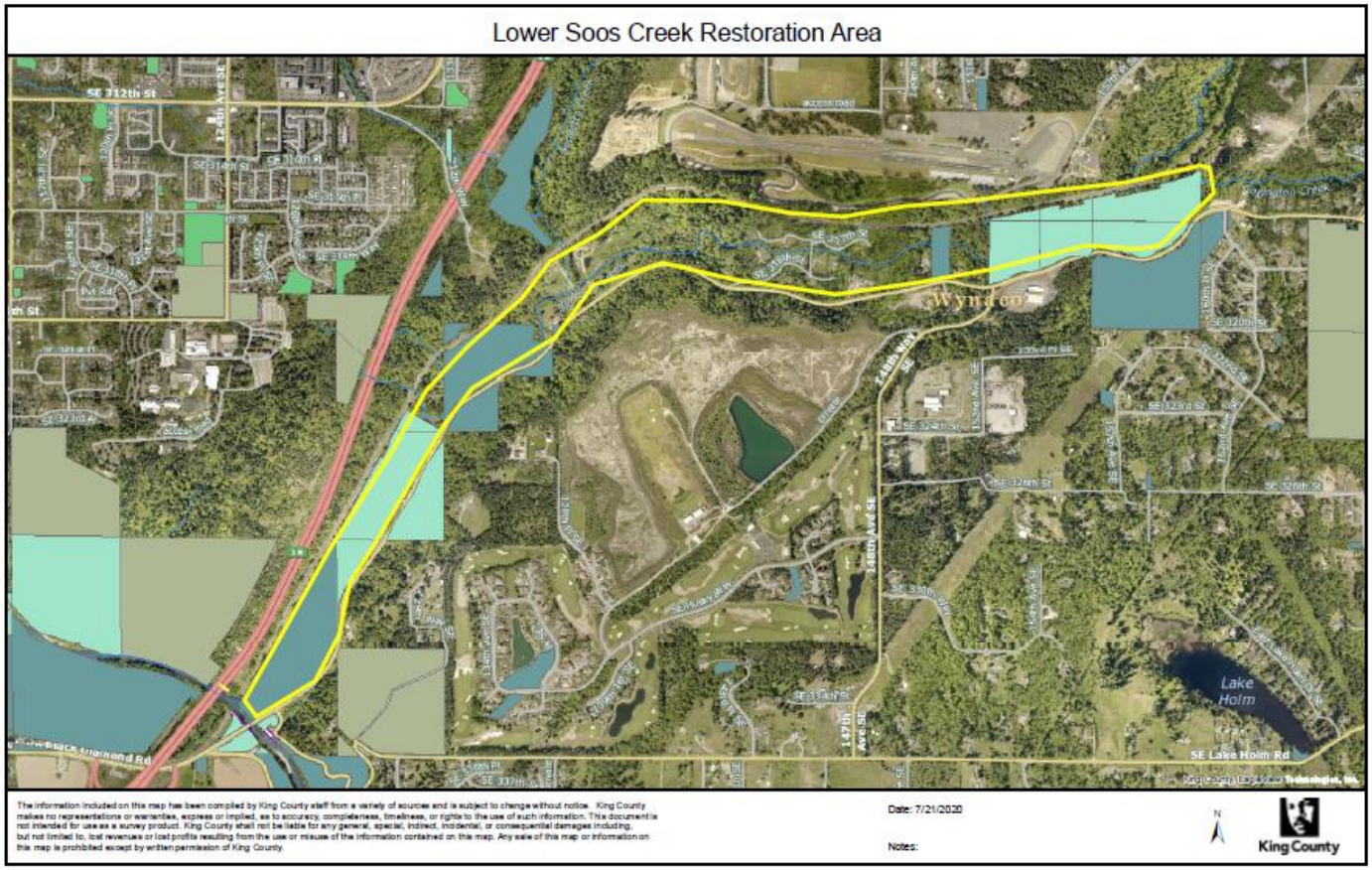


Figure 1. Site Plan for Lower Soos Creek Restoration Area

Turley Levee Setback (9-LMG-H10)

WRIA 9 - DRAFT Project Description

July 25, 2020

Project Name
Turley Levee Setback

WRIA 9 WRE Subbasin
Lower Middle Green River

Project Status
The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description
This project includes land acquisition, design and permitting to setback 1,000 feet of the Turley Levee, located along the Green River east of Auburn, Washington. Collectively, these efforts will improve floodplain connectivity and create 40 acres of aquatic habitat as the river traverses an unconstrained floodplain. The project is located within the WRIA 9 Lower Middle Green River subbasin.

This proposed project will remove the levee and relocate gravel in the levee under-structure into the river channel. The setback levee will be constructed away from the river. This project includes installation of dozens of large trees with rootwads in the river channel and remnant river channel, which currently lack large woody debris (LWD). In addition, hundreds of native trees and shrubs will be planted within the riparian and wetland habitats created. These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Sockeye, Bull Trout and resident Cutthroat Trout that utilize the Green River as rearing habitat. Chinook, Steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
Quantitatively, this project includes removal of the current levee, which is 1,300-feet long by 50-feet wide, installation of dozens of large trees with rootwads into the river channel and associated floodplain wetlands, and planting hundreds of native trees and shrubs. The setback levee will be approximately 1,000-feet long. The total project area is 53 acres and is projected to create 40 acres of salmon rearing habitat as the river reestablishes the floodplain within this area.

The addition of gravel material from the levee under-structure into the river will improve spawning and rearing habitat. Installation of LWD has several ecological functions including managing flows, creating deeper pools that provide refugia for fish, preventing bank erosion, and trapping organic material that provides nutrients for insects and invertebrates, which are a prey source for fish. Planted native trees and shrubs will provide instream shade to protect salmon and other fish species that utilize this habitat.

A map and drawings of the project location.

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

Description of the anticipated spatial distribution of likely benefits.

This project involves setting back the Turley Levee located along the right bank of the Green River within the Lower Middle Green River subbasin east of Auburn, Washington. The total project area proposed for restoration is approximately 53 acres, with creation of 40 acres of aquatic habitat for rearing salmonids. The length of Turley Levee is 1,800 feet. This proposed project would remove the existing levee and construct a setback feature for erosion control a substantial distance from the river (over 800').

Performance goals and measures.

Performance goals and measures will be based on length of levee removed, area of floodplain reconnected to the river, number of large wood structures placed in the floodplain, and number of trees and shrubs planted.

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Sockeye, Bull Trout and resident Cutthroat Trout that utilize the Green River. Chinook, Steelhead, and Bull Trout are priority species, protected under the ESA. Specifically, salmonids have been documented as using this river section for spawning and rearing habitat. Levee setback will expand existing aquatic habitat by 40 acres. Gravel placement, LWD and riparian plantings will directly benefit prey availability, spawning success as well as survival of pre-migrant and out-migrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

Funding is primary barrier, along with landowner willingness and King County's Farmland Preservation Program covenants which makes it challenging to build habitat restoration projects.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels, design, and permit, remove levee structure, replace levee and replant will be approximately $6 million.

Anticipated durability and resiliency.

Once the native plants are installed, irrigation and maintenance will be required to ensure plant survival. Monitoring of plant survival, native plant/shrub cover and non-native invasive plant cover will be performed for five years.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding, landowner willingness to sell property, and the King County Farmland Preservation Program.

