WRIA 7 – Project Description
Lake Shoecraft Outlet Modification

December 22, 2020

Project Name and Number
Lake Shoecraft Outlet Modification (7-T-W1)

WRIA 7 WRE Subbasin
Tulalip

Water Offset
62.5 AFY

Narrative Description
Lake Shoecraft is a 133-acre lake located in the Tulalip Plateau west of Arlington. The lake outlet is currently controlled by a weir with removable stop logs (8-inch height per log). Boards are removed in the winter to pass higher flows and prevent flooding and installed in the summer to increase storage and maintain lake levels. An adjustable slide-gate weir has been proposed to replace the stop logs to add more flexibility in outlet control. This would benefit the downstream Bernie Kai-Kai Gobin Hatchery by allowing greater control of releases from the lake and the opportunity to increase storage in the lake. The changes in operations would be targeted to align with hatchery needs, which vary from year to year. Spring and summer releases could be more tightly controlled to maintain higher lake levels and allow more consistent streamflow releases through the summer.

The hatchery has not actively managed the lake level control structure for purposes of maximizing water supply. Changing the structure to create a finer level of control over the lake level presents opportunities for the hatchery to increase management of lake levels to improve water supply – effectively treating Lake Shoecraft as a reservoir. Exploring the hydraulic connection between Lakes Goodwin and Shoecraft will be necessary to understand if the lake outlet control is the hydraulic control for both lakes. If that is the case, the storage in Lake Goodwin could be managed as well, potentially providing additional streamflow benefit.

The Tribes, WDFW and the Lake Shoecraft Homeowner's Association (LSHA) have a MOA for lake level control at Lake Shoecraft. The origination of the MOA was to allow the Tribes to protect the water supply on the West Fork of Tulalip Creek from being altered without warning by the LHSA. Communication with the Association is limited to requests for adding or subtracting a stop board in the lake level control structure a few times per year. Due diligence is needed to understand LSHA criteria for making requests and determining the acceptable range of lake elevations.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
There has been no analysis conducted yet for this project. Very roughly, the volume of water stored over the lake surface behind an 8-inch stop board is 28.6 million gallons (88 acre-feet) (total supply of water for 3 days running hatchery at 7,000 gpm). Changing the weir to a sliding gate which can be raised or lowered in smaller increments, will give the Hatchery could have greater control over the timing and the amount of water stored and released.

Actively managing the lake level, in coordination with the LSHA, could provide a wider range of flow control of West Fork Tulalip Creek to the Tribes' hatchery. As the project develops, Tulalip envisions being able to manage lake elevation within an acceptable range throughout the year to maximize downstream benefits at the hatchery.

A preliminary study for a similar outlet modification on Lake Stevens found that an adjustable outlet could modulate lake levels throughout the year and increase summer levels by as much as half a foot compared to an existing stop log weir. If a similar benefit could be achieved for Lake Shoecraft, that would provide a 62.5 acre-foot increase in summer storage. Site specific investigations are needed to determine more accurate estimates. Additional study could also determine if water temperature benefits could be realized by drawing water from a lower elevation in the lake, although it is assumed the lake stratifies at some point in the summer.

The current weir is entering the end phase of its design life. The dam boards are breaking and are in need of replacement. The weir is 10 feet high; it is assumed excavation was necessary to put the original weir in contact with competent rock. Sediment has built up in the channel behind the weir, placing pressure on the boards, which the weir was likely not designed to withstand. It is assumed that excavation of accumulated sediments will be necessary in order to replace the weir and to potentially increase storage at the downstream end of the lake.

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

Lake Shoecraft is situated north of the Tulalip Indian Reservation. It is hydraulically connected to Lake Goodwin and both lakes flow into West Fork Tulalip Creek. The lake outlet is located near the southwest corner of the lake. The Tulalip hatchery is south of Lake Shoecraft on Tulalip Creek. See Figure 1 and 2 for a map of the project location and hatchery location, respectively.

Description of the anticipated spatial distribution of likely benefits.

The project is anticipated to increase late spring and summer flow in West Fork Tulalip Creek and provide ability to manage streamflows to support the Tulalip salmon hatchery.

Performance goals and measures.

Lake level, weir gate setting, lake discharge, hatchery flows.

Snohomish County has collected continuous lake level data since 2016. There is a staff gauge at the lake outlet control, and Tulalip maintains a stream gauge on the West Fork Tulalip Creek. Performance goals would be to control releases from the lake to slow spring/summer drawdown and maintain higher outflows through late spring and summer.

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

The Tulalip Tribes raise summer/fall Chinook, coho, and chum at the hatchery. Adult salmon return to the hatchery facilities and each species is reared from egg stage to the appropriate life stage for release. Chinook are reared from September to June, coho for approximately 18 months from October over a year to the following May/June, and chum are reared from November to April or May.

The hatchery was originally designed with a water reuse system due to anticipated water shortages due to environmental limitations. As hatchery marking requirements increased, the Tribes' have been holding fish for longer, juggling space and increasing water reuse with limited ability to purify water prior to passing it over fish a second time. Additionally, climatic shifts in precipitation duration, timing

and intensity have altered the availability of water during the rearing cycle. Dry late winters or early springs lead to critical water shortages and water quality issues at the time when the highest biomass is held at the hatchery.

Identification of anticipated support and barriers to completion.

The Tulalip Tribes and WDFW are strong supporters of the project. WDFW owns the outlet structure and access to the outlet structure; Tulalip Tribes manages the downstream hatchery. The current weir is managed in cooperation between WDFW, citizen representatives, and Tulalip Tribes. The lake is surrounded by residential land use, so buy-in from lakeside homeowners and citizens currently cooperating on weir management will also be important. Analysis will be needed to demonstrate ability to manage year-round lake levels without increasing winter flood risk. The lake levels in Lake Shoecraft are not adjudicated and there is no reservoir permit or accompanying beneficial use permit for use of water in the lake that would be potential barriers.

Potential budget and O&M costs.

WDFW is responsible for maintenance of the weir. Additional O&M regarding lake level monitoring and release schedules are to be determined.

Anticipated durability and resiliency.

The current weir will need dam boards replaced in the next year due to deterioration that allows leakage. A stainless steel slide-gate weir would likely be significantly more durable than wood stop logs, though annual operation costs for an adaptively managed outlet may be higher. Replacing with a new outlet would provide greater control over lake levels that would create benefits to the Tribes' hatchery program as well as to LHSA members. A more flexible outlet would also increase resiliency by allowing for adjustment of operations in response to potential future climate change.

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

This project is still in the concept stage. The Tulalip Tribes, who operate the downstream hatchery, and Washington Department of Fish & Wildlife (WDFW), who owns the lake outlet, are strong proponents of the project. Additional analysis is needed on project feasibility.

Documentation of sources, methods, and assumptions.

Snohomish County. https://snohomishcountywa.gov/5391/Shoecraft

Snohomish County, 2020. Lake Shoecraft 2020 Health Report. https://snohomishcountywa.gov/DocumentCenter/View/63184/Shoecraft_2020?bidId=

Figure 1. Lake Shoecraft vicinity. Blue triangle denotes outlet location.

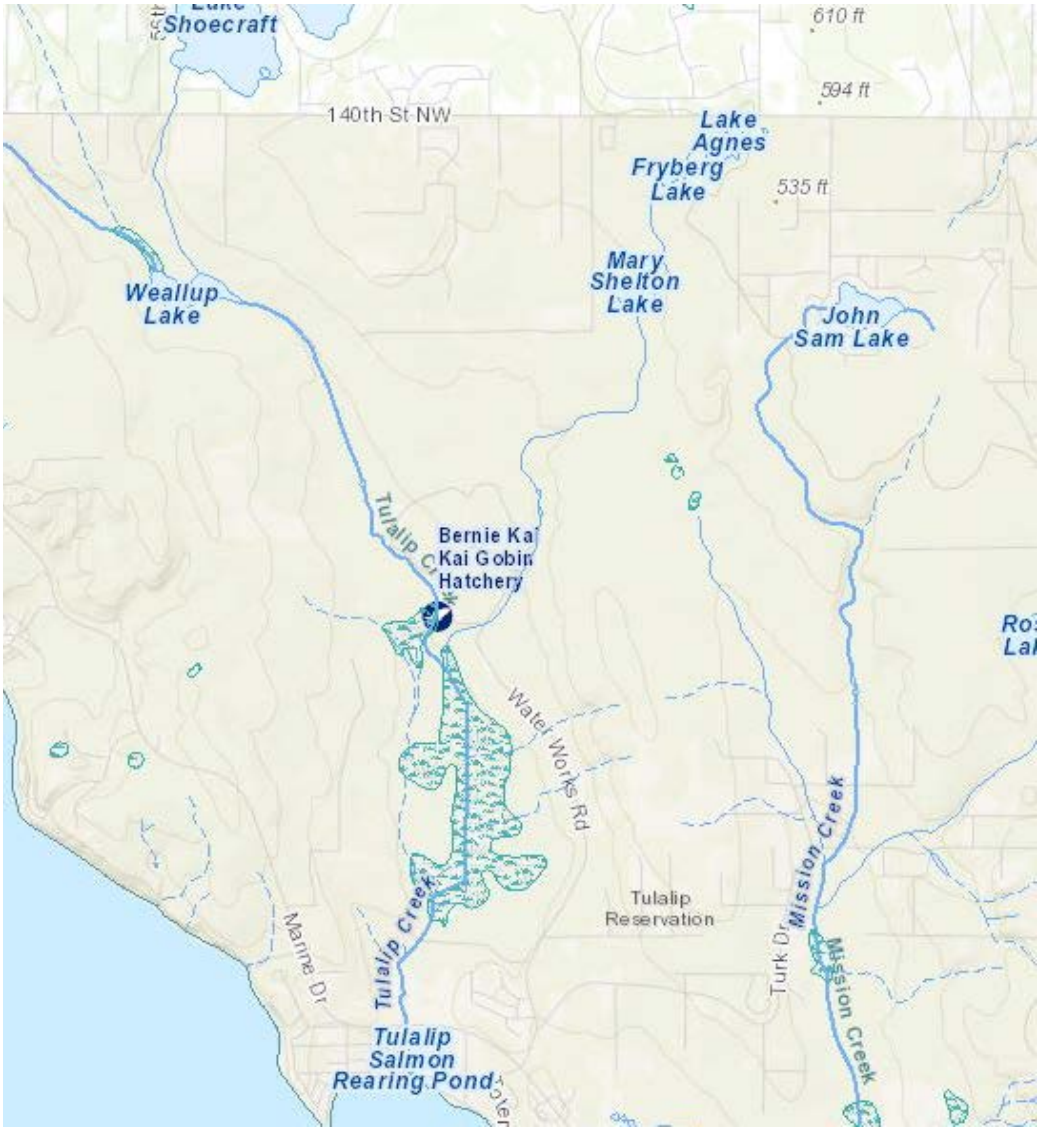


Figure 2. Hatchery location, south-southeast of Lake Shoecraft

WRIA 7 – Project Description
Coho Creek Relocation and Streamflow Enhancement Project

December 22, 2020

Project Name and Project Number
Coho Creek Relocation and Stream Flow Enhancement Project (7-QA-W2[1])

WRIA 7 WRE Subbasin
Quilceda-Allen

Water Offset
362 AFY

Narrative Description
This project includes restoration of fish habitat within Coho Creek (WRIA #07- 0048), a Type 3 tributary to Quilceda Creek located on the Tulalip Reservation within the WRIA 7 Quilceda-Allen sub-basin. This work is being proposed by the Tulalip Tribes to relocate and restore stream habitat conditions within Coho Creek and to augment summer low flows using effluent from a Membrane Bioreactor (MBR) Wastewater Treatment Plant adjacent to Coho Creek. In 1999, a culvert that blocked fish passage, just below the project area, was replaced, improving fish access to over 2 miles of ditch and stream channels. This current project proposes to restore a ditched section of the stream system with a natural channel configuration and to reuse water from the Tribes MBR plant to increase Coho and Chum salmon production within the stream system.

Since 2001, 2,500 feet of Coho Creek has been restored resulting in increased spawning and rearing production. Coho and Chum salmon spawning has averaged 39 and 167 fish annually within Coho Creek. With this proposed project, we hope to add substantially to the numbers of Coho and Chum that use the stream system. We propose to re-evaluate old channel designs, add a water reuse system adding approximately 0.5 cfs, construct 1300 feet of new stream channel, and replant approximately 3 acres of riparian area. The project area will be included in the Tulalip Tribes' annual Coho Creek maintenance and monitoring efforts to track results and needed modifications to ensure success.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
Quantitatively, this project will include restoration of up 1300 feet of Coho Creek through construction of a new stream channel and replant 3 acres of riparian habitat within the ditched sections of stream to improve spawning and rearing habitat for Coho and Chum salmon. Native riparian plantings will provide shade along this stream sections to protect water temperatures and directly benefit prey availability of pre-migrant and outmigrating juvenile salmonids.

[1] Other project numbers associated with this project: 2018-0400; 07-USR-064

In addition to channel restoration, this project will augment flows year-round, including during the summer low flow period by an estimated 0.5 cfs for a total of 362 acre-feet per year. The 0.5 cfs of streamflow augmentation is a year-round average; discharges are anticipated to fluctuate between 0.2 and 0.75 throughout year. These additional flows would be provided by treated wastewater from the Quil Ceda Village membrane bio-reactor (MBR) treatment plant and would be available right away. The MBR plant currently discharges treated wastewater through an EPA-approved underground injection control site (UIC) near I-5. The current UIC is reaching capacity and the wastewater utility is looking for other discharge options to manage predicted increases in discharge quantity. Effluent for flow augmentation to Coho Creek would be from expected increases in treated wastewater. Growth is driving new water uses within the Quil Ceda Village and a new casino is under construction that will be served by the MBR facility when it becomes operational. Treated effluent water quality is close to drinking water standards and would receive additional treatment to reduce temperature. It is anticipated that treated effluent will pass through an infiltration gallery and constructed wetland system prior to discharge into Coho Creek.

Quil Ceda Village and additional neighboring developments are supplied with water from the City of Everett's, which has sufficient water rights to meet current and future demand associated with this project. Additional wastewater treated at the MBR treatment plant will be used to supplement stream flows in Coho Creek.

A feasibility study is currently underway to predict increases in treated wastewater from Quil Ceda Village and potential new customers, and subsequent streamflow augmentation potential. An estimated 1 cfs additional streamflow could be provided to Coho Creek, however a conservative offset estimate of 0.5 cfs is applied since feasibility studies are still underway. The proposed project would provide an additional 20% of flow during low flows periods. There is currently purple pipe infrastructure in the vicinity of the project area, but additional piping will need to be constructed to bring water to Coho Creek.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features in Figure 1.

Description of the spatial distribution of likely benefits.

This project includes restoration of 1300 feet of Coho Creek through construction of a new stream channel and installation of 3 acres of riparian plantings along the ditched sections of stream to improve rearing and spawning habitat for Coho and Chum salmon. Coho Creek is a tributary to Quilceda Creek.

Performance goals and measures.

Construction of 1300 ft. of new stream channel, replacing the current ditched channel. Increasing capacity by increasing channel length by 430 ft. and increasing summer low flow levels. We estimate rearing areas will increase by 33% and spawning by 100% over existing conditions. The project will also increase habitat quality by providing a pool:riffle channel type with additions of large woody debris (~ 30 pieces) and a diversified riparian condition. With these improvements we expect spawning numbers of coho and chum to increase by 33% within six years of project implementation. Performance will be determined by completing construction according to designs and through monitoring of the riparian condition, and spawning within the constructed reach. Stream flow and water quality will also be monitored to evaluate performance. Monitoring will take place for at least a six year period and will help determine whether the restoration efforts were effective.