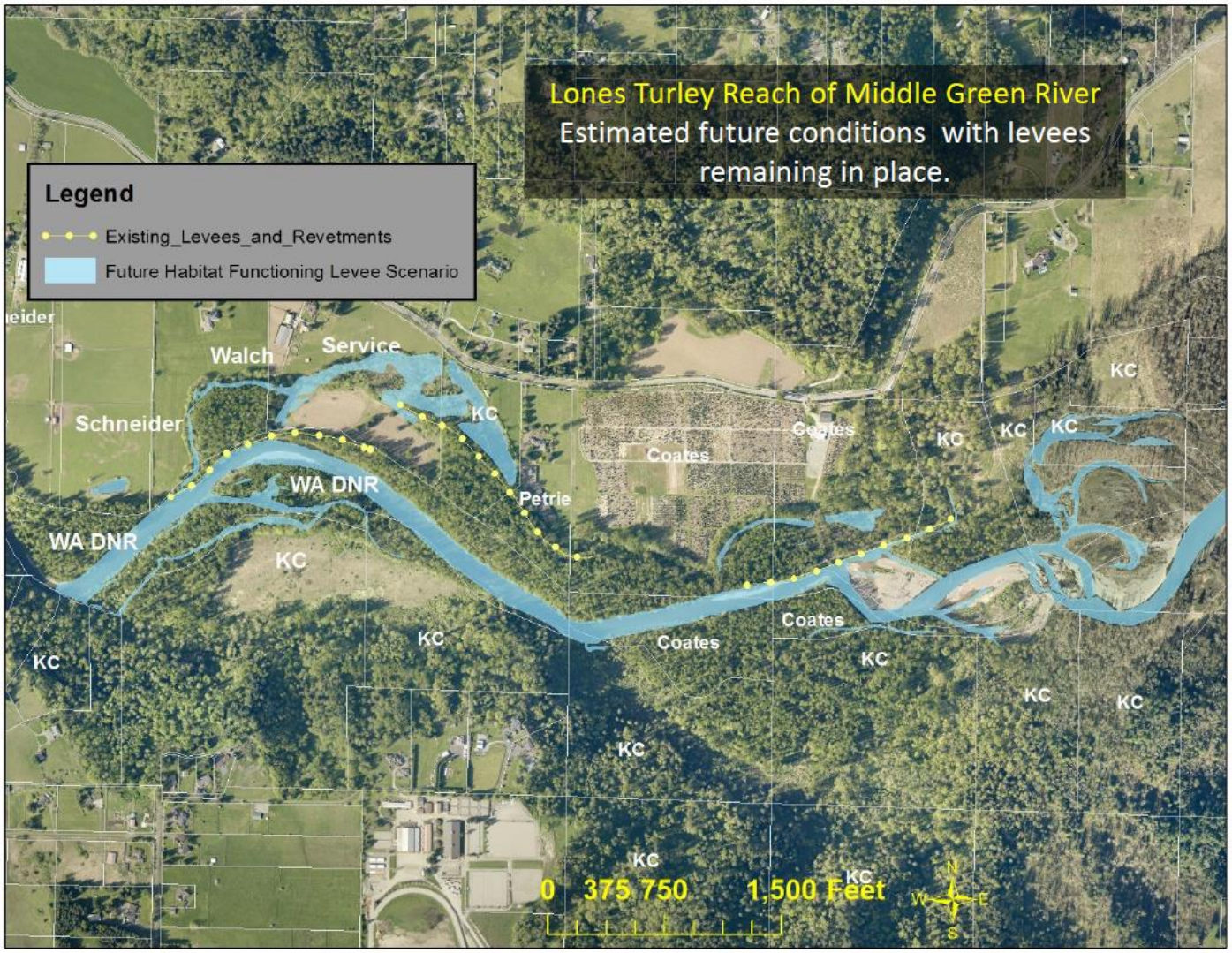


Figure 1. Site Plan for Turley Levee Setback – Estimated Future Conditions with Levees Remaining in Place

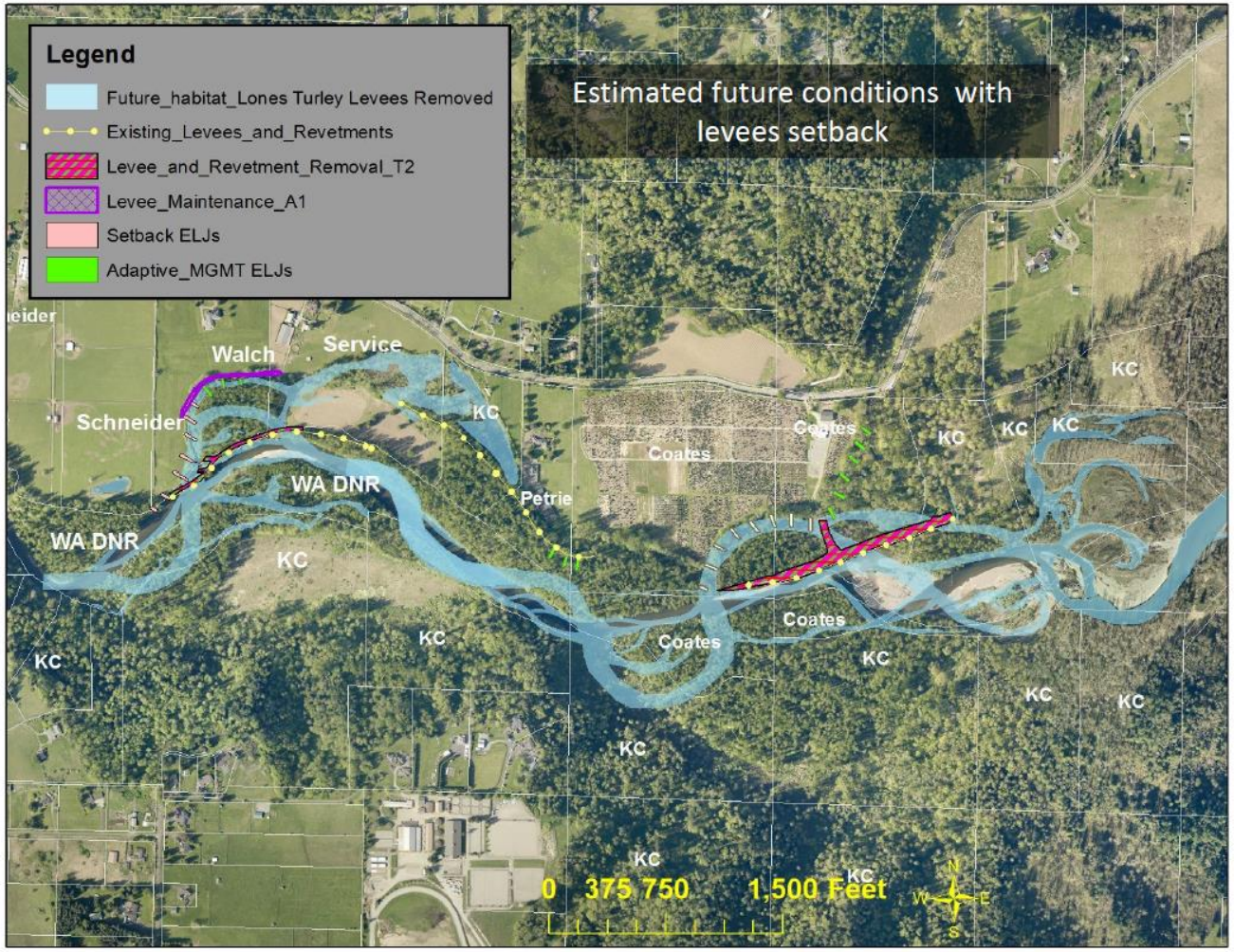


Figure 2. Site Plan for Turley Levee Setback -Estimated Future Conditions with Levees Setback

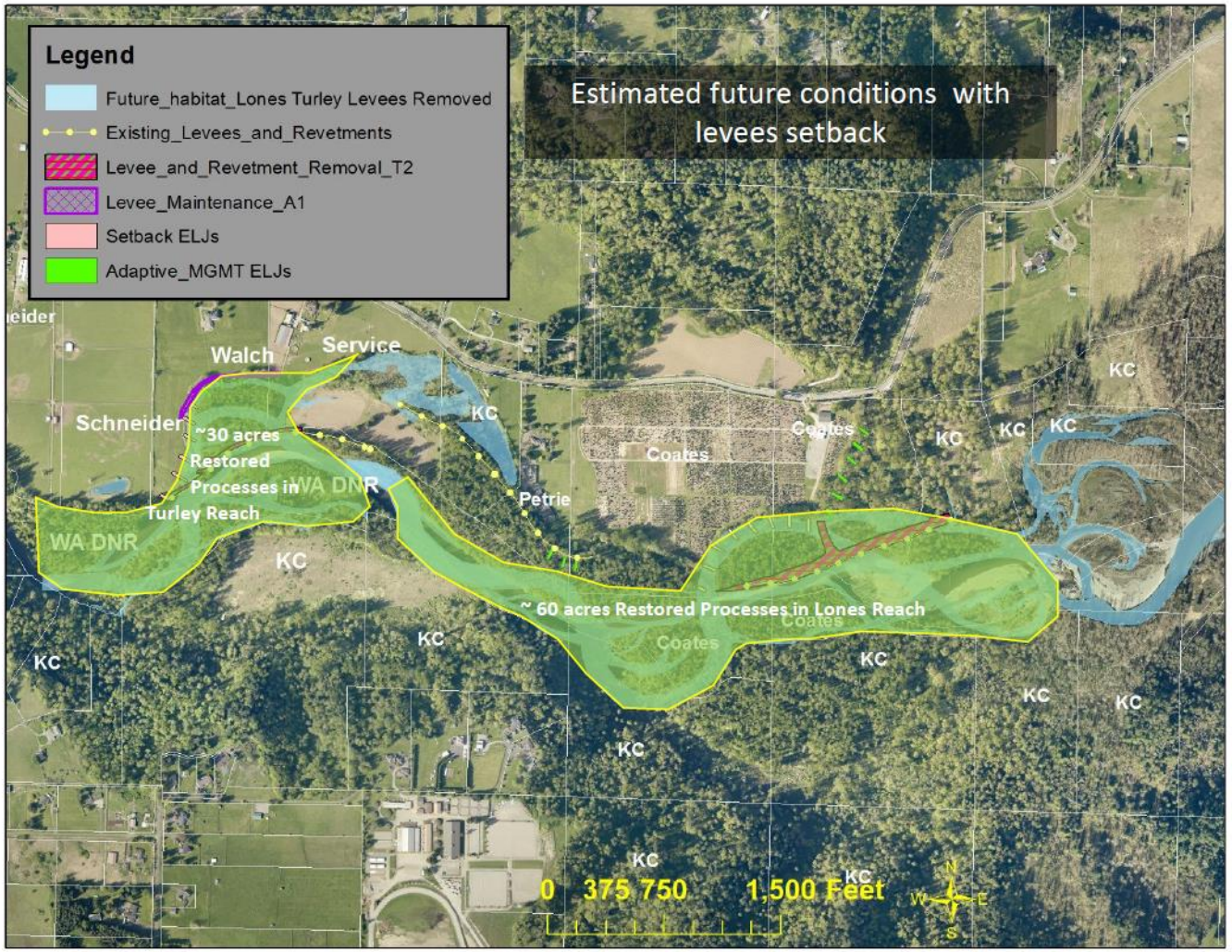


Figure 3. Site Plan for Turley Levee Setback -Estimated Future Conditions with Levees Setback

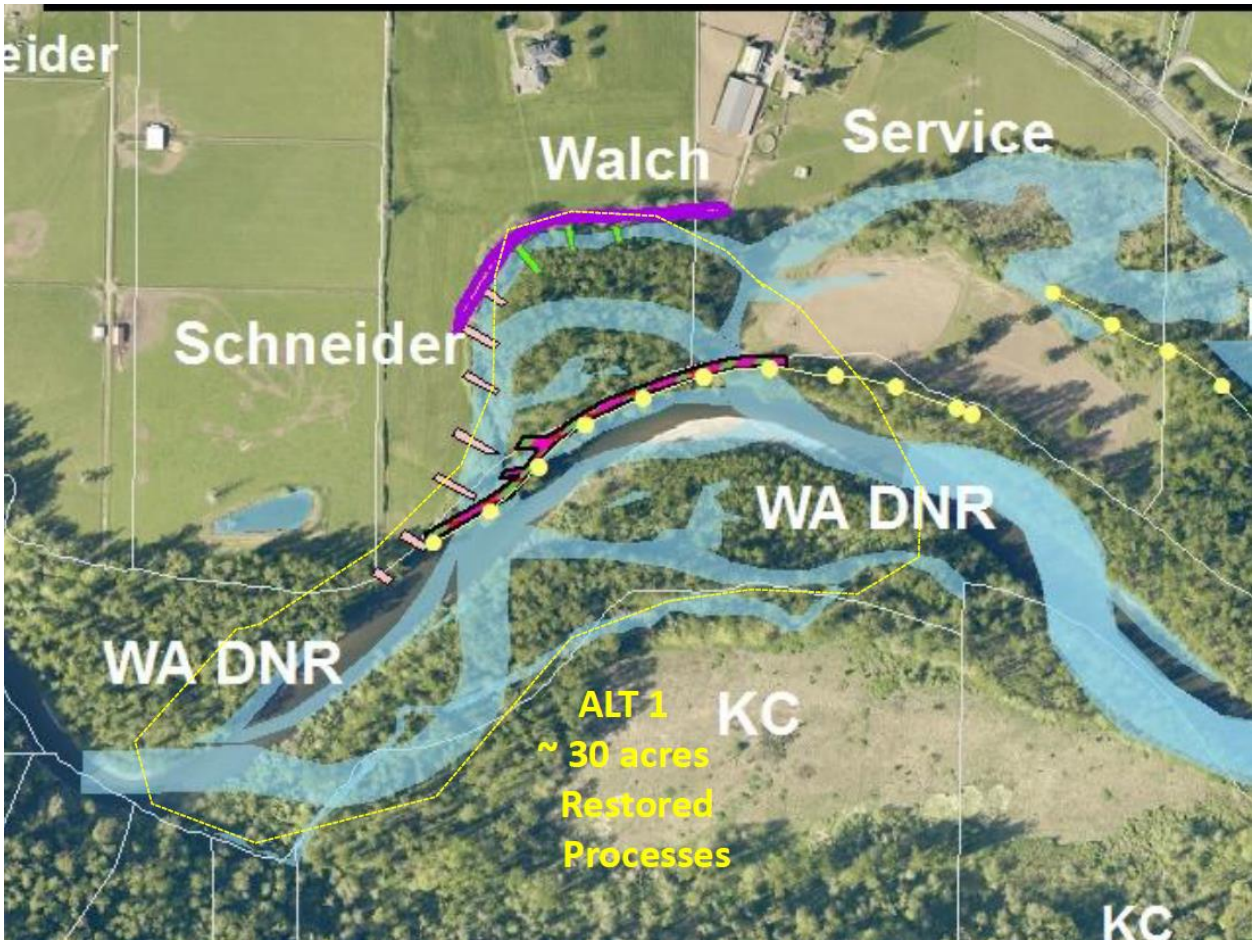


Figure 4. Site Plan for Turley Levee Setback -Estimated Future Conditions with Levees Setback

Hamakami Levee Setback (9-LMG-H11)

WRIA 9 – DRAFT Project Description

July 25, 2020

Project Name
Hamakami Levee Setback

WRIA 9 WRE Subbasin
Lower Middle Green River

Project Status
The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description
This project includes land acquisition, design and permitting to setback the Hamakami Levee located along the Green River east of Auburn, Washington. Collectively, these efforts will improve floodplain connectivity and create 40 acres of aquatic habitat as the river traverses an unconstrained floodplain. The project is located within the WRIA 9 Lower Middle Green River subbasin.

This proposed project will remove the levee and relocate gravel in the levee under-structure into the river channel. The setback levee will be constructed away from the river. This project includes installation of dozens of large trees with rootwads in the river channel and remnant river channel, which currently lack large woody debris (LWD). In addition, hundreds of native trees and shrubs will be planted within the riparian and wetlands habitats created. These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Sockeye, Bull Trout and resident Cutthroat Trout that utilize the Green River as rearing habitat. Chinook, Steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
Quantitatively, this project includes removal of the current levee which is 1,200-feet long by 50-feet wide, installation of dozens of large trees with rootwads into the river channel and associated floodplain wetlands, and planting hundreds of native trees and shrubs. The setback levee will be at least 1,200-feet long. The total project area is 47 acres and is projected to create 35 acres of salmon rearing habitat as the river reestablishes the floodplain within this area.

The addition of gravel material from the levee under-structure into the river will improve spawning and rearing habitat. Installation of LWD has several ecological functions including managing flows, creating deeper pools that provide refugia for fish, preventing bank erosion, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Planted native trees and shrubs will provide instream shade to protect salmon and other fish species that utilize this habitat.

A map and drawings of the project location.

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

Description of the anticipated spatial distribution of likely benefits.

This project involves setting back the Hamakami Levee located along the right bank of the Green River within the Lower Middle Green River subbasin east of Auburn, Washington. The total project area proposed for restoration is approximately 47 acres, with creation of 35 acres of aquatic habitat for rearing salmonids.

Performance goals and measures.

Performance goals and measures will be based on length of levee removed, area of floodplain reconnected to the river, number of large wood structures placed in the floodplain, and number of trees and shrubs planted.

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Sockeye, Bull Trout and resident Cutthroat Trout that utilize the Green River. Chinook, Steelhead, and Bull Trout are priority species, protected under the ESA. Specifically, salmonids have been documented as using this stream sections for spawning and rearing habitat. Levee setback will expand existing aquatic habitat by 35 acres. Gravel placement, LWD and riparian plantings will directly benefit prey availability, spawning success as well as survival of pre-migrant and out-migrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

Funding is primary barrier, along with landowner willingness and King County's Farmland Preservation Program covenants which makes it challenging to build habitat restoration projects.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels, design and permit, remove levee structure, replace levee and replant will be approximately $6 million.

Anticipated durability and resiliency.

Once the project is implemented, long-term ecological monitoring will take place for at least 10 years.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding, landowner willingness to sell property, and the King County Farmland Preservation Program.

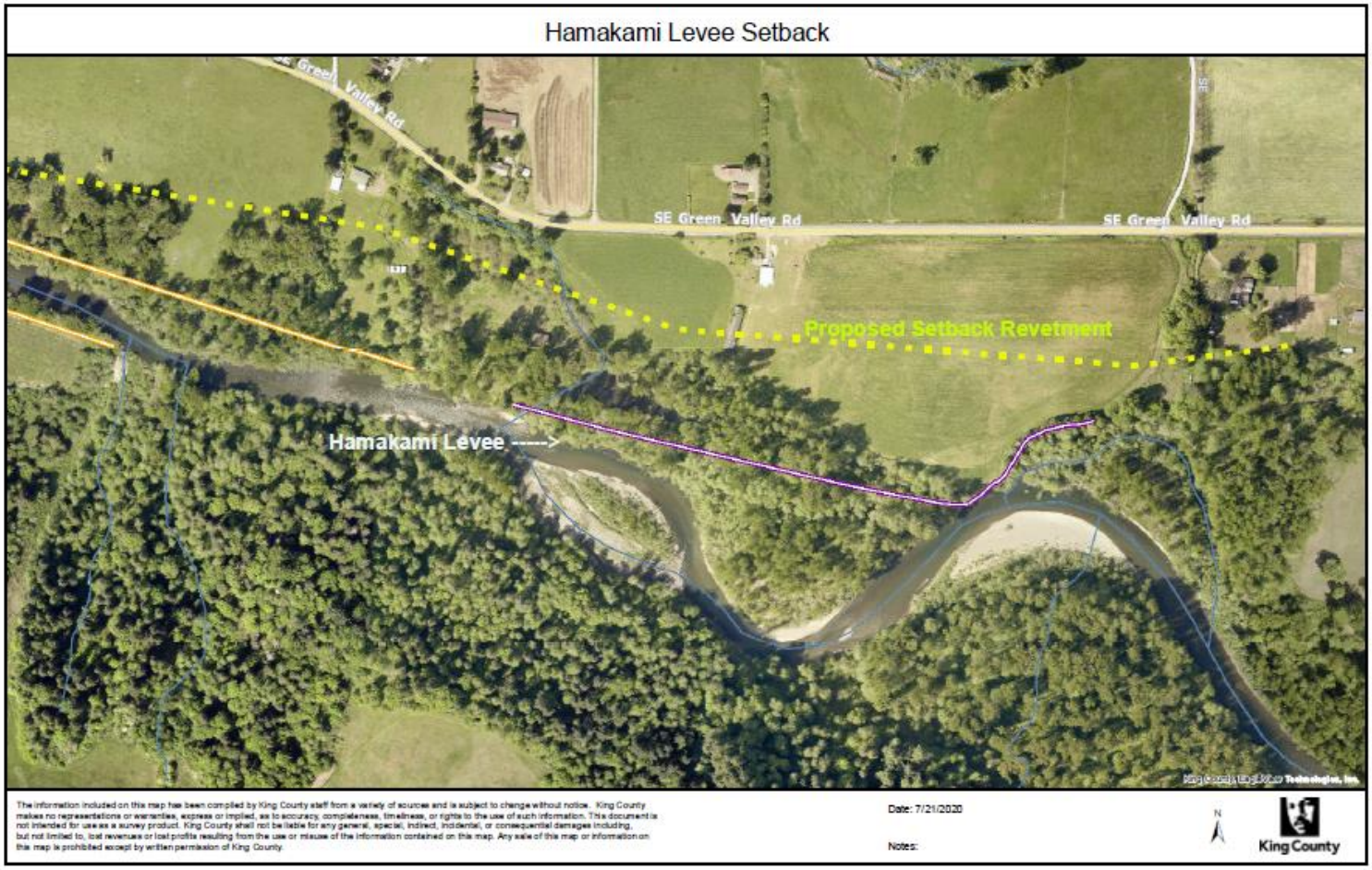


Figure 1. Site Plan for Hamakami Levee Setback

Burns Creek Restoration (9-LMG-H12)