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

These restoration actions will benefit juvenile and adult Coho and Chum that utilize this stream for spawning and rearing, increasing both the quantity and quality of habitat.

Identification of anticipated support for and barriers to completion.

The Tulalip Tribes support the improvement of salmonid habitat including flow augmentation. Lack of funding, the need for additional assessment and water reuse approval are known barriers to completion that we are aware of. Flow augmentation is still under study, location approach and quantity has yet to be determined.

Estimate of capital costs and reoccurring O&M costs.

The project area is under tribal ownership, a very rough estimated cost for project assessment, design permitting and construction is $950,000. Estimated operation and maintenance costs are $50,000 over 5 years or $10,000/yr.

Project durability and resiliency.

If constructed properly and after five years of maintenance it is hoped the project area will naturally adjust to post construction conditions and function without requiring additional future maintenance. The riparian enhancements will also survive and adjust to existing conditions. Maintenance in the form of weed control and plant replacement are likely and will 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. Spawning activity, discharge and water quality will also be monitored within the stream section restored.

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

Tulalip Tribe. Sponsor contact: Daryl Williams, dwilliams@tulaliptribes-nsn.gov and Kurt Nelson, knelson@tulaliptribes-nsn.gov. The sponsor will be ready to proceed with design and implementation in 2022.

Documentation of sources, methods, uncertainties, and assumptions.

Construction methods and uncertainties and assumptions are based on previous construction efforts and project plans. The current channel designs will be reevaluated especially previous assumptions, issues and changing conditions (e.g. how to do stream restoration with beaver).

Figure 1. Coho Creek Relocation and Stream Flow Enhancement Project Site

WRIA 7 – Project Description
Lake Stevens Outlet Structure & Lake Level Management Project

December 22, 2020

Project Name and Number
Lake Stevens Outlet Structure & Lake Level Management Project (7-LP-W3)

WRIA 7 WRE Subbasin
Little Pilchuck

Water Offset
500 AFY

Narrative Description
This project would replace an outdated weir structure in the Lake Stevens outlet channel that manages the elevation in Lake Stevens to maximize flood storage availability in the winter and maintain summer flows in the channel while keeping lake elevations high for summer recreation. A review of lake management data and historic lake elevations indicated that a replacement weir could improve functionality and summer base flows for fish. The replacement weir would allow for more precise management of lake levels, resulting in increased lake levels and increased streamflow coming out of the lake during the summer and early fall months into Catherine Creek.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
Based on preliminary modeling, modification of the weir structure and operations could increase summer (July-October) lake levels by nearly half a foot. This would provide approximately 500 acre-feet per year of additional summer storage and increased streamflow releases for the 1,000-acre lake. Figure 1 below shows proposed lake levels (green) compared to existing (blue) for 2016-2018.

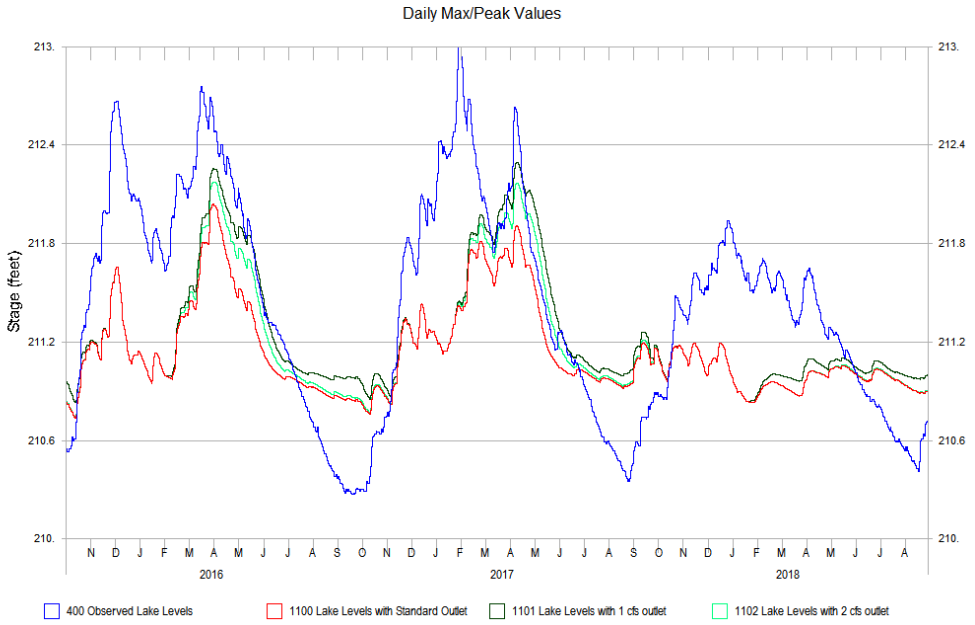


Figure 1. Plot of current and modeled lake levels

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

See Figure 2 and Figure 3 below for the location of the Lake Stevens Outlet Channel and project area, respectively.

Figure 2. Lake Stevens Outlet Channel

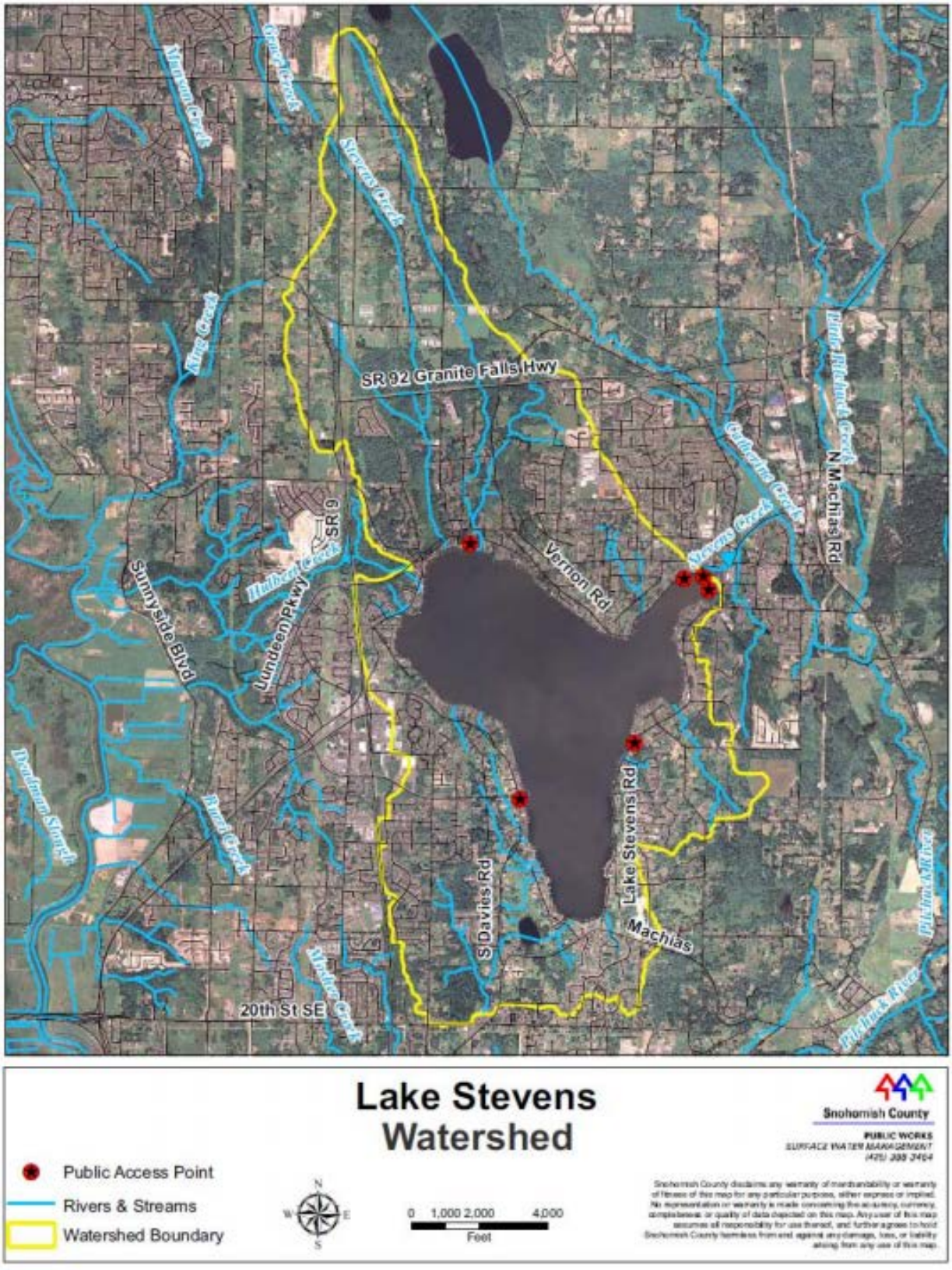


Figure 3. Lake Stevens outlet management and lake level management project area

Description of the anticipated spatial distribution of likely benefits.

This project would provide additional summer flow in the Lake Stevens outlet channel and Catherine Creek downstream from river mile 1.1, tributary to the Little Pilchuck River, and potential winter flood reduction around Lake Stevens.

Performance goals and measures.

Lake level, weir gate setting, lake discharge, creek flows.

The project is expected to allow lake level to be managed within a more precise range (as shown in the figure above). Lake level monitoring and flow monitoring in the lake outlet channel and/or Catherine Creek should be initiated prior to weir replacement to provide ability to compare pre- and post-project conditions.

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

The Lake Stevens outlet stream is listed as being used by coho salmon, cutthroat trout, steelhead, and bull trout by various sources (WDFW 2019, USFWS 2019, SalmonScape 2019). Kokanee are also present in the lake and inflowing tributaries and may use the outlet channel as well. Of these salmonid fish species, coho salmon and cutthroat trout are expected to make the most frequent use of the ditch-like outlet stream channel along North Lakeshore Drive and Hartford Drive extending downstream from the lake. Steelhead and bull trout use may occasionally occur, but their use is anticipated to be infrequent.

Identification of anticipated support and barriers to completion.

The City of Lake Stevens is the project proponent and sponsor. The City anticipates additional support from lakeside residents, Sound Salmon Solutions, Snohomish County Conservation District, the City's legislative delegation, and several regulatory agencies. Potential regulatory barriers to completion could be the United States Army Corps of Engineers and Department of Archaeology and Historic Preservation (DAHP).

Potential budget and O&M costs.

Preliminary cost estimate: $1.4 million

Estimated O&M costs: $2,000 annual operational costs (i.e., electricity/controls) and $5,000 annual inspection and maintenance costs (i.e., City crew routine inspection and cleaning of weir facility)

Anticipated durability and resiliency.

The proposed outlet control facility will likely be a reinforced concrete weir wall system with corrosion resistant adjustable and possibly automated weir(s) and gate(s). This structure would likely be significantly more durable than the current wood stop log configuration, though annual operation costs for an adaptively managed outlet may be higher. The facility will be designed for decades of use with adjustability for climate change.

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

The City of Lake Stevens is the identified project sponsor. The project is being added to the City's 2021-2026 Capital Improvement Plan to be approved by City Council this fall 2020. This project is in early analysis stage. The City of Lake Stevens conducted a preliminary hydrologic/hydraulic modeling analysis to evaluate potential benefits of outlet modifications. The feasibility study has been conducted and the project will be moving into design next.

Documentation of sources, methods, and assumptions.

Davido Consulting Group, Inc., 2020. Lake Stevens Outlet Study Technical Memorandum. Seattle, WA.

WRIA 7 – Project Description
Lochaven Source Switch

December 22, 2020

Project Name and Number
Lochaven Source Switch (7-P-W4)

WRIA 7 WRE Subbasin
Pilchuck

Water Offset
12.7 AFY

Narrative Description
This project would involve retirement of the water right associated with the Lochaven Estates community (Lochaven) as a basis for increasing flows within the Pilchuck River and downstream areas. Water supply for this community would be transitioned to the Snohomish PUD (PUD) system and Lochaven's existing water right would be protected instream through Ecology's trust water resources program. Lochaven should be eligible to apply for a grant during future grant rounds to be compensated for permanently putting their water right in the trust program.

Lochaven (also referred to as Lochsloy) is located approximately two miles northeast of the City of Lake Stevens, Washington. The 83-home community is situated between State Route 92 (Granite Falls Highway) and the Pilchuck River. The Washington State Department of Health (DOH) indicates that the Lochaven Water System serves a residential population of 225 people with 83 calculated connections (DOH 2020). The community's water source is a shallow (23 feet deep) dug groundwater production well installed in 1968 with a capacity of 200 gallons per minute (gpm) (DOH 2020). The well is located in the southwest quarter of the southwest quarter of Section 27, Township 30 North, Range 6 East in the WRIA 7 delineated Pilchuck subbasin. The shallow completion depth of the Lochaven Water System groundwater well suggests hydraulic connection with the Pilchuck River is possible. The PUD sources its water primarily from the City of Everett system. The City of Everett primarily sources its water from Spada Lake. Existing PUD transmission lines border Lochaven to the west and north.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
The Lochaven Water System's water right consists of the following:

Groundwater Certificate G1-*09986CWRIS – Issued to Evergreen Group No. 3 on August 5, 1971. This certificate specifies an instantaneous quantity (Qi) of 100 gpm and an annual quantity (Qa) of 42 acre-feet per year (AFY).

According to the Lochaven Water System Water Use Efficiency Reports, the water system's total annual water use during the period from 2010 to 2019 averaged 9,562,481 gallons per year (29 AFY) (DOH 2020). During the last 5 years, the highest annual use occurred during 2018, when annual use was 11,428,300 gallons (35.1 AFY). The committee decided to count the consumptive use portion of the water right for offset and calculate consumptive use using assumptions from Consumptive Use tech memo. However, using that method led to a result greater than the actual water use. Therefore, it was

assumed that indoor use was 60 gpcd (x 2.75 people per household) and the remainder was outdoor use. This leads to a consumptive use estimate of 12.7 AFY.

This project is centered around the cessation of withdrawal from an aquifer in hydraulic connection with the Pilchuck River and a commensurate increase in water obtained from the PUD. Based on historic water use and full cessation of the Lochaven Estates water right, we estimate that the project offset to the Pilchuck River would be on the order of 29 to 42 AFY. Water provided from the PUD to the Lochaven Water System would come from Lake Stevens area groundwater water rights (25%) and Spada Reservoir (75%).

This estimate assumes that groundwater production from Lochaven is terminated as a result of this project. The estimate also assumes 100 percent streamflow depletion (that is, the amount of water removed from the Skykomish River as a result of pumping is equivalent to the pumping volume, not counting return flows). This estimate is also based on the full amount listed on the water right certificates and would need to be evaluated if this project moves forward.

The reduction in groundwater withdrawal from the water system would presumably require the City of Everett to increase their diversion from certificated rights to supply this community. Everett has sufficient water rights (both inchoate and beneficially used rights) to satisfy this projected volume.

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

See Figure 1 for a map of the site location.

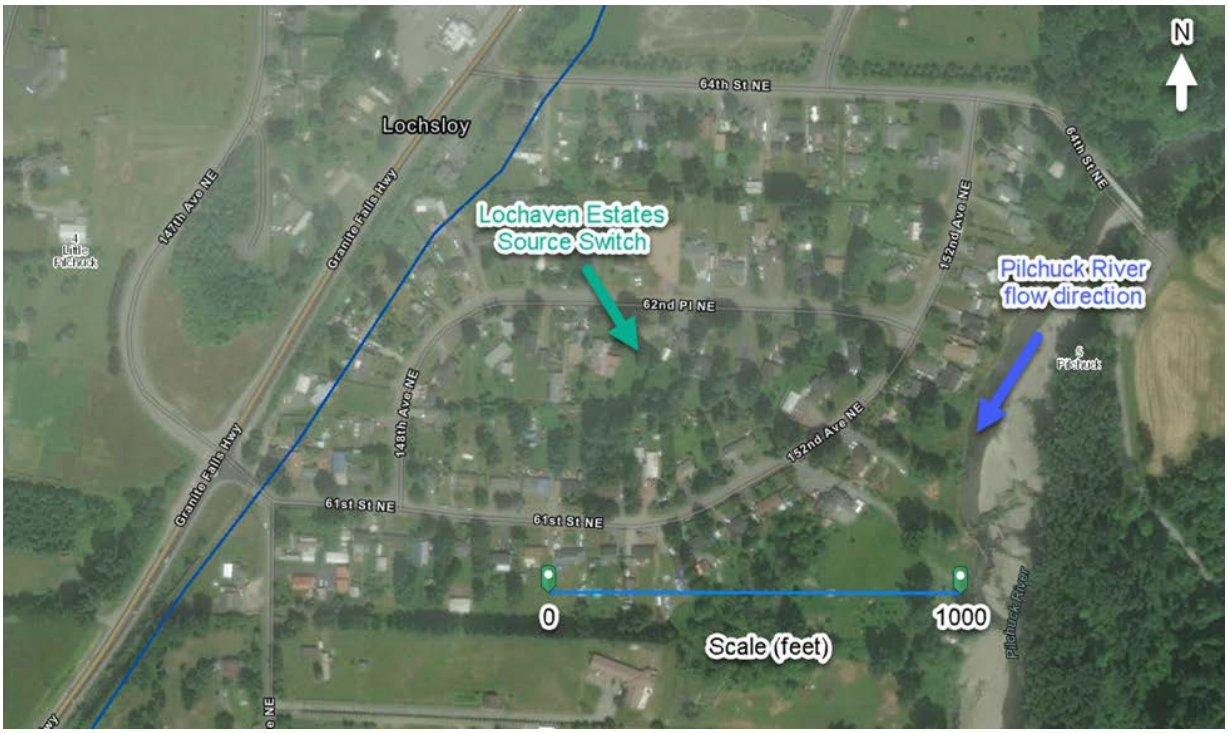


Figure 1. Lochaven Estates

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the Pilchuck River (including portions of the Little Pilchuck Subbasin) and downstream areas. The project offset is anticipated to occur near River Mile 15, approximately 10 ½ linear miles from the confluence with the mainstem Snohomish River.

Performance goals and measures.

The performance goals are to increase streamflow within the Pilchuck River by terminating the pumping of near-river groundwater for water supply. Performance can be directly measured by the quantity of water obtained by the water system from the PUD and the reduction in groundwater pumping by the Lochaven Water System.

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

The Pilchuck subbasin is inhabited by Chinook, Sockeye, Coho, Chum, Pink, Steelhead, Bull Trout, coastal Cutthroat Trout and rainbow trout (WDFW 2020a and 2020b). Chinook, Steelhead and Bull Trout are priority species, protected by the U.S. Endangered Species Act.

Identification of anticipated support and barriers to completion.

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

Barriers to completion include the following:

- Potential reluctance from Lochaven Water System leadership to release their water right and/or control of their water supply.
- Potential reluctance from Lochaven Estates residents to a possible increase in water rates.

Potential budget and O&M costs.

The primary cost associated with this source switch are: (1) the costs associated with connecting the PUD water conveyance to Lochaven; and (2) the cost to purchase the Lochaven system water right for permanent instream flow benefit.

The estimated budget required to connect to the PUD system is between $400,000 and $1.6m depending upon whether the Lochaven system would like to wholesale water from the PUD or have the PUD take over and upgrade the system, respectively. The estimate for the PUD to provide wholesale service to Lochaven would include the cost to install the necessary master meter, pressure reducing valve, complete the connection(s) between the two systems, and payment of the PUD's General Facilities Charge (GFC). The estimate for the PUD to take over the Lochaven system would include the purchase price of the private water system, payment of the GFC, replacement of the system's aging and insufficiently sized 2" distribution lines with new 8" ductile iron mains, installation of new meters, installation of fire hydrants, and connection into the PUD's mains to the north and southwest side of the Lochaven system.

The water rights owned by Lochaven that could be released as a component of this project have value. A cost evaluation would be required to estimate a value for the Lochaven water right portfolio. 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 AFY ranged from $1,500 to $6,505. For Lochaven's

Certificate G1-*09986CWRIS and its Qa of 42 AFY, this equates to a value in the range of $63,000 to $273,210.

The primary ongoing cost associated with this source switch for the City is purchase of water from the PUD, which would be dependent on the negotiated rate. Assuming a rate of $3.24 per 100 cubic feet (PUD's existing commodity rate for commercial customers) and an annual volume of 9,562,481 gallons, the associated fee would be about $41,000/yr. This ongoing cost is anticipated to be covered by ratepayers.

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, based on a certificated water right, and not subject to interruption.
- The new source is associated with a purveyor with sufficient inchoate water rights to support the source switch on a long-term basis.
- 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.

Snohomish PUD has been identified as the project sponsor and has started conversations with the Lochaven Estates. This project is in the conceptual development stage.

Documentation of sources, methods, and assumptions.

GeoEngineers, Inc. (GeoEngineers) and NHC. 2020. WRIA 7 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. January 2020.

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

Washington State Department of Health. 2020. Division of Environmental Health Office of Drinking Water, Sentry Internet Home Page. https://fortress.wa.gov/doh/eh/portal/odw/si/Intro.aspx

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.

WRIA 7 – Project Description
Three Forks Potential MAR Site

December 22, 2020

Project Name and Number
MAR in Snoqualmie Watershed (7-USQ-W10)

WRIA 7 WRE Subbasin
Upper Snoqualmie

Narrative Description
One of the potential MAR sites identified by Ecology is located on King County Parks property near North Bend, Washington. The site is located where the North Fork Snoqualmie River and the Middle Fork Snoqualmie River meet to form the Snoqualmie River. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to the Snoqualmie River above what occurs under existing conditions. The project concept includes diverting surface water annually from the North Fork or Middle Fork Snoqualmie Riverduring high flow periods when 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 Snoqualmie River during the low flow period (typically late summer and early fall) by recharging the aquifer adjacent to the North Fork Snoqualmie River and providing additional groundwater discharge to the river through MAR.

The site is located in the WRIA 7 Upper Snoqualmie River subbasin and is currently covered by farmland and forest. The downstream baseflow benefit will likely be predominately within the Snoqualmie South subbasin due to subbasin proximity and flow direction. The site is located in Section 34, Township 24 North, Range 8 East (Willamette Meridian) and is bounded to the north by the North Fork Snoqualmie River, to the south by the Middle Fork Snoqualmie River, and to the east by 428th Ave SE. Using the Washington State Department of Ecology's online Well Report Viewer database, no domestic water supply wells were identified within approximately ¼ mile of site.

The project should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
The proposed MAR facility will result in streamflow benefits to the Snoqualmie River by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but, based on historic streamflow data, the project could divert surface water from either the North Fork or Middle Fork Snoqualmie River at a rate of approximately 1 cubic foot per second (cfs) for approximately 155 days between November and January and again between March and June when water is available for beneficial use. The goal of the project is to increase streamflow. The project could divert up to 198 acre-feet (AF) per year into the MAR facility. This is a preliminary estimate of the quantity of water diverted and timing of diversion, which needs further analysis through a site

specific feasibility study. The Committee used the USGS STRMDEPL "stream deplete" model to estimate monthly streamflow augmentation. The Committee anticipates the greatest benefit from streamflow augmentation during low flow periods (typically late summer and early fall). The results of the 30-year run of the stream deplete model are shown in Table 1 below.

Month	Acre-feet
January	21.53
February	22.21
March	22.29
April	21.00
May	24.12
June	26.15
July	28.67
August	26.89
September	23.38
October	21.73
November	19.70
December	18.88

Table 1. Three Forks Potential MAR Site Stream Deplete Monthly Results

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 Snoqualmie 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 in Figure 1. The specific project site and size would be determined during the feasibility study.

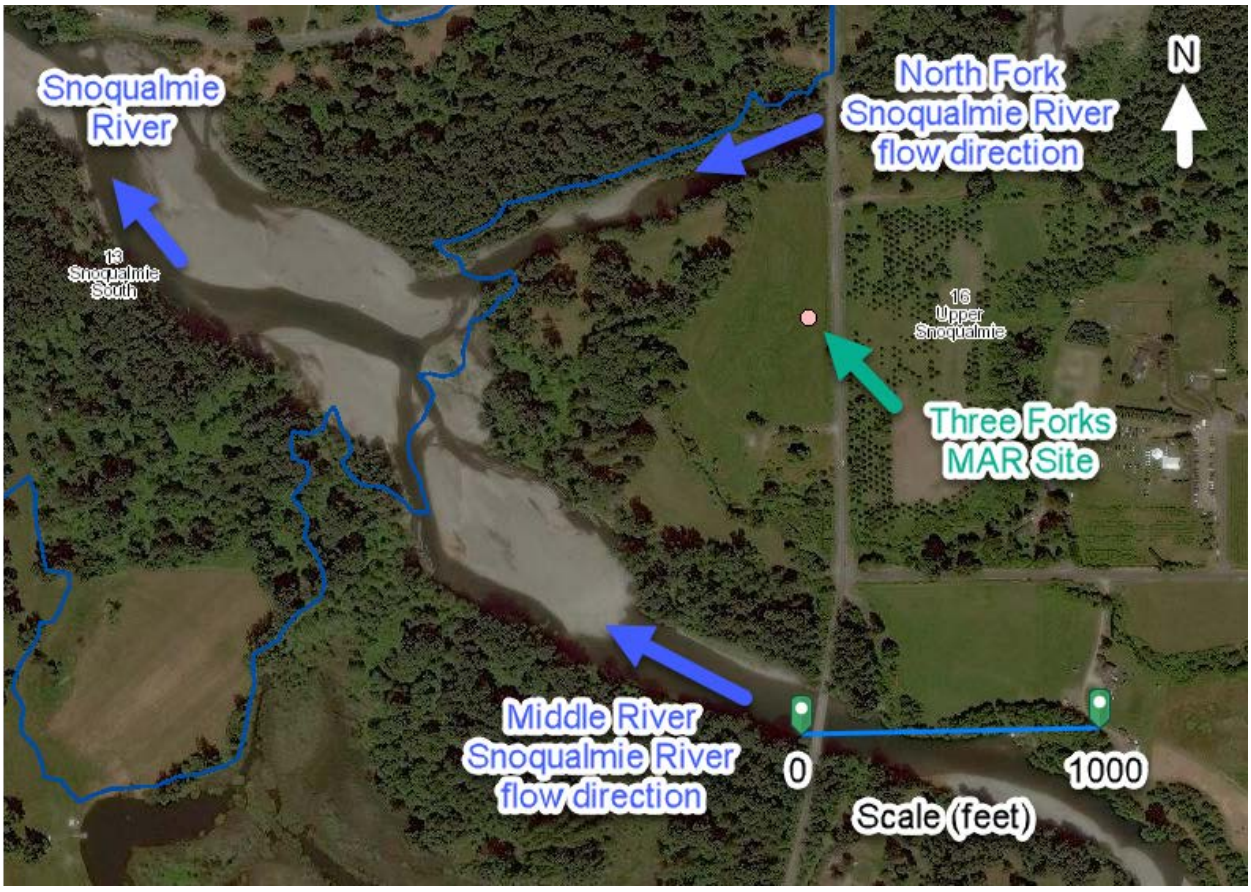


Figure 1. Three Forks MAR Potential Site Location

Description of the anticipated spatial distribution of likely benefits.

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

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the Snoqualmie River by infiltrating water through the MAR facility to improve baseflow in the Snoqualmie River. The performance measures will be an increase in baseflow in summer in the Snoqualmie River. Specific quantities and timing for surface water diversion would be determined during a feasibility study.

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

The Upper Snoqualmie River subbasin is inhabited by coastal cutthroat trout and rainbow 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 Act. 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 feasibility, construction and operation and maintenance costs, and obtaining a water right from the North Fork or Middle Fork Snoqualmie River or the adjacent aquifer for beneficial use at the MAR facility. WWT initiated outreach to the landowner (King County) to evaluate their level of support for the project and they expressed support for discussing the project concept.

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 has been identified as 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

Dragovich, J. D., Littke, H. A., Anderson, M. L., Wessel, G. R., Koger, C. J., Saltonstall, J. H., MacDonald, J. H., Jr., Mahan, S. A., and DuFrane, S. A., 2010, Geologic map of the Carnation 7.5-minute quadrangle, King County, Washington: Washington Division of Geology and Earth Resources, Open File Report 2010-1, scale 1:24,000 https://ngmdb.usgs.gov/Prodesc/proddesc_23051.htm

Geoengineers, Inc. (GeoEngineers). 2020. WRIA 7 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. January 2020.

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

WRIA 7 – Project Description
North Bend Potential MAR Site

December 22, 2020

Project Name and Number
MAR in Snoqualmie Watershed (7-USQ-W10)

WRIA 7 WRE Subbasin
Upper Snoqualmie

Narrative Description
One of the potential MAR sites identified by Ecology is located on City of North Bend property near North Bend, Washington. The site is located on the south side of the South Fork Snoqualmie River about one mile upstream of the confluence with the Snoqualmie River. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to the South Fork Snoqualmie River above what occurs under existing conditions. The project concept includes diverting surface water annually from the South Fork Snoqualmie River during high flow periods when 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 South Fork Snoqualmie River during the low flow period (typically late summer and early fall) by recharging the aquifer adjacent to the South Fork Snoqualmie River and providing additional groundwater discharge to the river through MAR.

The site is located in the WRIA 7 Upper Snoqualmie subbasin and is currently covered by forest. The site is located in Section 4, Township 23 North, Range 8 East (Willamette Meridian) and is bounded to the north by Mt Si Golf course, to the south by forest and commercial buildings including Calvary Mt Si church and Mt Si gymnastics academy, to the east by the Snoqualmie Valley Trail and to the west by Boalch Avenue NW. Using the Washington State Department of Ecology's online Well Report Viewer database, twelve domestic water supply wells were identified within approximately ¼ mile of the site and are completed at depths ranging between 22 and 129 feet; it is likely that several of the identified wells are located on the opposite side of the South Fork Snoqualmie River (east side) in a nearby housing development.

The project should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
The proposed MAR facility will result in streamflow benefits to the South Fork Snoqualmie River by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but, based on historic streamflow data, the project could divert surface water from the South Fork Snoqualmie River at a rate of approximately 1 cubic foot per second (cfs) for approximately 100 days between November and the end of May when water is available for beneficial use. The goal of the project is to increase streamflow. The project could divert up to 198 acre-feet per

year (AFY) into the MAR facility. These are preliminary estimate of the quantity of water diverted and timing of diversion, which needs further analysis through a site specific feasibility study. The Committee used the USGS STRMDEPL "stream deplete" model to estimate monthly streamflow augmentation. The Committee anticipates the greatest benefit from streamflow augmentation during low flow periods (typically late summer and early fall). The results of the 30-year run of the stream deplete model are shown in Table 1 below.