WRIA 9 – DRAFT Project Description

July 25, 2020

Project Name
Burns Creek Restoration

WRIA 9 WRE Subbasin
Lower Middle Green River

Project Status
The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description
This project includes acquisition of several parcels or portions of parcels of land, and construction of associated habitat restoration along the lower two miles of Burns Creek, a tributary to the Green River, located east of Auburn, Washington. This project is located within the WRIA 9 Lower Middle Green River subbasin.

This proposed project will install hundreds of large trees with rootwads in the stream and wetlands, as these habitats are almost completely lacking in-channel large woody debris (LWD). In addition, thousands of native trees and shrubs will be planted within the riparian and wetlands habitats created. These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, and resident trout that utilize these streams as spawning and rearing habitat. Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
Quantitatively, the project includes acquiring several parcels along Burns Creek, installing of large logs with rootwads into the stream and associated wetlands, and planting thousands of native trees and shrubs along the lower two miles of stream.

Large instream wood has several ecological functions including managing flows, creating deeper pools that provide refugia for fish, preventing bank erosion, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Planted native trees and shrubs will provide shade in stream sections which currently reach temperatures that are approximately 6˚C below the threshold for protection of designated aquatic life use for Core Summer Salmonid Habitat.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features on the attached Site Plan.

Description of the anticipated spatial distribution of likely benefits.
This project involves work along the lower two miles of Burns Creek, a tributary to the Green River, just east of Auburn, Washington. Estimated acreage of restored riparian zone: 28.

Performance goals and measures.

Acres acquired and protected, large log structures installed instream, and number of trees and shrubs planted in the Burns Creek riparian zone.

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, and resident trout that utilize Burns Creek. Chinook and Steelhead are priority species, protected under the ESA. Specifically, salmonids have been documented as using this lower section of Burns Creek for spawning and rearing habitat. LWD and riparian and wetland plantings will directly benefit prey availability, spawning success as well as survival of pre-migrant and out-migrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

Funding and landowner willingness to sell their property.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels, remove structures and replant is estimated at $2M.

Anticipated durability and resiliency.

Once the native plants are installed, irrigation and maintenance will be required to ensure plant survival. Monitoring of plant survival, native plant/shrub cover and non-native invasive plant cover will be performed for a minimum of five years post-planting.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with the acquisition process immediately upon receipt of funding.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain primarily to the ability to acquire land.

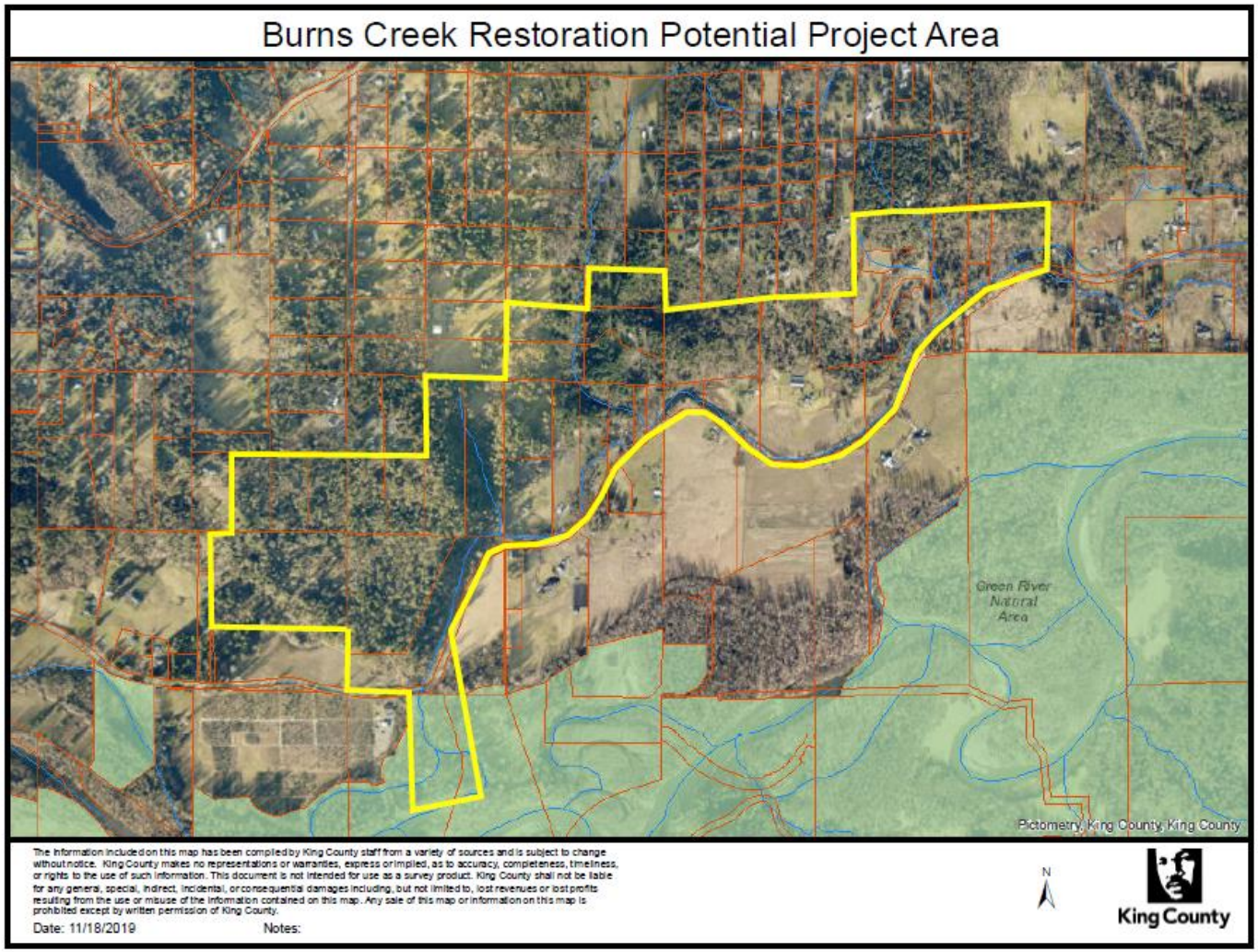


Figure 1. Site Plan for Burns Creek Restoration Area

Crisp Creek Watershed Protection Project (9-MMG-H13)

WRIA 9 – DRAFT Project Description

August 9, 2020

Project Status:

The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Project Name

Crisp Creek Watershed Protection Project

Narrative Description

This project supports an ongoing effort within the Crisp Creek watershed to acquire undeveloped forest lands which would benefit the hydrologic integrity of the WRIA 9 Mid Middle Green River subbasin and protect the water supply and water rights for the Muckleshoot Indian Tribe's Keta Creek Hatchery. The Crisp Creek watershed is located in South King County between the cities of Black Diamond and Maple Valley, Washington and Crisp Creek is an important tributary to the Green River. Watershed protection through land acquisition is important to the Class A Diamond Springs Water Association's water supply. Crisp Creek is one of the highest quality streams in King County and provides cold, clean water to the Green River. This project would be phased in over time and would involve preserving over 400 acres. Protection of the hydrologic function within the Crisp Creek watershed will benefit both hatchery and wild salmon in the Green River including Chinook, Coho, Steelhead, and Chum. Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

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

Acquiring undeveloped forest land within the Crisp Creek watershed protects the long-term hydrologic integrity of the basin, the water quality of Crisp Creek, and the fisheries and aquatic resources of the Green River.

A map and drawings of the project location.

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

Description of the anticipated spatial distribution of likely benefits.

This project involves acquisition of numerous parcels of undeveloped forest land within the Crisp Creek watershed. Distribution of benefits is dependent on the location of acquired parcels within the watershed, but all parcels will be within the Mid Middle Green River subbasin.

Performance goals and measures.

To be determined.

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

Protection of the hydrologic function through acquisition of developed or undeveloped land within the Green River Watershed has the potential to benefit salmon, including Chinook, Coho, Steelhead, and Chum. Chinook and Steelhead are priority species, protected under the ESA.

Identification of anticipated support and barriers to completion.

To be determined.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels is currently unknown.

Anticipated durability and resiliency.

The acquisition and protection of land in the Crisp Creek sub-basin will provide increase resiliency for the basin to provide continual cold, clean water to the downstream fish hatchery and to the Green River salmon resources.