Month	Acre-feet
January	11.65
February	10.61
March	11.37
April	12.76
May	15.83
June	17.47
July	18.35
August	17.32
September	15.54
October	14.84
November	13.73
December	12.39

Table 1. North Bend Potential MAR Site Stream Deplete Monthly Results

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 may be added to actual streamflow in the South Fork Snoqualmie 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 in Figure 1. The specific project site and size would be determined during the feasibility study.

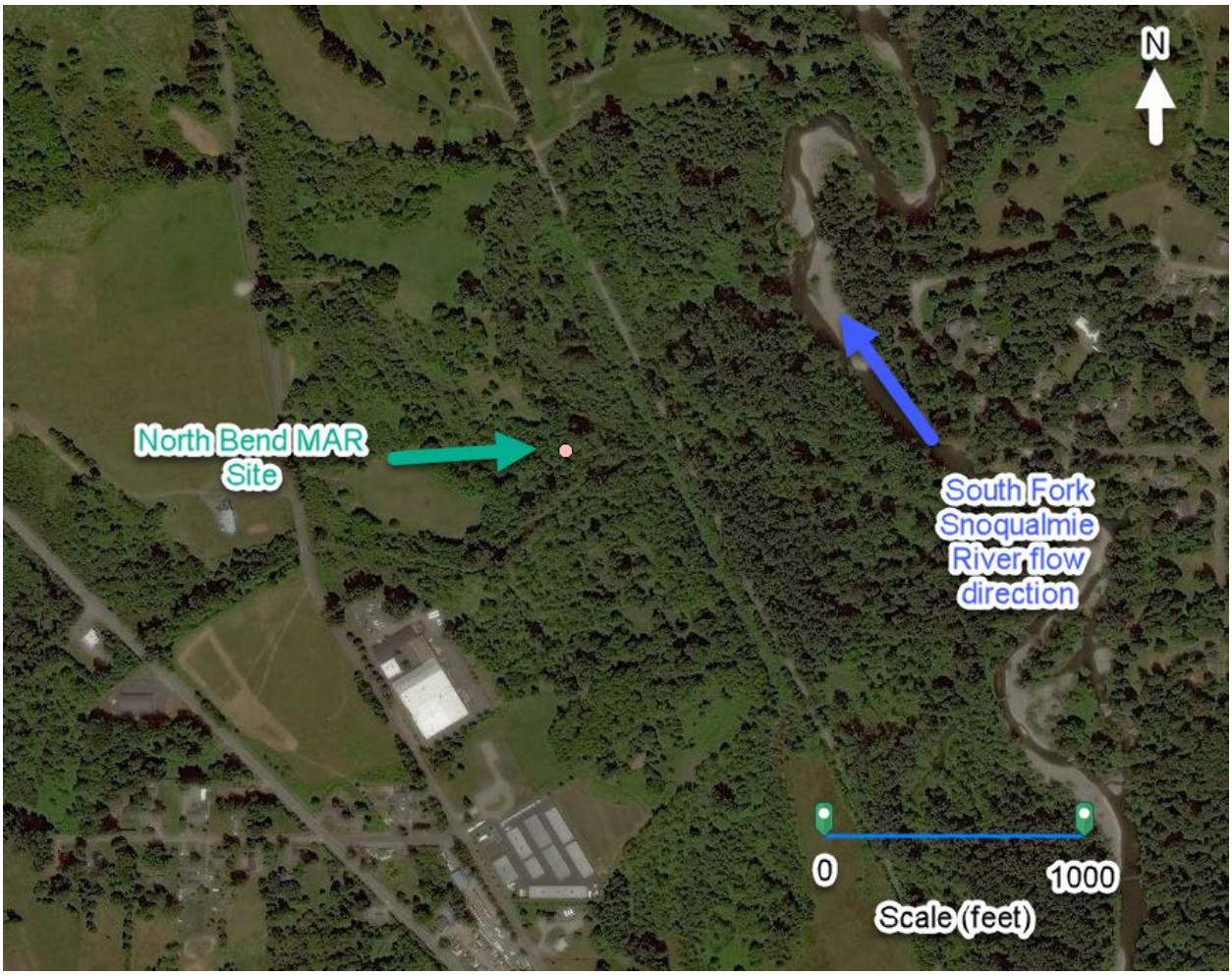


Figure 1. North Bend MAR Potential Site Location

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the South Fork Snoqualmie River and the mainstem of the Snoqualmie River.

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the South Fork Snoqualmie River by infiltrating water through the MAR facility to improve baseflow in the South Fork Snoqualmie River. The performance measures will be an increase in baseflow in summer in the South Fork Snoqualmie River. Specific quantities and timing for surface water diversion would be determined during a feasibility study.

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

The Upper Snoqualmie subbasin is inhabited by coastal cutthroat trout and rainbow 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 Act. 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 feasibility, construction and operation and maintenance costs, and obtaining a water right from the South Fork Snoqualmie River or the adjacent aquifer for beneficial use at the MAR facility. GeoEngineers initiated outreach to the landowner (City of North Bend) to evaluate their level of support for the project and they expressed support for discussing the project concept.

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 has been identified as 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

Dragovich, J.D., Littke, H.A., Anderson, M.L., Hartog, Renate, Wessel, G.R., DuFrane, S.A., Walsh, T.J., MacDonald, J.H., Jr., Mangano, J.F., and Cakir, Recep. 2009. Geologic map of the Snoqualmie 7.5-minute quadrangle, King County, Washington: Washington Division of Geology and Earth Resources, Geologic Map GM-75. Scale 1:24,00. https://ngmdb.usgs.gov/Prodesc/proddesc_87491.htm

Geoengineers, Inc. (GeoEngineers). 2020. WRIA 7 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. January 2020.

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

WRIA 7 – Project Description
Middle Fork Snoqualmie Potential MAR Site

December 22, 2020

Project Name and Number
MAR in Snoqualmie Watershed (7-USQ-W10)

WRIA 7 WRE Subbasin
Upper Snoqualmie

Narrative Description
One of the potential MAR sites identified by Ecology is located on Washington State Department of Natural Resources (DNR) State Trust Lands property near Tanner, Washington. The site is located upstream of Tanner along the south side of a bend in the Middle Fork Snoqualmie River. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to the Middle Fork Snoqualmie River above what occurs under existing conditions. The project concept includes diverting surface water annually during high flow periods 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 Middle Fork Snoqualmie River during the low flow period (typically late summer and early fall) by recharging the aquifer adjacent to the Middle Fork Snoqualmie River and providing additional groundwater discharge to the river through MAR.

The site is located in the WRIA 7 Upper Snoqualmie subbasin and is currently covered by forest. The site is located in Section 21, Township 21 North, Range 9 East (Willamette Meridian) and is bounded to the north by the Middle Fork Snoqualmie River, to the south by National Forest Development Road NF-5600, to the east by forest, and to the west by sparsely populated single-family homes among forest. Using the Washington State Department of Ecology's online Well Report Viewer database, two domestic water supply wells were identified within approximately ¼ mile of the site and are completed at depths of 272 and 400 feet, respectively.

The project should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
The proposed MAR facility will result in streamflow benefits to the Middle Fork Snoqualmie River by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but, based on historic streamflow data, the project could divert surface water from the Middle Fork Snoqualmie River at a rate of approximately 1 cubic foot per second (cfs) for approximately 100 days between November and the end of May when water is available for beneficial use. The goal of the project is to increase streamflow. The project could divert up to 198 acre-feet per year (AFY) into the MAR facility. These are preliminary estimate of the quantity of water diverted and timing of diversion, which needs further analysis through a site specific feasibility study. The Committee

used the USGS STRMDEPL "stream deplete" model to estimate monthly streamflow augmentation. The Committee anticipates the greatest benefit from streamflow augmentation during low flow periods (typicallylate summer and early fall). The results of the 30-year run of the stream deplete model are shown in Table 1 below.

Month	Acre-feet
January	8.14
February	7.91
March	14.88
April	21.29
May	26.76
June	23.99
July	19.42
August	15.63
September	12.77
October	11.46
November	10.15
December	8.86

Table 1. Middle Fork Snoqualmie Potential MAR Site Stream Deplete Monthly Results

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 may be added to actual streamflow in the Middle Fork Snoqualmie 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 may 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 in Figure 1. The specific project site and size would be determined during the feasibility study.

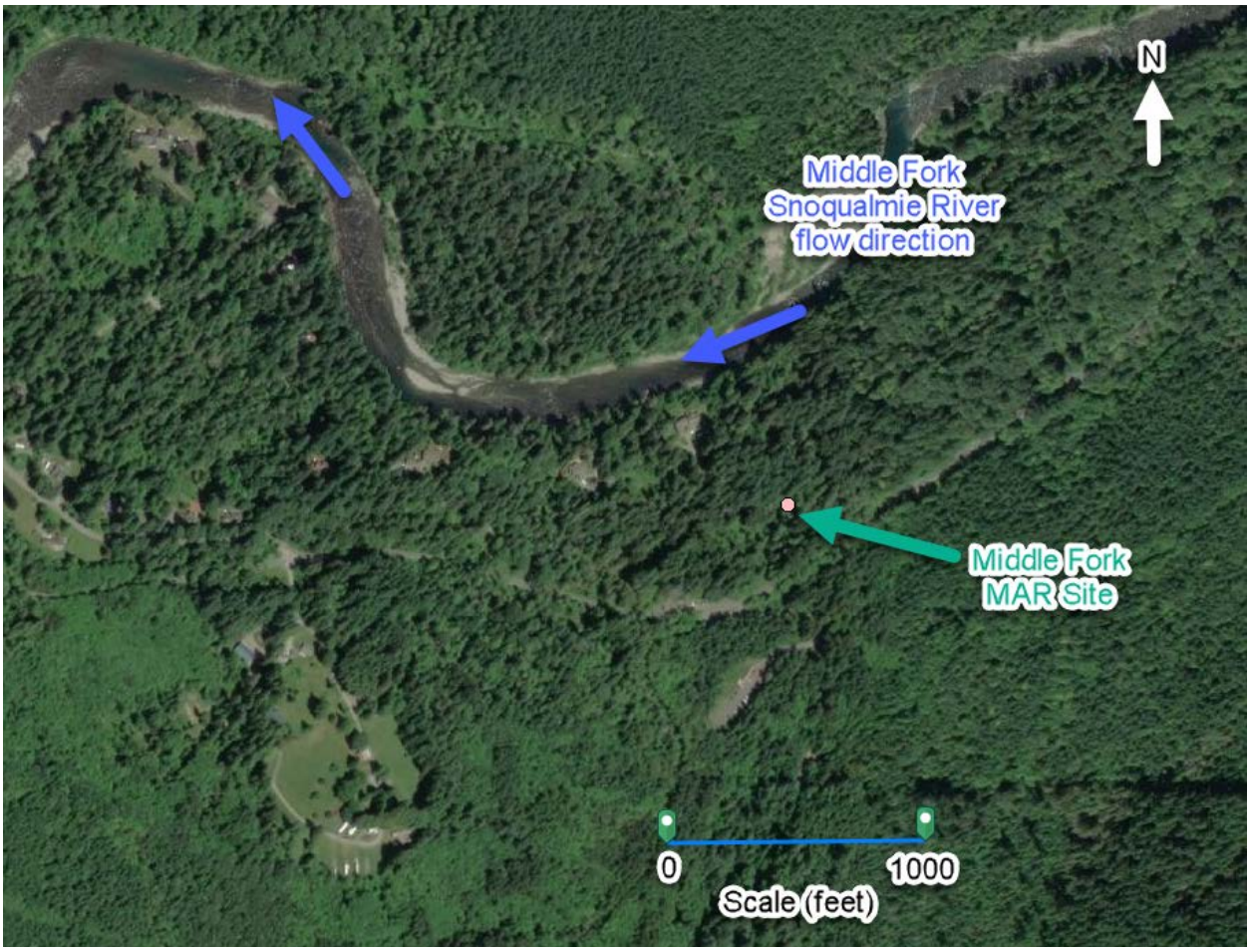


Figure 1. Middle Fork Snoqualmie MAR Potential Site Location

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the Middle Fork Snoqualmie River.

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the Middle Fork Snoqualmie River by infiltrating water through the MAR facility to improve baseflow in the Middle Fork Snoqualmie River. The performance measures will be an increase in baseflow in summer in the Middle Fork Snoqualmie River. Specific quantities and timing for surface water diversion would be determined during a feasibility study.

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

The Upper Snoqualmie subbasin is inhabited by coastal cutthroat trout and rainbow 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 Act. 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 feasibility, construction and operation and maintenance costs, and obtaining a water right from the Middle Fork Snoqualmie River or the adjacent aquifer for beneficial use at the MAR facility. WWT initiated outreach to the landowner (Washington State Department of Natural Resources) to evaluate their level of support for the project and they expressed support for discussing the project concept.

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 has been identified as a potential project sponsor for this project.

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

Jones, M.A. 1999. Geologic framework for the Puget Sound aquifer system, Washington and British Columbia: U.S. Geological Survey. Professional Paper PP-1424-C. Scale 1:100,000. https://ngmdb.usgs.gov/Prodesc/proddesc_23051.htm

Geoengineers, Inc. (GeoEngineers). 2020. WRIA 7 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. January 2020.

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

WRIA 7 – Project Description
NF-5700 Potential MAR Site

December 22, 2020

Project Name and Number
MAR in Snoqualmie Watershed (7-USQ-W10)

WRIA 7 WRE Subbasin
Upper Snoqualmie

Narrative Description
One of the potential MAR sites identified by Ecology is located on Washington State Department of Natural Resources (DNR) State Trust Lands property near the headwaters of the North Fork Snoqualmie River. This project would augment stream flows by increasing surficial aquifer discharge (baseflow) to the North Fork Snoqualmie River above what occurs under existing conditions. The project concept includes diverting surface water annually from the North Fork Snoqualmie River during high flow periods when 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 North Fork Snoqualmie River during the low flow period (typically late summer and early fall) by recharging the aquifer adjacent to the North Fork Snoqualmie River and providing additional groundwater discharge to the river through MAR.

The site is located in the WRIA 7 Upper Snoqualmie subbasin and is currently covered by forest. The site is located in Section 11, Township 25 North, Range 9 East (Willamette Meridian) and is bounded to the north by National Forest Development Road NF-5700, to the east by National Forest Development Road NF-5720, and to the south and west by forest. Using the Washington State Department of Ecology's online Well Report Viewer database, no domestic water supply wells were identified within approximately ¼ mile of site.

The project should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.
The proposed MAR facility will result in streamflow benefits to the North Fork Snoqualmie River by diverting and temporarily storing a portion of seasonal high flows into the shallow alluvial aquifer. This project is currently conceptual but, based on historic streamflow data, to the project could divert surface water from the North Fork Snoqualmie River at a rate of approximately 1 cubic foot per second (cfs) for approximately 155 days between mid-November and mid-January and again from the end of March to the end of June when water is available for beneficial use. The goal of the project is to increase streamflow. The project could divert up to 307 acre-feet per year (AFY) into the MAR facility. This is a preliminary estimate of the quantity of water diverted and timing of diversion, which needs further analysis through a site specific feasibility study. The Committee used the USGS STRMDEPL "stream deplete" model to estimate monthly streamflow augmentation. The Committee anticipates the greatest

benefit from streamflow augmentation during low flow periods (typically late summer and early fall). The results of the 30-year run of the stream deplete model are shown in Table 1 below.

Month	Acre-feet
January	20.27
February	19.74
March	21.37
April	20.58
May	21.17
June	20.87
July	22.36
August	23.11
September	22.47
October	22.80
November	22.09
December	20.62

Table 1. NF5700 Potential MAR Site Stream Deplete Monthly Results

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 may be added to actual streamflow in the North Fork Snoqualmie 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 in Figure 1. The specific project site and size would be determined during the feasibility study.

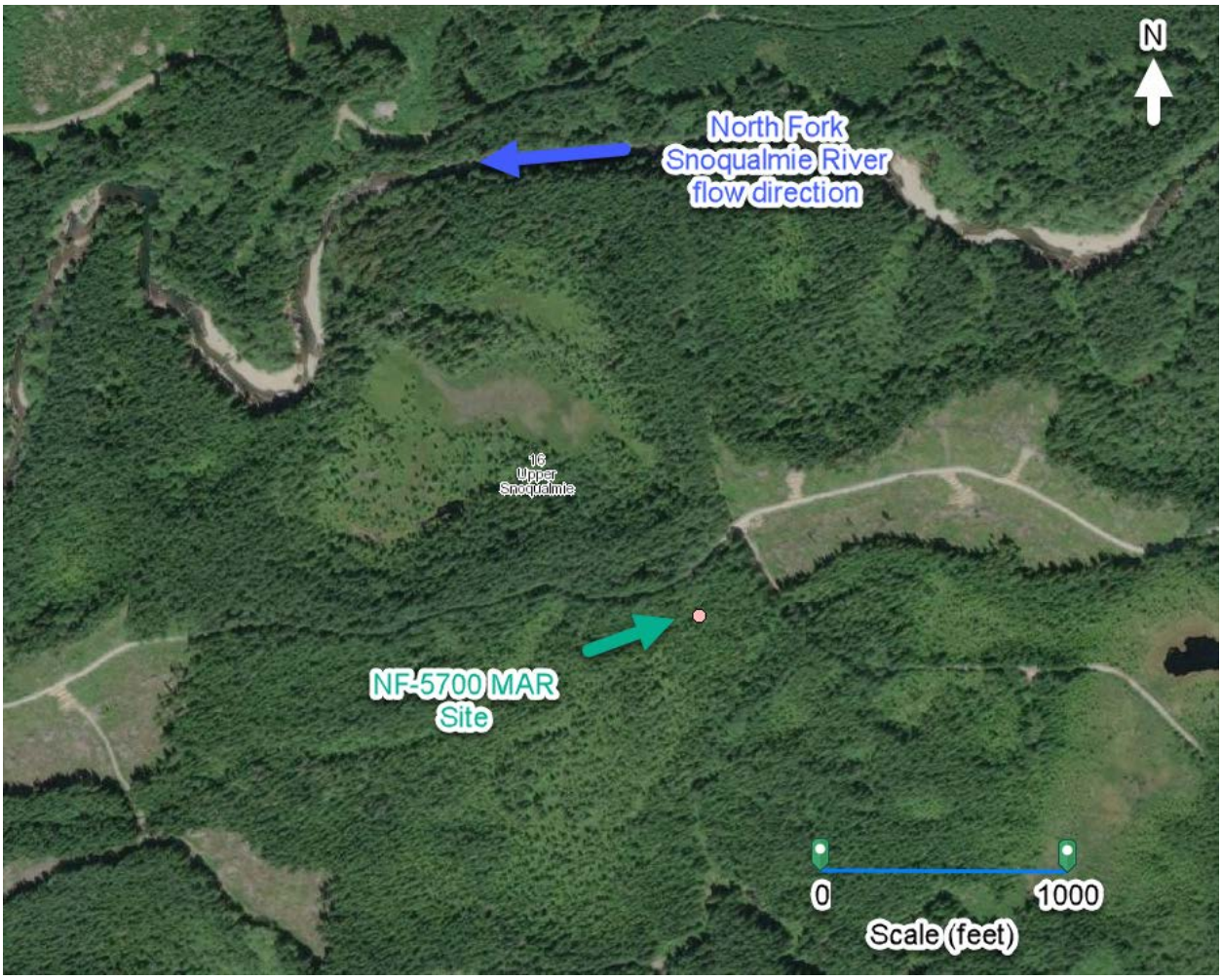


Figure 1. NF5700 MAR Potential Site Location

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the North Fork Snoqualmie River and may also provide streamflow benefits to Sunday Creek, a tributary to the North Fork Snoqualmie River.

Performance goals and measures.

The performance goals are to increase water storage in the alluvial aquifer adjacent to the North Fork Snoqualmie River by infiltrating water through the MAR facility to improve baseflow in the North Fork Snoqualmie River. The performance measures will be an increase in baseflow in summer in the North Fork Snoqualmie River. Specific quantities and timing for surface water diversion would be determined during a feasibility study.

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

The Upper Snoqualmie subbasin is inhabited by coastal cutthroat trout and rainbow 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 Act. 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 feasibility, construction and operation and maintenance costs, and obtaining a water right from the North Fork Snoqualmie River or the adjacent aquifer for beneficial use at the MAR facility. WWT initiated outreach to the landowner (Washington State Department of Natural Resources) to evaluate their level of support for the project and they expressed support for continuing discussions of the project concept.

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 has been identified as 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

Booth, D.B. 1990. Surficial geologic map of the Skykomish and Snoqualmie Rivers area, Snohomish and King Counties, Washington: U.S. Geological Survey, Miscellaneous Investigations Series Map I-1745. Scale 1:50,000. https://ngmdb.usgs.gov/Prodesc/proddesc_9900.htm

Geoengineers, Inc. (GeoEngineers). 2020. WRIA 7 Consumptive Use Estimates – Final Draft. Technical memorandum prepared for Washington State Department of Ecology. January 2020.

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

WRIA 7 – Project Description
Snoqualmie River Watershed Surface Water Storage

December 22, 2020

Project Name and Number
Snoqualmie River Watershed Surface Water Storage (7-USQ-W11)

WRIA 7 WRE Subbasin
Snoqualmie River Watershed, Various Subbasins

Water Offset
104 – 3,311 AFY

Narrative Description
In 2018, with funding from the Washington Department of Ecology (Ecology), SVWID initiated a study of the potential for creating small-scale water storage within the Snoqualmie Valley. SVWID completed an assessment of small-scale surface water storage facilities that would be limited in size, with targeted storage capacities generally smaller than 10 acre-feet. The study focused on the lower Snoqualmie River and its tributaries that flow through the SVWID service area from just upstream of Fall City to just downstream of Duvall. Through that study, the need became apparent for a more robust, Comprehensive Storage Study that would assess the potential for a wide range of surface water storage options, including small to large storage opportunities throughout the watershed. Work on the Snoqualmie River Watershed Comprehensive Storage Study was initiated in January 2020. A screening analysis has been completed as the initial step toward completing the Comprehensive Storage Study. The screening analysis was summarized in a draft report circulated to WRIA 7 Watershed Restoration and Enhancement Committee (WREC) members late in July 2020. The screening analysis included review of mapping and existing data, a weighted GIS overlay of data to identify and evaluate potential surface water storage opportunities, a high-level analysis of each storage site based on a wide range of criteria, and scoring and ranking of the sites based on the criteria identified.

The screening analysis identified and evaluated 20 potential water storage projects, as summarized in Table 1. The projects are located in 7 different subbasins within the Snoqualmie River Watershed. Basins that are closed to future water right appropriations were not considered. Each site has been evaluated at a high level to estimate potential water storage capacity and scored and ranked each site according to a variety of criteria identified for this evaluation. The sites range in storage capacity from 22 acre-feet per year (AFY) to more than 3,311 AFY. The sites include off-channel storage reservoirs, on-channel storage reservoirs near the headwaters of tributaries, and projects that would result in raising the level of an existing lake to create additional storage capacity.

Project ID	Subbasin	Estimated Full Water Surface Area (Acres)	Estimated Water Storage Volume (AFY)	Description/Type
SNO1	Lower Snoqualmie	18.8	38	Existing Lake, Raise Water Surface 1 to 2 Feet
SNO2	Lower Snoqualmie	14.7	42	Existing Pond, Expand with Constructed Impoundment
SNO3	Lower Snoqualmie	17.9	197	Existing Pond, Expand with Constructed Impoundment
CCK1	Cherry Creek	53.1	106	Existing Lake, Raise Water Surface 1 to 2 Feet
CCK2	Cherry Creek	22.2	173	Existing Lakes, Expand with Constructed Impoundment
CCK3	Cherry Creek	7.9	22	Existing Pond, Expand with Constructed Impoundment
LOT1	Lower Tolt	23.7	84	Existing Pond, Expand with Constructed Impoundment
LOT2	Lower Tolt	19.4	130	Off-channel, Constructed Impoundment
NFT1	North Fork Tolt	11.6	113	Off-channel, Constructed Impoundment
NFT2	North Fork Tolt	7.3	62	Off-channel, Constructed Impoundment, Near Tributary
NFT3	North Fork Tolt	11.5	132	Impoundment on Upstream End of Small Tributary
NFT4	North Fork Tolt	133.6	1,296	Off-channel, Constructed Impoundment, Timber Area
TOK1	Tokul Creek	8.1	38	Off-channel, Constructed Impoundment
TOK2	Tokul Creek	40.0	80	Existing Lake, Raise Water Surface 1 to 2 Feet
TOK3	Tokul Creek	50.6	101	Existing Lake, Raise Water Surface 1 to 2 Feet
TOK4	Tokul Creek	38.4	77	Existing Lake, Raise Water Surface 1 to 2 Feet
NFK1	North Fork Snoqualmie	47.3	449	Off-channel, Constructed Impoundment, Near Tributary
NFK2	North Fork Snoqualmie	47.3	482	Off-channel, Constructed Impoundment, Timberland
NFK3	North Fork Snoqualmie	6.0	29	Impoundment on Upstream End of Small Tributary
MFK1	Middle Fork Snoqualmie	173.8	3,311	Off-channel, Constructed Impoundment, Near Tributary

Table 1. Summary of Potential Storage Sites Identified and Evaluated Through Screening Analysis

The WRIA 7 WREC has expressed general support for surface water storage and have requested this project description for a water storage project that would include implementation of one or more of the surface water storage projects that have been identified by the comprehensive storage study. For the

purposes of watershed planning, this project is defined as one or more surface water storage reservoirs that will collectively result in the potential to store and release at least 104 AFY, which is the median capacity of the 20 storage projects identified to date, and up to 3,311 AFY, which is the estimated maximum storage capacity of the largest project identified. Water would be released during critical low-flow periods to sustain streamflows in critical reaches of the Snoqualmie River and its tributaries and offset future domestic water uses.

Further study will include a more detailed analysis of the most highly ranked sites, including landowner outreach and more detailed analysis of hydrology and capacity. This detailed work and the design of specific storage sites identified for implementation will account for the following **design considerations**, identified by the WRIA 7 WREC:

- Future work to score, rank, and prioritize sites for implementation will carry forward through an engagement process with the tribes and stakeholders.
- Water storage should avoid or minimize impacts to floodplain and/or critical habitat.
- Storage sites that don't impact critical areas should be given preference. Design should consider impacts to fringe wetlands and other critical areas. For sites that are ranked highly as part of the screening analysis, but may have mapped impacts to critical areas, those potential impacts should be field verified, and the costs and benefits of those impacts should be considered.
- Water quality, and specifically impact on water temperatures is a consistent concern with surface water storage. Design and implementation of a storage project will need to consider and mitigate for impacts to water quality.
- The evaluation, scoring, and ranking of sites should consider downstream benefit to salmon. Benefit to streams listed in the Snohomish River Basin Salmon Conservation Plan as being flow deficient should be reflected in the scoring and ranking of sites. Preference should be given to storage projects that will make the biggest difference for fish habitat and passage conditions.
- The evaluation, scoring, and ranking of sites should also consider the magnitude of flows released relative to natural flow rates in the downstream tributary. Design of a storage project should ensure that the receiving water body can convey the flows released by the project.
- Resident fish species should not be compromised for benefit to anadromous fish protection or enhancement. Structures that impound a tributary must maintain passage for resident fish.
- When prioritizing sites for implementation, those with low infiltration capacity or ability to store without high loss to groundwater should be given preference so that water can be released when needed most.
- Storage projects should be primarily designed to protect instream flows.

Quantitative or qualitative assessment of how the project will function. Show how offset volume(s) were calculated.

The Snoqualmie River is a critical resource that provides water for multiple needs, including water supply for domestic water use, irrigation water for agriculture, and instream flows that support fish and wildlife. The Snoqualmie River and its tributaries are home to several fish species that are listed as threatened or endangered under the Endangered Species Act (ESA). ESA-listed species include Puget Sound Chinook salmon (Oncorhynchus tshawytscha), bull trout (Salvelinus confluentus), and Puget Sound steelhead (Oncorhynchus mykiss). The river and its tributaries also support a variety of other fish and wildlife species. Preserving and augmenting streamflows is critical to supporting these species.

Like other rivers in western Washington, the Snoqualmie River is influenced by seasonal rains; mountain snowmelt; and a relatively dry, warm summer. Heavy autumn and winter rains cause frequent flooding in the Snoqualmie River Valley. Peak flow rates occur during these warm, heavy rain events. Higher than average flow conditions persist through the late summer and spring, as snowmelt influences the hydrograph throughout the watershed. The late summer brings warmer, drier weather and low-flow conditions that prevail at the time when water is needed most for both instream and out-of-stream uses. With changing climate and shifting weather patterns, the availability of Snoqualmie River flows to meet instream and out of stream needs is not as certain.

Water storage has become an increasingly valuable tool for water resource managers. Water stored during high-flow periods in the autumn, winter, and spring can be released during the late summer, when water is needed to provide additional and more reliable water supply and to augment streamflows to support fish and wildlife. Carefully planned, well-designed water storage allows water resource managers to retime flows to benefit instream flows, address water supply concerns, and improve habitat conditions for fish and other species.

The proposed project would be designed to capture and store water from one of the tributaries of the Snoqualmie River during periods of high flow in the fall, winter, and spring for release during periods of low flow in the late summer. This project will consist of implementation of one or more storage projects identified in the Comprehensive Storage Study. The projects are currently only developed to the conceptual level. Additional work will be required to verify the capacity, release rate, and other key characteristics of specific projects. However, based on the initial work that has been done, it is anticipated that water storage can be implemented to store between 104 AFY and 3,311 AFY for release during the late summer to sustain instream flows and offset future domestic water use. These volumes would allow for release of an average 1.9 cfs to 59.6 cfs if released over a 4-week low flow period, or 0.6 cfs to 19.9 cfs if released over a 12-week low flow period.

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

The site location is the Snoqualmie River Watershed. A map of potential storage sites is shown below in Figure 1.