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

Muckleshoot Indian Tribe and King County. Sponsor contact: Carla Carlson, Carla.Carlson@muckleshoot.nsn.us. The sponsor is ready to proceed with scoping and reconnaissance immediately. There are only a few landowners in the upper portion of the Crisp Creek basin, each owning substantial land.

Documentation of sources, methods, uncertainties, and assumptions.

To be determined.

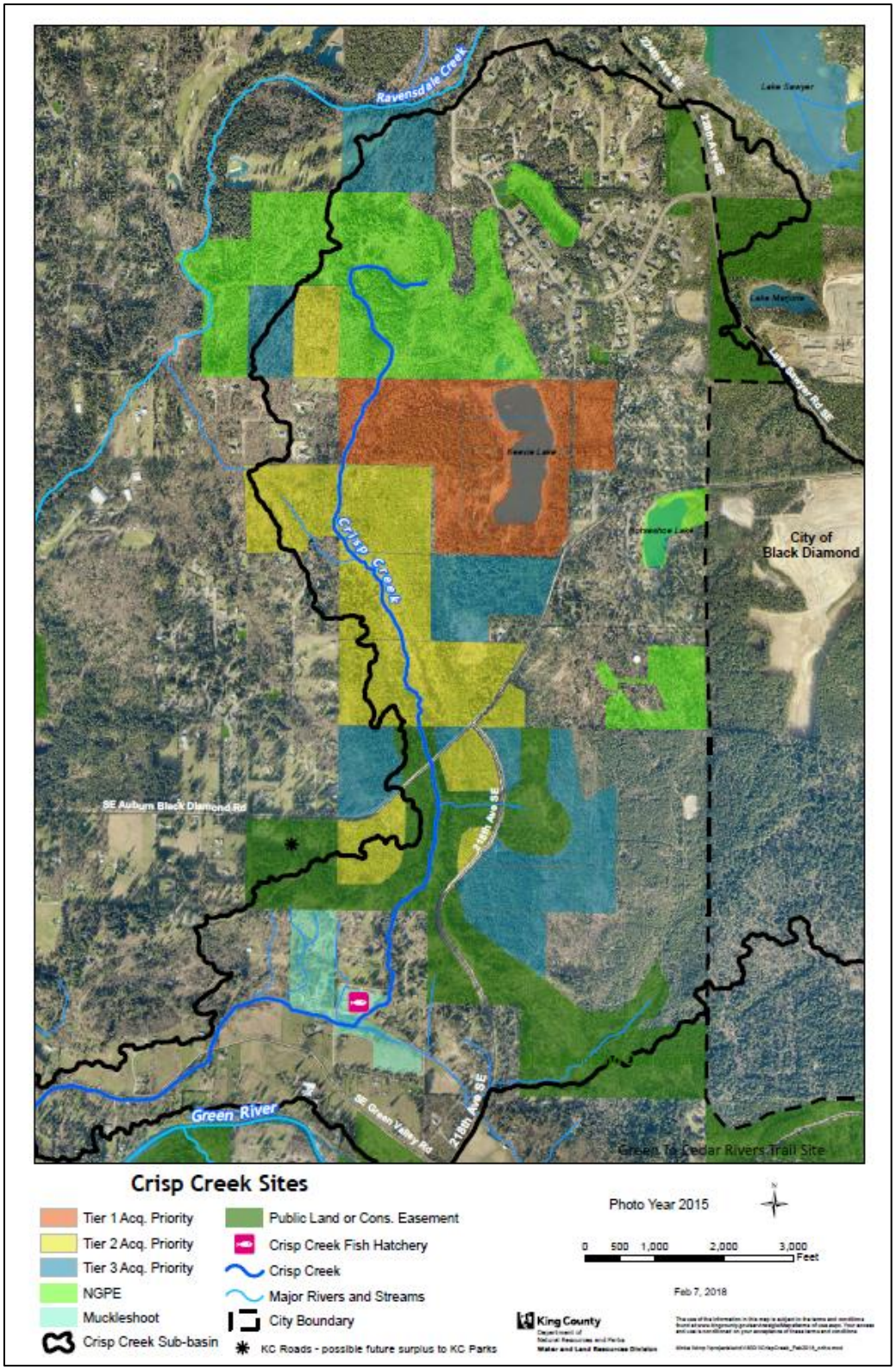


Figure 1. Site Plan for Crisp Creek Restoration Area

Flaming Geyser Revegetation (9-MMG-H14)

WRIA 9 – DRAFT Project Description

July 25, 2020

Project Name
Flaming Geyser Revegetation

WRIA 9 WRE Subbasin
Mid Middle Green River

Project Status
The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description
This project includes revegetating the Green River riparian zones and floodplain wetland within Flaming Geyser State Park which is located about eight miles east of Auburn, Washington. This effort will improve shade and overhanging cover to the river which will moderate water temperatures, reduce evaporation, and enhance fish habitat. The project is located within the WRIA 9 Mid Middle Green River subbasin.

These restoration actions will benefit Chinook, Coho, steelhead, chum, pink, and sockeye salmon, and cutthroat trout that use the Green River for spawning and rearing habitat. Chinook and Steelhead are protected under the U.S. Endangered Species Act (ESA).

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
Planting thousands of native trees and shrubs will provide instream shade to the river to moderate water temperatures and protect salmon and other fish species that use this habitat. Post planting, the trees and shrubs will be monitored and maintained for a minimum of five years.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features on the attached Site Plan.

Description of the anticipated spatial distribution of likely benefits.
This project involves planting the riparian zone of the Green River as it flows for two miles through Flaming Geyser State Park which is currently mostly unvegetated. The total project area proposed for restoration is approximately 42 acres.

Performance goals and measures.
Acres and stream miles revegetated and number and percentage of trees and shrubs that survived after five years.

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

The proposed revegetation action will benefit Chinook, Coho, Steelhead, Chum, Pink, and Sockeye salmon, along with resident Cutthroat Trout. Chinook and Steelhead are protected under the ESA. Specifically, salmonids have been documented as using this river section for spawning and rearing habitat.

Identification of anticipated support and barriers to completion.

Funding is our only limiting factor at this point.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to revegetate the 42 acres of riparian habitat and monitor and maintain the sites is approximately $1.5 million.

Anticipated durability and resiliency.

Once native plants are installed, irrigation and maintenance will be required to ensure plant survival. Monitoring and maintenance of planted vegetation will be performed for five years.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, uncertainties, and assumptions.

The only uncertainty at this point is implementation funding.

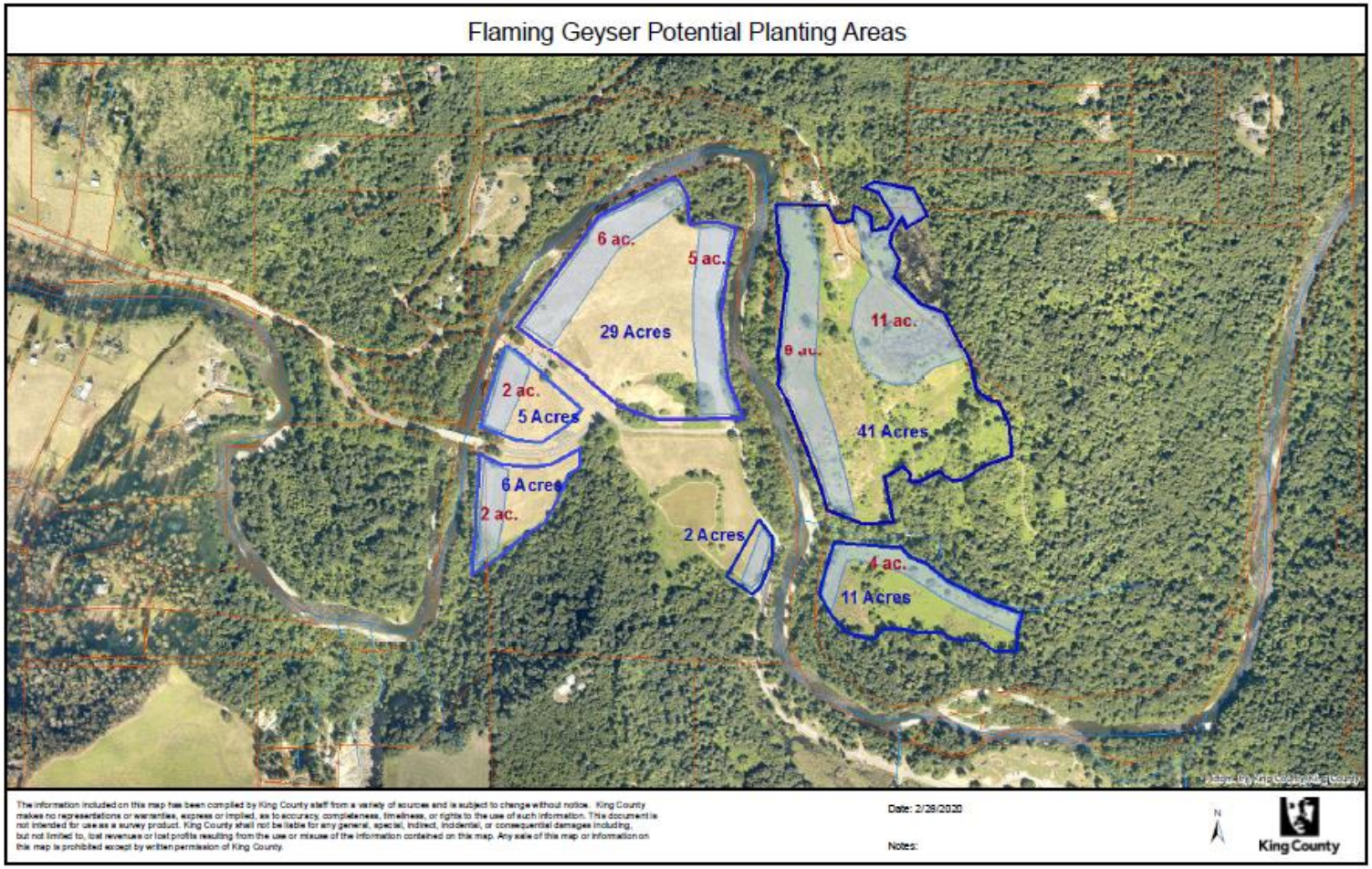


Figure 1. Site Plan for Flaming Geyser Potential Planting Areas

Newaukum Creek Revegetation through Riparian Revegetation and Beaver Colonization (9-N-H15)

WRIA 9 - DRAFT Project Description

July 25, 2020

Project Name

Newaukum Creek Revegetation through Riparian Revegetation and Beaver Colonization

WRIA 9 WRE Subbasin

Newaukum Creek

Project Status

The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description

This project includes acquisition of several parcels along Newaukum Creek and Big Spring Creek located in the City of Enumclaw, Washington. The project is located within the WRIA 9 Newaukum Creek subbasin.

This project targets sections of Newaukum Creek and Big Spring Creek that currently have low effective shade with corresponding high water temperatures. This proposal includes removing structures (buildings, fences, septic infrastructure, etc.) along these stream sections and planting 160,000 native trees and shrubs on 61 acres. These streams flow through active agricultural lands and a livestock exclusion fence will be constructed at one of the sites. These actions will attract beaver colonization, which occurred at a nearby restoration site along Big Spring Creek. Beavers will construct dams and maintain streamflows by ponding water. Shade from installed riparian vegetation will moderate water temperature, reduce evaporation and create habitat. This could be particularly beneficial to documented Chinook, Coho, Steelhead, Chum, Sockeye and resident trout that utilize these streams as spawning and rearing habitat. Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

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

Quantitatively, this project will include planting 160,000 native trees and shrubs on 61 acres along Newaukum Creek and Big Spring Creek. Approximately four miles of stream (one side of creek) will be planted as part of this project.

Native trees and shrubs will provide shade along these stream sections which currently reach temperatures that meet or exceed the threshold for protection of designated aquatic life use of Core Summer Salmonid Habitat. Beaver colonization will result in dams, which will slow water and produce ponds of deeper, cooler water for fish. Newly planted trees will serve as a food supply to attract and support beaver colonization.

A map and drawings of the project location.

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

Description of the spatial distribution of likely benefits.

This project involves three sites along Newaukum Creek: Brandjes, Gaddy and Gwerder. All three project sites are in the City of Enumclaw, Washington. The Brandjes site is 14 acres, Gaddy site is 9 acres and the Gwerder site is 38 acres, for a total project area of 61 acres along Newaukum Creek and Big Spring Creek. This project will plant native trees and shrubs across 61 acres of riparian zone/wetland habitat.

Performance goals and measures.

Acres and stream miles revegetated. Also, localized flooding as a result of beaver dam construction will have to be monitored and addressed, if necessary, by King County.

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Sockeye, and resident trout that utilize these streams. Chinook and Steelhead are priority species, protected under the ESA. Specifically, salmonids have been documented as using these stream sections for spawning and rearing habitat. Improving streamflows and water temperatures through beaver colonization and riparian plantings will directly benefit spawning success as well as survival of pre-migrant and out-migrating juvenile salmonids.

Identification of anticipated support for and barriers to completion.

Funding is our only limiting factor at this point.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels, remove structures and replant is currently unknown.

Project durability and resiliency.

Once the native plants are installed, maintenance (weed control, watering, plant replacement) will be required to ensure a high plant survival rate. Monitoring plant survival, native plant/shrub cover and non-native invasive plant cover will be performed for at least the first five years post-implementation.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with implementation immediately upon receipt of project funding.

Documentation of sources, methods, uncertainties, and assumptions.

The only uncertainty at this point is implementation funding.

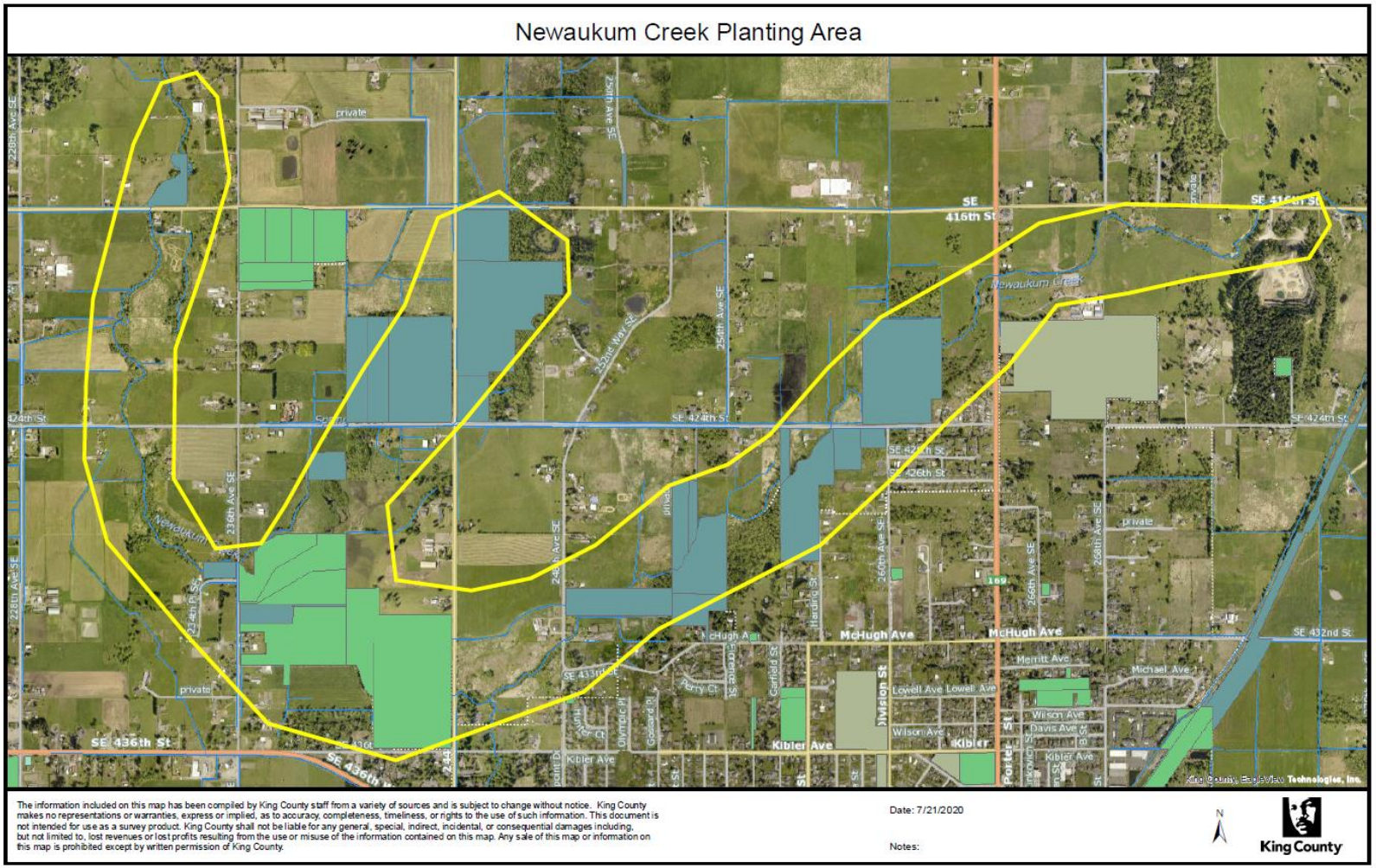


Figure 1. Site Plan of Newaukum Creek Planting Area

Newaukum Creek Tributary Restoration (Gwerder, et al.) (9-N-H16)

WRIA 9 – DRAFT Project Description

July 25, 2020

Project Name

Newaukum Creek Tributary Restoration (Gwerder, et al)

WRIA 9 WRE Subbasin

Newaukum Creek

Project Status

The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description

This project includes excavation and restoration of wetlands and stream channels of Newaukum Creek tributaries located within the City of Enumclaw, Washington. The project is located within the WRIA 9 Newaukum Creek subbasin. This proposed project will install hundreds of large trees with rootwads in the streams and wetlands, as these habitats are almost completely lacking in-channel large woody debris (LWD). In addition, tens of thousands of native trees and shrubs will be planted within the riparian and wetland habitats created. These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Sockeye and resident trout that utilize these streams as spawning and rearing habitat. Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

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

Quantitatively, this project includes installation of hundreds of large trees with rootwads into streams and wetlands and planting tens of thousands of native trees and shrubs on approximately 75 acres. Approximately 0.5 miles of stream will be planted as part of this project.

LWD has several ecological functions including managing flows, creating deeper pools that provide refugia for fish, preventing bank erosion, and trapping organic material that provides nutrients for insects and invertebrates which are a prey source for fish. Planted native trees and shrubs will provide shade in a stream sections which currently reach temperatures that are approximately 6˚C below the threshold for protection of designated aquatic life use for Core Summer Salmonid Habitat.

A map and drawings of the project location.

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

Description of the anticipated spatial distribution of likely benefits.

This project involves work at the Gwerder site located along the right bank of Stonequarry Creek, a tributary to Newaukum Creek, located within the City of Enumclaw, Washington. The total acreage proposed for riparian and wetland restoration is approximately 50 acres.