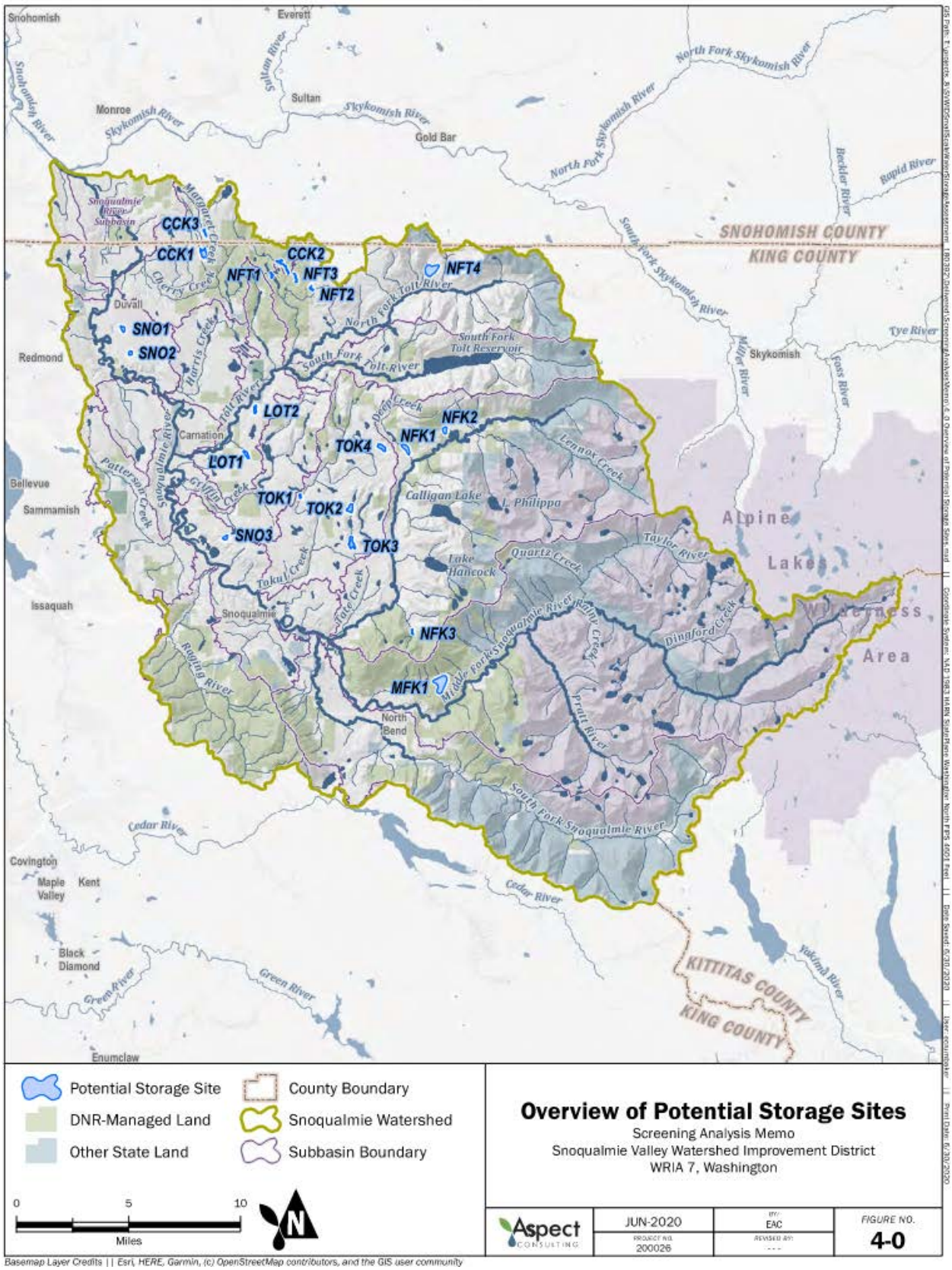


Figure 1. Overview of potential storage sites

Description of the anticipated spatial distribution of likely benefits.

The project is expected to provide streamflow benefits in the tributaries and in the mainstem Snoqualmie River downstream of the storage projects that are moved forward through implementation. Based on work done to date, the storage sites that are most highly ranked and most likely to may move forward for further consideration are located in the Cherry Creek S, North Fork Tolt River, Tokul Creek, the North Fork Snoqualmie River, and Middle Fork Snoqualmie River Subbasins.

Performance goals and measures.

The primary performance goals are to increase surface water storage in the Snoqualmie River Watershed by at least 104 acre-feet of storage that would be released when needed to benefit instream flows and offset domestic water use. The performance measures will be an increase in baseflow in summer in the tributaries and main stem Snoqualmie River downstream of storage projects that are implemented. An additional performance goal is to minimize or mitigate for any impacts on water quality. Impacts on water quality will also be measured in the tributaries and main stem Snoqualmie River downstream of storage projects that are implemented.

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

The Snoqualmie River and its tributaries are home to several fish species that are listed as threatened or endangered under the Endangered Species Act (ESA). ESA-listed species include Puget Sound Chinook salmon, bull trout, and Puget Sound steelhead. The river and its tributaries also support a variety of other fish and wildlife species. Preserving and augmenting streamflows is critical to supporting these species. Portions of the upper Snoqualmie Subbasin are not accessible to these ESA-listed anadromous species, but do provide habitat for resident fish species, such as coastal cutthroat trout and rainbow 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 Act. Surface water storage has been used as an effective water management tool that allows for water to be captured and stored during high flow periods and release of water to sustain streamflows when water is most needed for both instream and out-of-stream needs.

The barriers or challenges to implementation of this project may include funding, technical feasibility, land acquisition, site accessibility, potential permitting or environmental impact complications, construction and operation and maintenance costs, and the need to secure water rights for the diversion and storage of water.

Potential budget and O&M costs.

Detailed budget and operations and maintenance (O&M) costs are yet to be determined. Initial project implementation costs have been estimated at a very high level based on the concepts developed for the screening analysis. The overall estimated project cost ranges from approximately $3.5 million, for 104 acre-feet of storage, to $112 million, for 3,311 acre-feet of storage. The median estimated project cost of the 20 project sites that were identified by the screening analysis is approximately $33,145 per acre-foot of water stored. The estimated project cost for the largest project evaluated (3,311 acre-feet of storage) is approximately $33,961 per acre-foot of water stored.

Anticipated durability and resiliency.

It is anticipated that the durability of the project, as reflected in its ability to maintain the estimated water offset and flow benefits over time and despite of changing external conditions, will be very strong if storage facilities are well-maintained and carefully operated and maintained to provide those benefits. We anticipate that the proposed project will be very durable, based on the following:

- Ranking and selection of water storage projects for implementation will consider the magnitude and variability of water available to fill each reservoir.
- It is anticipated that water storage will be constructed in areas that will have high potential for annual refill.
- The water storage will require a water right to divert and store water. While the water right may be interruptible, storage will take advantage of the seasonal variation of water flow availability, capturing and storing water during times of high flow when it is available, and releasing water when it is critical to supporting other water needs.

It is also anticipated that water storage will improve the resiliency of water resources in the Snoqualmie River Watershed, as reflected in the ability to maintain the estimated water offset and flow benefits over time 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 and would improve the resiliency of water resources in the Snoqualmie River Watershed, based on the following:

- Diversion and storage of water would occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Water storage would make additional water available for offset and sustain instream flows during the late summer, when the impacts of climate change are anticipated to have the most significant impact on water resources.
- Water storage may have potential to capture peak flood flows, which already impact the Snoqualmie River Valley and those impacts are anticipated to increase as a result of climate change.

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

Snoqualmie Valley Watershed Improvement District has been identified as the project sponsor and is engaged in completing the Comprehensive Storage Study.

Documentation of sources, methods, and assumptions.

Anchor QEA (Anchor QEA, LLC), 2018. Draft Memorandum to: Snoqualmie Valley Watershed Improvement District. Regarding: Screening Criteria and Methodology. September 11, 2018.

Anchor QEA, 2019a. Memorandum to: Snoqualmie Valley Watershed Improvement District. Regarding: SVWID Small-Scale Storage Screening Analysis of Potential Storage Sites. March 6, 2019.

Anchor QEA, 2019b. Memorandum to: Snoqualmie Valley Watershed Improvement District. Regarding: SVWID Foster Pond Storage Project – Conceptual Design. October 29, 2019.

Anchor QEA, 2020. *Small-Scale Storage Study Summary Report.* Prepared for Snoqualmie Valley Watershed Improvement District. January 2020.

Anchor QEA and Aspect Consulting, 2020. *Comprehensive Storage Study Work Plan*.

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

Snohomish Basin Salmon Recovery Forum. 2005. Snohomish CouSnohomish River Basin Salmon Conservation Plan. June 2005. Referred to as the Salmon Plan.

WRIA 7 – Project Description
Jones Creek Relocation & Wetland Enhancement

December 22, 2020

Project Name and Number
Jones Creek Relocation & Wetland Enhancement (7-QA-H1[2])

WRIA 7 WRE Subbasin
Quilceda-Allen

Narrative Description
This project includes water storage, riparian habitat, and fish habitat improvement on Jones Creek near the mouth of the Snohomish River, within the City of Marysville. Jones Creek drains directly into the recently restored 400-acre Qwuloolt Estuary located a quarter-mile downstream of the proposed restoration site. This basin has water impairments associated with local development and is used by critical salmonid species.

This project intends to address issues associated with urbanization including flashy flows, loss of riparian habitat, channelization, poor water quality, and a reduction in summer base flows by creating a 780-foot long meandering channel with large wood debris (LWD) installations to replace the existing channelized and heavily incised channel. The project will also include riparian reforestation and the creation of several wetland depressions for water storage and recharge. These restoration actions will benefit documented Chinook, Coho, Chum, and Pink salmon as well as Bull, Cutthroat, and Steelhead trout. Chinook salmon and Bull Trout are priority species protected under the U.S. Endangered Species Act.

Quantitative or qualitative assessment of how the project will function.
The project will create approximately 780 linear feet of new meandering stream channel, 4 wetland surface water infiltration ponds (0.1 acres) isolated from the stream, 5 off-channel rearing water infiltration ponds (0.5 acres) directly connected to the stream, 3.6 acres of restored riparian buffer, and 65 LWD installations. Overall, the project is anticipated to provide a water offset potential of approximately 3.7 acre-feet per year.

The new channel morphology and LWD installations will create higher quality fish habitat and a more resilient channel, better suited to handle the effects of urbanization. The new channel will have significantly more floodplain interaction, which will buffer high flows by storing and absorbing floodwaters. The addition of LWD will create pools for fish refuge and increase hyporheic interaction, improving summer base flows and acting as a source of cool water input.

The project will add approximately 0.6 acres of constructed wetland. The wetland depressions will have a water depth of approximately 10-12 feet to allow temperature stratification in the summer. Additional LWD will be anchored and submerged in the off-channel wetland areas to provide aquatic habitat for macroinvertebrates and rearing fish. Stream flow inlet and outlet locations will be oriented to always replenish the depressions and to prevent fish stranding. The wetland depressions will improve storage

[2] Other project numbers associated with this project: 07-USR-034

and recharge the shallow aquifer, thereby contributing to summer base flows when the stream no longer receives direct input from precipitation.

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.

The project site is approximately 11.5 acres. The existing channel currently borders the southern property line, adjacent to several residential properties. As a result, the riparian buffer on the south bank is essentially nonexistent. Relocating the stream to the center of the 11.5 acre parcel and establishing a natural meandering channel with wetlands depressions and LWD will significantly increase the floodplain and hyporheic interaction. The project will create approximately 780 linear feet of new meandering stream channel, 4 wetland surface water infiltration ponds (0.1 acres) isolated from the stream, 5 off-channel rearing water infiltration ponds (0.5 acres) directly connected to the stream, 3.6 acres of restored riparian buffer, and 65 LWD installations.

Performance goals and measures.

Performance goals and measures will be based on the length of additional channel added, number of LWD installments, number of trees and shrubs planted, area of restored riparian habitat, and area of constructed wetland depressions.

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

These restoration actions are expected to benefit documented Chinook, Coho, Chum, and Pink salmon as well as Bull, Cutthroat, and Steelhead trout. Chinook salmon and Bull trout are priority species protected under the U.S. Endangered Species Act. The project's proposed wetlands and LWD installations are designed to provide aquatic habitat for macroinvertebrates and rearing fish. The riparian plantings will directly benefit prey availability and survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

Funding is the primary barrier. Sound Salmon Solutions and Adopt-a-Stream Foundation have a history of restoration activities at this site. Both are sponsors of this project. No land acquisition is required. The City of Marysville, another sponsor, owns the property where the restoration work will take place.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit, build the new channel, construct the wetlands, install LWD, and replant the riparian buffer will be approximately $769,044. Reoccurring O&M costs will be minimal and limited to plant survival monitoring and invasive species removal.

Anticipated durability and resiliency.

The project is designed to mimic sustainable, pre-settlement conditions and accommodate seasonal hydrologic changes. Once the native plants are installed, maintenance will be required to ensure plant survival. Monitoring of plant survival, native plant replacement, and non-native invasive plant removal will be performed for approximately 5 years post-construction.

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

All sponsors are ready to proceed immediately.

- City of Marysville: Jessie Balbiani, Surface Water Specialist, jbalbiani@marysvillewa.gov
- Sound Salmon Solutions: Jessica Lange, Habitat Program Manager, jessica@soundsalmonsolutions.org
- Adopt-a-Stream Foundation: Walter Rung, Senior Ecologist, walterr@streamkeeper.org

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding. Current design elements and water offset calculations are based on best available knowledge.