Performance goals and measures.

To be determined.

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

This project is expected to improve stream habitat with the installation of LWD and reduce in-stream temperatures through shade created by installed native trees and shrubs. These restoration actions will directly benefit documented Chinook, Coho, Steelhead, Chum, Sockeye and resident trout that utilize these streams. Specifically, Chinook, Coho, Steelhead, and Chum are documented as using these stream sections for spawning habitat. Chinook and Steelhead are priority species, protected under the ESA.

Identification of anticipated support and barriers to completion.

Funding and landowner willingness to sell property are the major barriers to completion.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels, remove structures and replant is currently unknown.

Anticipated durability and resiliency.

Once the native plants are installed, irrigation and maintenance will be required to ensure plant survival. Monitoring of plant survival, native plant/shrub cover and non-native invasive plant cover will be performed for a minimum of five years post-construction.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with acquisition, design, and permitting immediately.

Documentation of sources, methods, uncertainties, and assumptions.

The primary uncertainty is funding.

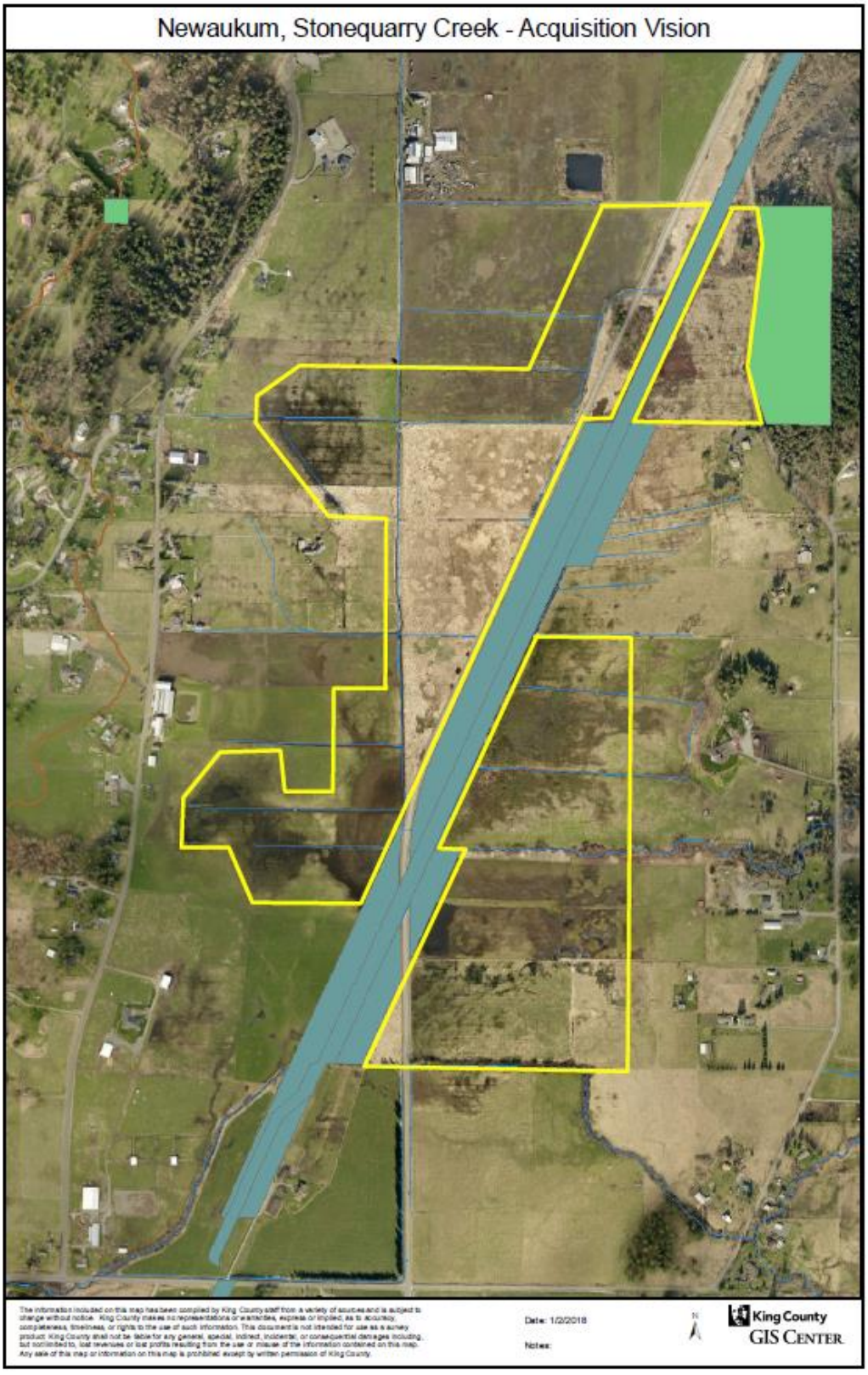


Figure 1. Site Plan for Newaukum Creek Tributary Restoration Site

Middle Green River Open Space Acquisitions (9-MG-H17)

WRIA 9 – DRAFT Project Description

July 25, 2020

Project Name

Middle Green River Open Space Acquisitions

WRIA 9 WRE Subbasin

Soos Creek, Jenkins Creek, Covington Creek, Lower Middle Green River, Mid Middle Green River, Newaukum Creek, and Upper Middle Green River

Project Status

The WRIA 9 WREC discussed this project at the June 23 meeting and supported including this project in the plan.

Narrative Description

This project supports an ongoing effort within the Green River Watershed to acquire developed or developable land which would benefit the hydrologic integrity of the basin. If acquired land was previously developed, structures would be removed including homes, septic systems, and wells. Protection of the hydrologic function within the Green River Watershed has the potential to benefit salmon, including, Chinook, Coho, Steelhead, Chum, as well as Bull Trout and resident trout. Chinook, Steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA).

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

Acquiring developed or developable land within the Green River watershed protects the long-term hydrologic integrity of the basin.

A map and drawings of the project location.

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

Description of the anticipated spatial distribution of likely benefits.

This project involves acquisition of land within the Green River Watershed. Distribution of benefits is dependent on the location of acquired parcels within the watershed. The pertinent Middle Green River subbasins include: Soos Creek, Jenkins Creek, Covington Creek, Lower Middle Green River, Mid Middle Green River, Newaukum Creek, and Upper Middle Green River.

Performance goals and measures.

To be determined.

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

Protection of the hydrologic function through acquisition of developed or undeveloped land within the Green River Watershed has the potential to benefit salmon, including, Chinook, Coho, Steelhead,

Chum, as well as Bull Trout and resident trout. Chinook, Steelhead, and Bull Trout are priority species, protected under the ESA.

Identification of anticipated support and barriers to completion.

The only barriers to completion are funding and landowner willingness to sell property.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels is currently unknown. King County will match funding on a 1:1 basis.

Project durability and resiliency.

The acquisition, restoration and long-term protection of land provides watershed hydrological durability and resiliency.

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

King County. Sponsor contact: Josh Kahan, Josh.Kahan@kingcounty.gov. The sponsor is ready to proceed with Implementation if funding is provided.

Documentation of sources, methods, uncertainties, and assumptions.

To be determined.

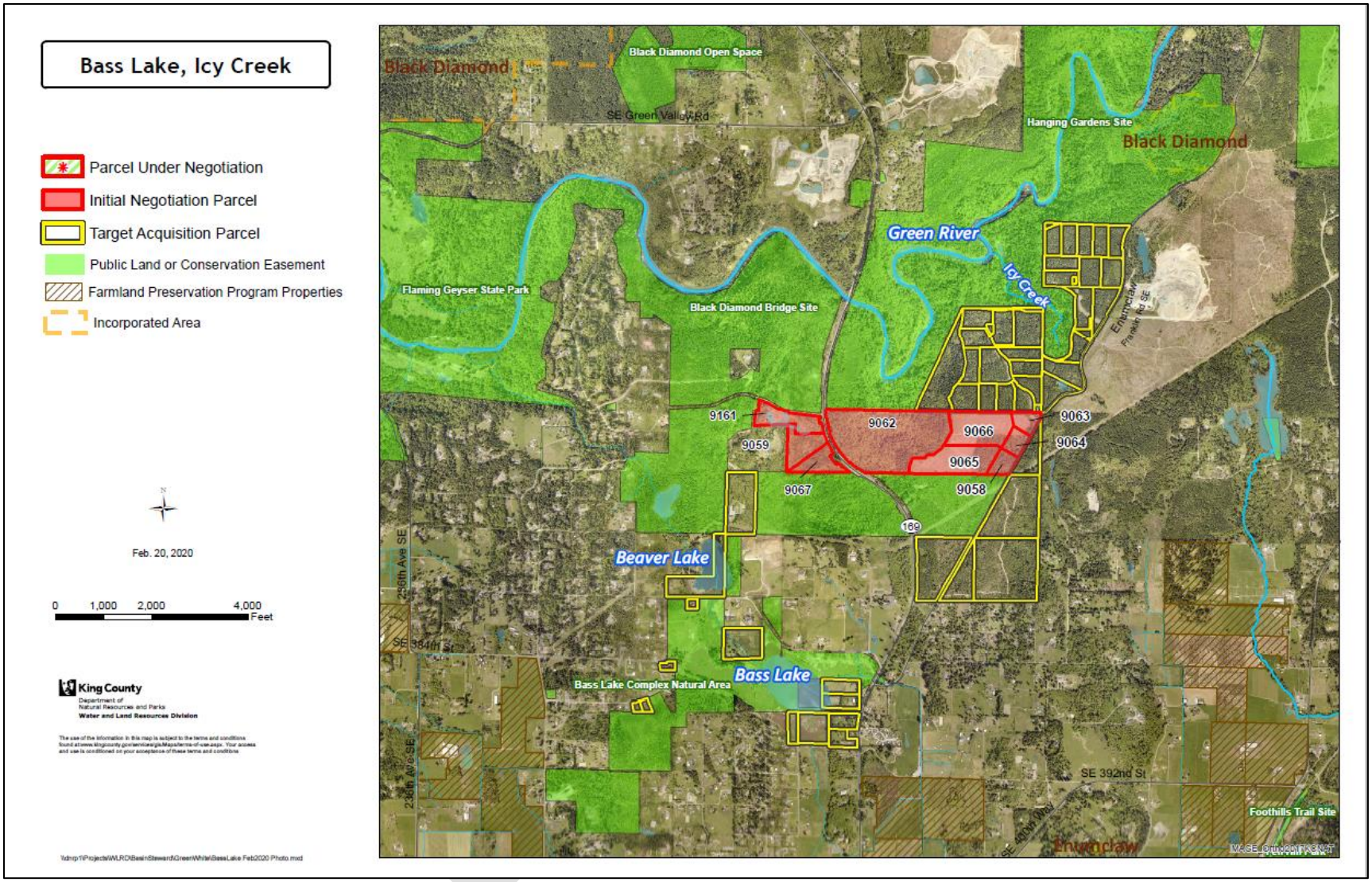


Figure 1. Site Plan for Middle Green River Open Space Acquisitions – Bass Lake and Icy Creek

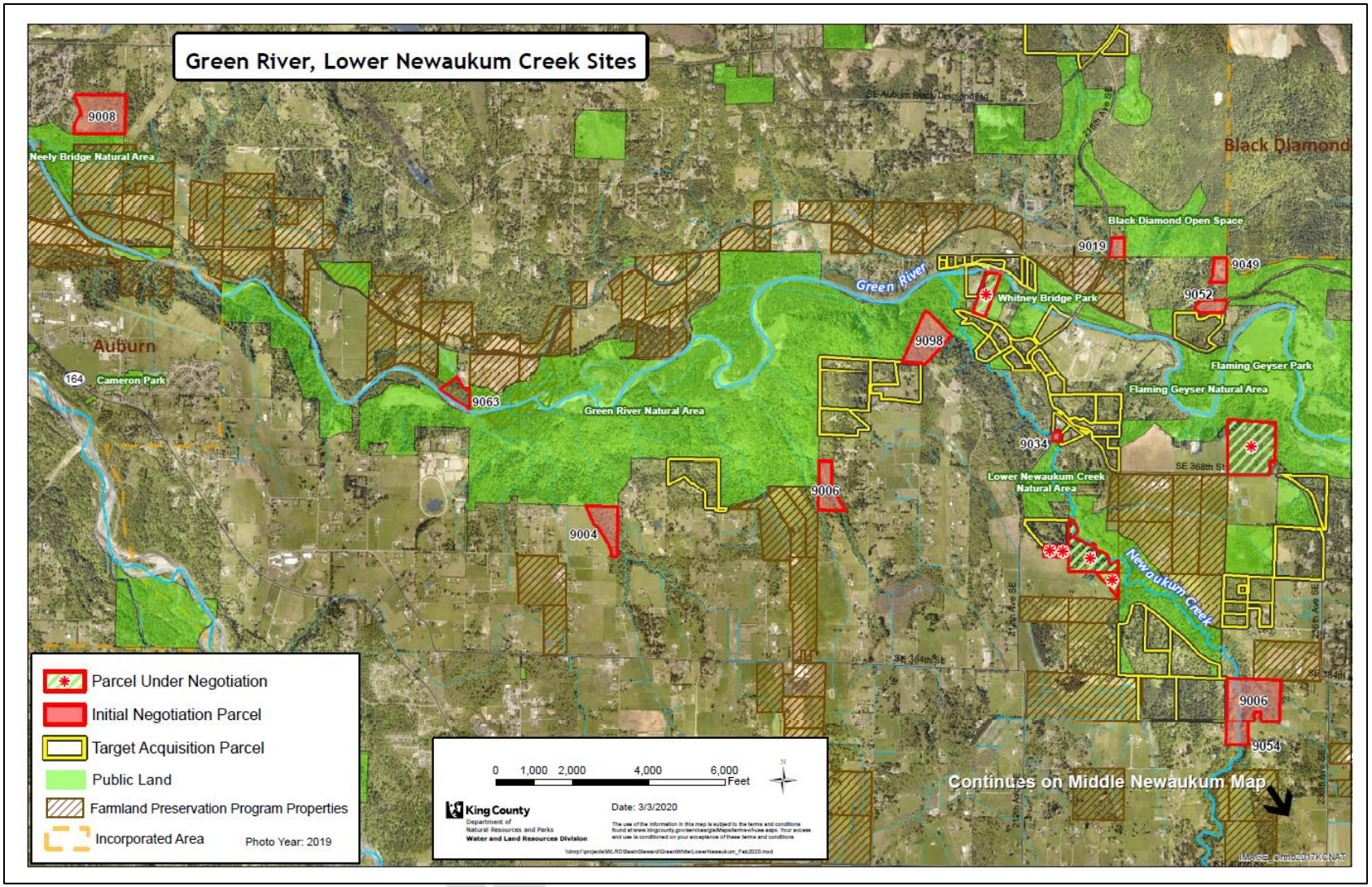


Figure 2. Site Plan for Middle Green River Open Space Acquisitions – Lower Newaukum Creek Sites

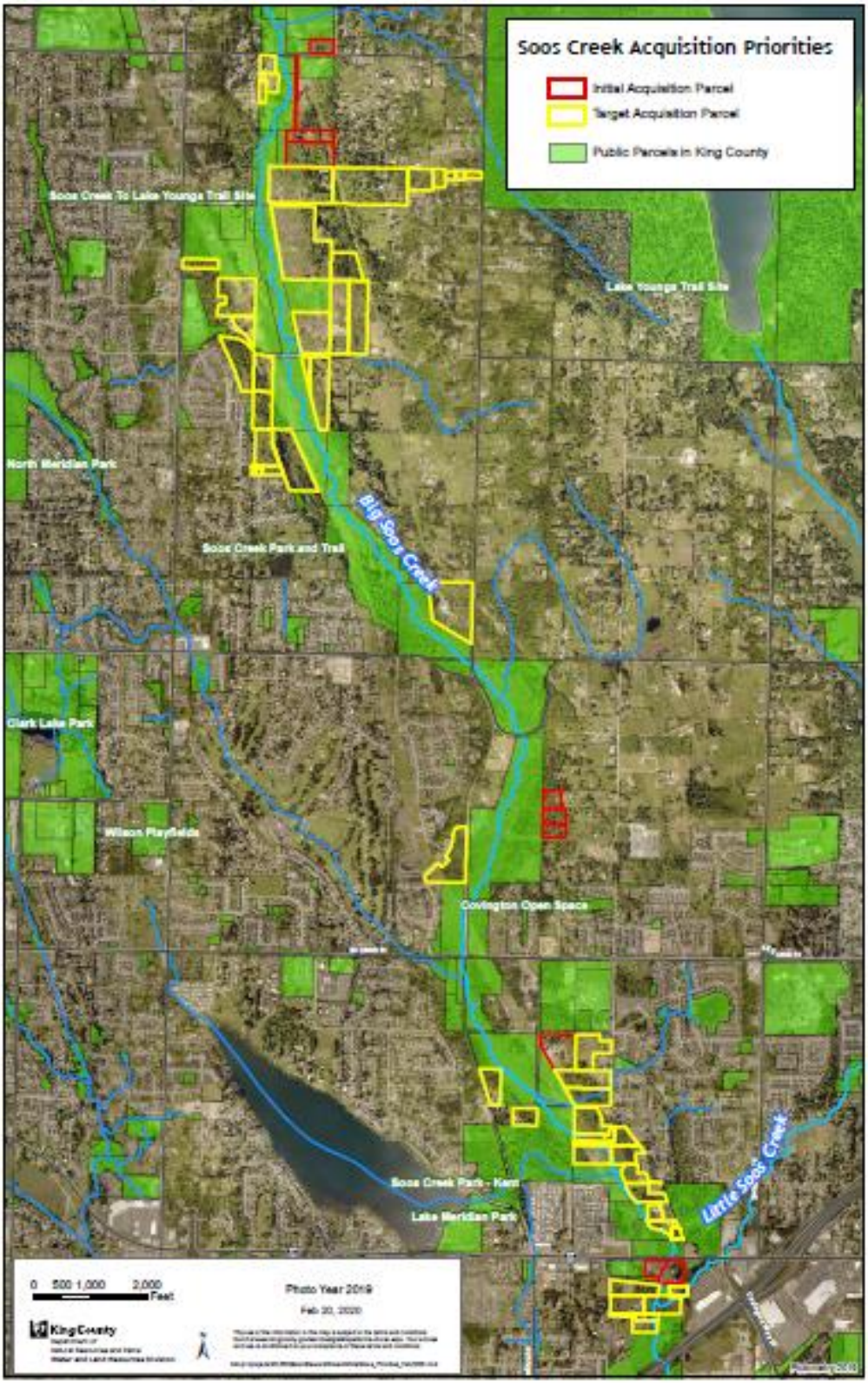


Figure 3. Site Plan for Middle Green River Open Space Acquisitions – Little Soos Creek Sites