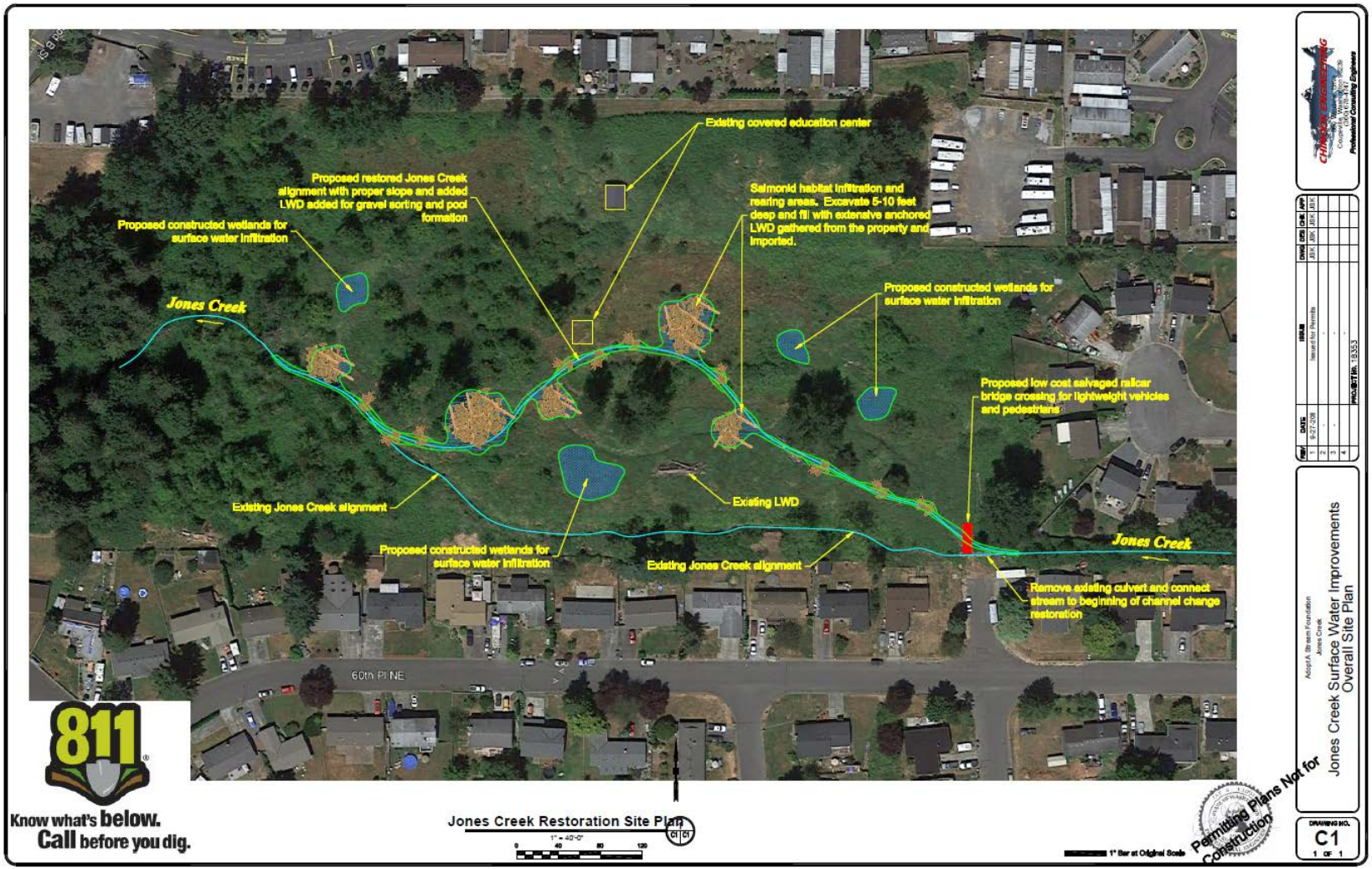


Figure 1. Site Plan for Jones Creek Relocation and Wetland Enhancement Project

WRIA 7 – Project Description
Marysville Stormwater Retrofits

December 22, 2020

Project Name and Number
Marysville Stormwater Retrofits (Quilceda Stormwater Project) (7-QA-H2)

WRIA 7 WRE Subbasin
Quilceda-Allen

Narrative Description
The objective of these projects is to restore aquifer groundwater in the Allen-Quilceda watershed through infiltration of stormwater runoff. The proposed projects include green stormwater infrastructure in denser urban areas ("depaves"), retrofits of stormwater ponds in older suburban areas, rainfall capture in rural areas, and a comprehensive outreach and education program based on stewardship and low impact water management. SCD expects to pilot pond retrofits on four existing detention ponds owned by the City of Marysville (specific sites to be determined). Depave retrofit locations have not yet been identified but are targeted for the corridor east of SR 529.

Quantitative or qualitative assessment of how the project will function.
Infiltration flow rates were computed by SCD based on assumed facility footprint and range of plausible infiltration rates. Pond size estimates are based on plans sent to the SCD by the City of Marysville, who own and operate the ponds. The depave sizes are based on SCD's experience and measurements. Estimated net increase in infiltration was computed by multiplying the calculated infiltration rates to the average number of hours with rain in the area, based on Snohomish County's extended Smokey Point precipitation gage record. Based on the precipitation record, there are 816 hours of rain per year on average (water years 1950 through 2012). For the driest ten years, the average drops close to 20% to 678 hours per year.

There are a number of existing, undersized stormwater ponds serving older suburban/residential areas of Marysville (yellow area on included map). These ponds could be retrofitted to provide infiltration and additional storage. For pond retrofits, an infiltration footprint of 8000 square feet was assumed, with potential rates ranging from 0.2 inches per hour (in/hr) to 2 in/hr. Each pond could be expected to infiltrate between 2.5 and 25 acre-feet per year (AFY) on average, depending on native soil infiltration rates. Minimum net increase in infiltration (based on dry years) would be between 2.1 and 21 AFY per pond. No water offset is assumed for purposes of the Plan.

Depaves are anticipated to be implemented along the SR 529 corridor in downtown Marysville (green area on map below), where infiltration rates are higher than the pond locations. For depaves, an infiltration footprint of 1000 square feet was assumed for each project, and the assumed infiltration range was between 0.5 and 5 in/hr. Each project could be expected to infiltrate between 0.8 and 8 AFY on average, depending on native soil infiltration rates. Minimum net increase in infiltration (based on dry years) would be between 0.6 and 7 AFY per project. No water offset is assumed for purposes of the Plan.

The SCD will partner with farmers in the rural area east of Marysville (orange area on map) to establish a rainwater capture program. This area has a high number of combined use wells. SCD will provide

cisterns to store rainwater to replace well water as a source for livestock watering, kitchen garden irrigation, and other current well water applications. No water offset is assumed for purposes of the Plan.

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

Projects will be located within the City of Marysville and surrounding rural area in the Quilceda and/or Allen Creek watersheds. A map showing targeted areas for pond retrofits (yellow), depaves (green), and cisterns (orange) is included at the end of this description.

Description of the anticipated spatial distribution of likely benefits.

Potential project locations are within the Quilceda and Allen Creek watersheds. Enhanced infiltration would return storm runoff to the ground, delaying flows to the creeks.

Performance goals and measures.

Performance goal is to infiltrate as much stormwater runoff to ponds and depaves as possible. Infiltration is difficult to measure directly; proxy measures include contributing area, added storage volume, and surface outlet discharges. Measures for the cistern program would include number of participants, cisterns per property, and volume of captured rainwater used.

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

Salmonids. According to the Salmonscape website, both the creeks are salmon-bearing streams. Species in these creeks include Steelhead, bull trout, chum, cutthroat, pink, coho, and Chinook.

Identification of anticipated support and barriers to completion.

SCD is leading this effort and has support from the City of Marysville, which owns and operates pilot pond retrofit locations, and the Tulalip Tribes. SCD has a history of working with homeowners associations on stormwater pond operation and maintenance and has built relationships with farmers to do stormwater collection in the past. Barriers could include identification of suitable depave sites or lack of suitable infiltration.

Potential budget and O&M costs.

Project is currently conceptual and costs will depend on specific sites and facility types to be implemented. SCD proposed $426,000 toward planning, design, and installation of the program in a prior grant application.

Anticipated durability and resiliency.

Green stormwater infrastructure has a great track record of durability, sustainability, and climate adaptation. In this context, durability refers to the capacity of the project to maintain the estimated net increase in infiltration over time and despite changing external conditions (which could include seasonal variation in stormwater runoff, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Facilities would be designed to typical standards.
- Infiltration rate would be maintained through regular maintenance and periodic rehabilitation of infiltration structures or media.
- Land use changes external to the project site would have negligible impact on project function.

- The water source likely would lack the predictability inherent to other types of aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation and runoff.

Resiliency refers to the capacity of the project to maintain the estimated net increase in infiltration 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, an increase in the frequency and/or intensity of storm events, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- Sea level increase would not impact project function.
- Infiltration volume could be impacted by changes in annual precipitation or storm patterns, including increase in the frequency and/or intensity of large storm events, or other climatic factors.

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

Snohomish Conservation District is the sponsor for this project and is partnered with City of Marysville and the Tulalip Tribes. SCD is ready to move forward with feasibility study pending funding.

The Snohomish Conservation District (SCD) has previously submitted a grant application for potential stormwater projects in the Quilceda and Allen Creek basins in and around the City of Marysville.

Documentation of sources, methods, and assumptions.

Snohomish County. 2015. Snohomish Basin Protection Plan. [cited 2020, April]. Available from: https://snohomishcountywa.gov/Archive/ViewFile/Item/4402

Snohomish Basin Salmon Recovery Forum. June 2005. Snohomish River Basin Salmon Conservation Plan Snohomish County Department of Public Works, Surface Water Management Division. Everett, WA. Available from: https://snohomishcountywa.gov/ArchiveCenter/ViewFile/Item/2153

City of Marysville. 2016. SURFACE WATER COMPREHENSIVE PLAN UPDATE. [cited 2020,April]. Available from: http://docs.marysvillewa.gov/htcomnet/Handlers/AnonymousDownload.ashx/Surface+Water+Comprehensive+Plan+Update+Final.pdf?file=7750c6b8

City of Marysville. 2017. City of Marysville Stormwater Management Program. [cited 2020, April]. Available from: https://marysvillewa.gov/794/Stormwater-Comprehensive-Plan

Salmonscape Website [internet]. Washington DOE, c2020. [cited 2020, April]. Available from: http://apps.wdfw.wa.gov/salmonscape/map.html

Water Quality Atlas [internet]. Washington DOE, c2020. [cited 2020, April]. Available from: https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx

Washington Dept. of Ecology. 2013. [cited 2020, April]. Available from: https://edis.ifas.ufl.edu/ae398

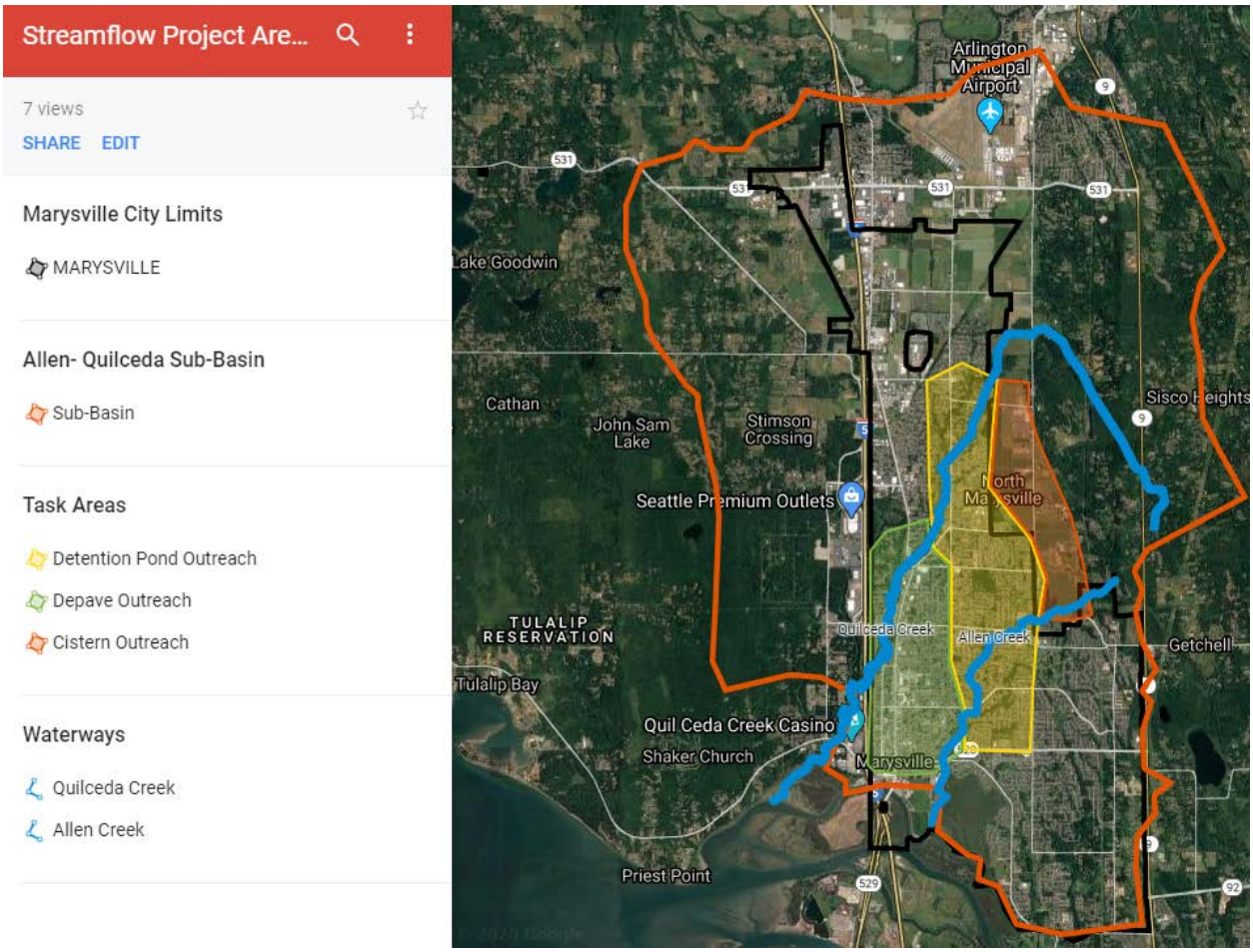
Washington Dept. of Ecology. 2019. Washington State Stormwater Manual. [cited 2020, April]. Available from: https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMWW/Content/Resources/DocsForDownload/2019SWMMWW.pdf

Snohomish Conservation District. 2019. Agriculture Resilience Plan for Snohomish County. [cited 2020, April]. Available from: https://static1.squarespace.com/static/54933166e4b00173e5357840/t/5ddd7e765e1d641741e5126a/1574796956745/AgricultureResiliencePlan_FINAL_ALL+-+Reduced+File+Size.pdf

EPA. 2014. Enhancing Sustainable Communities with Green Infrastructure. [cited 2020, April]. Available from: https://www.epa.gov/sites/production/files/2014-10/documents/green-infrastructure.pdf

Kitsap County. 2012. Kitsap County Stormwater Pond Retrofit Manual. [cited 2020, April]. Available from: https://www.kitsapgov.com/pw/Documents/KC_Pond_Retrofit_Manual_2012.pdf

Sanjay Shukla and Fouad H. Jaber. 2018. Stormwater as an Alternative Source of Water Supply: Feasibility and Implications for Watershed Management. [cited 2020, April]. Available from: https://edis.ifas.ufl.edu/ae398


Streamflow Project Are...
7 views
SHARE EDIT
Marysville City Limits
MARYSVILLE
Allen- Quilceda Sub-Basin
Sub-Basin
Task Areas
Detention Pond Outreach
Depave Outreach
Cistern Outreach
Waterways
Quilceda Creek
Allen Creek
Arlington Municipal Airport
Lake Goodwin
Cathan
John Sam Lake
Stimson Crossing
Seattle Premium Outlets
North Marysville
Sisco Heights
TULALIP RESERVATION
Tulalip Bay
Quil Ceda Creek Casino
Shaker Church
Marysville
Getchell
Priest Point

WRIA 7 – Project Description
Quilceda 8 Restoration & Potential Water Right Acquisition

December 22, 2020

Project Name and Number
Quilceda 8 Restoration & Potential Water Right Acquisition (7-QA-H3)

WRIA 7 WRE Subbasin
Quilceda-Allen

Narrative Description
This is a property acquisition proposal of a parcel located on an unnamed tributary to Allen Creek located on the eastern border of the City of Marysville, Washington. This parcel is currently under private ownership and has been managed as farmland since the families' ownership since 1962. The landowners approached Snohomish County with interest in selling the lower floodplain portion of their property to provide restoration opportunities.

This property acquisition has the potential to improve juvenile rearing and adult spawning habitat for two ESA-listed fish: Chinook Salmon and Steelhead.

Quantitative or qualitative assessment of how the project will function.
Acquiring this land and underlying water right has the potential to restore hydrologic function to the adjacent unnamed tributary to Allen Creek and the greater Snohomish River. The water right associated with the property has some uncertainties but based on the delineated 16 acres of irrigation and assuming pasture and sprinkler irrigation, 16.8 afy may be available for acquisition. There is potential for riparian restoration actions within the lower floodplain through invasive removal and native species planting.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1.

Description of the anticipated spatial distribution of likely benefits.
This property acquisition has the potential to restore hydrologic function to Allen Creek.

Performance goals and measures.
Not applicable for this stage of project.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.
Restoration of hydrologic function of Allen Creek and the proposed future restoration efforts within the lower floodplain have the potential to benefit documented Chinook, Coho and Steelhead Trout. Chinook Salmon and Steelhead Trout are priority species protected under the U.S. Endangered Species Act.

Identification of anticipated support and barriers to completion.

Funding is the primary barrier to completion. Additional barriers include landowner willingness to sell the water right associated with the property, limited information on recent beneficial use of the water right and multiple landowners within the water right's place of use.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to purchase this parcel is unknown at this time.

Anticipated durability and resiliency.

Not applicable at this stage of project.

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

The Tulalip Tribes are the sponsor of this project. The surviving landowner is a few years from moving off the property at which point the land will be available for purchase.

Documentation of sources, methods, uncertainties, and assumptions.

Unknown at this phase of the project.

Figure 1. Quilceda 8 Restoration & Potential Water Right Acquisition Location

WRIA 7 – Project Description
Silver Firs Stormwater Pond Retrofits

December 22, 2020

Project Name and Number
Silver Firs Stormwater Pond Retrofits (Little Bear Stormwater) (7-ES-H4)

WRIA 7 WRE Subbasin
Estuary/Snohomish Mainstem

Narrative Description
Snohomish County has identified several potential stormwater retrofit projects in the Little Bear Creek basin, including two stormwater pond infiltration retrofits in the Silver Firs subdivision. The County plans to retrofit two existing ponds to increase infiltration capacity. The two ponds are part of the existing stormwater drainage system; each receives surface storm runoff from about 125 acres of residential development.

The first pond (County CIP site 10) is located in Silver Firs Sector 3 Division 7. The project would involve expanding the existing pond by deepening and increasing pond infiltration potential. This would add 1.09 acre-feet (af) of storage and increase infiltration. The second pond (CIP site 16) is located in Silver Firs Sector 7. This project would increase the existing pond volume by deepening and increase pond infiltration potential. This would add 2.0 af of storage. Neither existing pond was designed as an infiltration facility, but infiltration has been observed to occur. The difference between existing infiltration and infiltration after retrofits will provide a net increase in infiltration into the aquifer.

Quantitative or qualitative assessment of how the project will function.
HSPF modeling was conducted as part of Snohomish County's retrofit analysis to quantify benefits of proposed projects. The HSPF model was used to estimate the average annual net increase in infiltration volumes for the two pond projects. The modeling analysis was run over 63 years of historic precipitation data and assumed existing infiltration at 1.2 inches per hour for both ponds, doubling to 2.4 inches per hour with modifications. No water offset is assumed for purposes of this Plan.

At Site 10, the model showed a net increase of 38 acre-feet per year (AFY) of infiltration. Additional infiltration at Site 16 was estimated to be 7 AFY. A minimum net increase of infiltration can be estimated by looking at just the driest years in the simulated record. Using the 10 driest years from the 63-year simulation (based on annual precipitation), the minimum net increase in infiltration can be estimated as 25 AFY for Site 10 and 2 AFY for Site 16. No water offset is assumed for purposes of this Plan.

Conceptual-level map and drawings of the project and location.
The Silver Firs development is located at the north end of the Little Bear Creek basin. Previous groundwater studies and watershed modeling (Golder, 2005; King County, 2005; Snohomish County, 2017) suggest that groundwater at the pond sites and tributary areas flows east to the Snohomish River. See Figure 3 for project location map.

Description of the anticipated spatial distribution of likely benefits.

Based on previous groundwater studies and watershed modeling (Golder, 2005; King County, 2005; Snohomish County, 2017), it is believed that groundwater in this area flows east to the Snoqualmie River, rather than locally to Little Bear Creek. Thus, net increase in enhanced infiltration would accrue to WRIA 7 rather than WRIA 8 (though reductions in peak streamflows and stream flashiness would benefit Little Bear Creek).

The closest mapped streams in WRIA 7 to the pond locations are Thomas Creek (approximately 5,000 feet to mapped headwater) and Larimer Creek (approximately 5,500 feet to mapped headwaters). Both streams drain through lowland agricultural drainage systems to the Snohomish River in the vicinity of Ebey Slough. The importance of groundwater to nearby stream channels during the low flow season is coupled to the large areal extent of wetlands along the mainstem of Little Bear Creek. Given these natural recharge sources in Little Bear Creek sustain much of the summer low flow, equally important is the groundwater recharge received by WRIA 7 streams from the proposed stormwater pond retrofits.

Small streams like Larimer Creek, shown in Figure 1 that maintain cold-water refugia throughout the summer have groundwater contribution from beneath thick clay layers that border the edges of the stream. Thomas Creek, shown in Figure 2 has gentle streamside slopes with a thick aggregate of organic materials and soil beneath which groundwater enters the stream. Like Larimer Creek, the summer low flow water temperature is unusually cold. When considered together, these small feeder streams to larger rivers represent important sources of cold groundwater refugia to migrating summer salmonids. Migration of groundwater to these streams may begin during the wet season and reach the WRIA 7 streams during the dry season.

Figure 1. Larimer Creek

Figure 2. Thomas Creek

Performance goals and measures.

Performance goal is to infiltrate as much water from the ponds as possible. Infiltration is difficult to measure directly; proxy measures include area treated, pond water levels, and pond outlet discharges.

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

The Little Bear Creek system is an important resource for fish, and the following salmonid species are known to be present in the basin: chinook, sockeye, kokanee, and coho salmon. The WRIA 8 Chinook Salmon Recovery Plan notes that the estimated number of Chinook salmon spawning in Little Bear Creek averaged 11 fish for many years up to 1998. Coastal cutthroat trout and steelhead/rainbow trout have also been observed. Anadromous salmon and trout access almost all this system, though there are some significant passage barriers to adults during periods of low stream water flows, and to juveniles during high flows.

Identification of anticipated support and barriers to completion.

This project is currently listed in Snohomish County's Little Bear Creek Basin Plan and Snohomish County intends to implement the project, when funding is available.

Potential budget and O&M costs.

CIP Site 10: $600,000 design & construction

CIP Site 16: $815,000 design & construction

Both locations have existing stormwater ponds, so operation and maintenance costs are unlikely to change significantly.

Anticipated durability and resiliency.

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

- Facility would be designed to typical County standards.

- Infiltration rate would be maintained through regular maintenance and periodic rehabilitation of infiltration structures or media.
- Land use changes external to the project site would have negligible impact on project function.
- The water source likely would lack the predictability inherent to other types of aquifer recharge projects because it relies on the timing, rate, and volume of area precipitation and runoff.

Resiliency refers to the capacity of the project to maintain the estimated net increase in infiltration 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, an increase in the frequency and/or intensity of storm events, or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project water source is not tied to the water right permitting process and is not subject to regulatory or other anthropogenic interruption.
- The project does not remove water from surface water and therefore is not reliant on minimum streamflow requirements.
- The project does not remove water from a groundwater body, and therefore is not subject to well interference.
- Sea level increase would not impact project function.
- Infiltration volume could be impacted by changes in annual precipitation or storm patterns, including increase in the frequency and/or intensity of large storm events, or other climatic factors.

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

Snohomish County Public Works would sponsor the project. Snohomish County has identified two stormwater pond retrofit projects in the northern part of the Little Bear Creek basin. The project is currently listed on the County's Capital Improvement Project list and the County would be ready to proceed with design and construction upon funding.

Documentation of sources, methods, and assumptions.

Golder and Associates, 2005. *Little Bear Creek Hydrogeologic Overview*. Prepared for Jones and Stokes and Snohomish County.

King County, 2005. *Brightwater Treatment System Environmental Impact Statement*. Available online: http://www.kingcounty.gov/environment/wtd/Construction/North/Brightwater/Background/Env-Review.aspx

Snohomish County, 2016. Little Bear Creek Basin Planning: Current Conditions Assessment Report.

Snohomish County, 2017. Little Bear Creek Basin Plan. Appendix B: Watershed Modeling Report.

Snohomish County, 2019. Stormwater Treatment CIPs: Final Report of Task 2.07.1 of the Little Bear Creek Basin Plan.

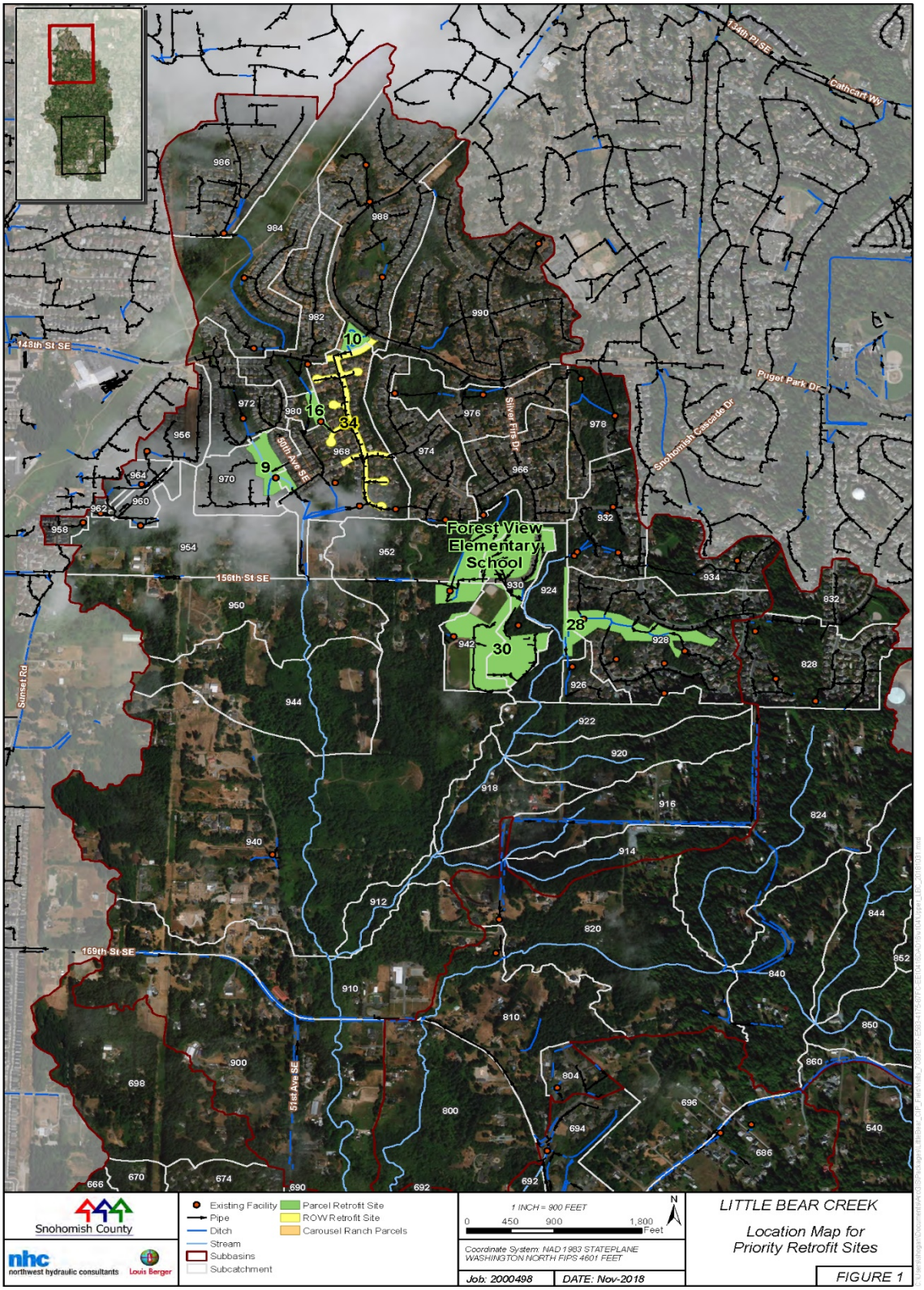


Figure 3. Silver Firs Stormwater Retrofit Site Location

WRIA 7 – Project Description
Thomas' Eddy Hydraulic Reconnection

December 22, 2020

Project Name and Number
Thomas' Eddy Hydraulic Reconnection (7-ES-H5[3])

WRIA 7 WRE Subbasin
Pilchuck

Narrative Description
The Thomas' Eddy Hydraulic Reconnection Project at Bob Heirman Wildlife Park proposes to remove a minimum of 1400 feet of remnant, failing levee and bank armor to improve floodplain connection and riverine process to approximately 200 acres of disconnected floodplain of the Snohomish River. The project aims to increase hydrologic connection and salmon access to 1.5 miles of off-channel waterbodies and improve floodplain complexity through a minimum of 30 acres of riparian planting, invasive weed control, floodplain channel construction and installation of floodplain structures (potentially including flood fences, log jams and/or beaver dam analogs.) The preferred design alternatives will incorporate key stakeholder input and will provide improved park user access to the Snohomish River and wildlife viewing areas and protect and enhance habitat for fish, waterfowl and other wildlife that use the site.

These restoration actions will benefit documented Chinook, Coho, Chum, Sockeye and Pink salmon as well as Bull Trout and Cutthroat, and Steelhead Trout. Chinook, Steelhead and Bull Trout are priority species protected under the U.S. Endangered Species Act.

Quantitative or qualitative assessment of how the project will function.
The project will improve floodplain connection and riverine process to approximately 200 acres of disconnected floodplain. Salmon will have access to 1.5 miles of new off-channel habitat. The installation of a minimum of 30 acres of riparian plantings and floodplain structures will provide additional habitat function.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1.

Description of the anticipated spatial distribution of likely benefits.
This project proposes to restore 200 acres of disconnected floodplain of the Snohomish River through removal of levee and bank armoring. These efforts will provide salmon access to 1.5 miles of off channel waterbodies.

Performance goals and measures.
The project is currently in design phase. Performance measures will be considered and finalized as design progresses.

[3] Other project numbers associated with this project: 07-MPR-034

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

These restoration actions are expected to benefit documented Chinook, Coho, Chum, Sockeye and Pink salmon as well as Bull Trout and Cutthroat, and Steelhead trout. Chinook, Steelhead and Bull Trout are priority species protected under the U.S. Endangered Species Act. The project's proposed restoration of floodplain habitat is designed to provide aquatic habitat for macroinvertebrates and rearing fish. The riparian plantings will directly benefit prey availability and survival of pre-migrant and outmigrating juvenile salmonids.

Identification of anticipated support and barriers to completion.

Restoration of the floodplain at Thomas' Eddy has been supported by the Salmon Recovery community since the completion of the Snohomish Basin Salmon Plan but stakeholder opposition to past proposals hindered restoration actions. A primary component of the current design phase is stakeholder outreach. The project sponsor has identified and is in contact with key stakeholders and will work with them during the design process to ensure their concerns are addressed and that the preferred alternative has broad support to move forward to construction.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit, remove levee and bank armor, install the riparian plantings and floodplain structures will be approximately $3.5 million. Reoccurring O&M costs will be minimal and limited to project effectiveness monitoring, plant survival monitoring and invasive species removal.

Anticipated durability and resiliency.

The project is being designed to mimic sustainable, pre-settlement conditions and accommodate seasonal hydrologic changes within constraints of a park with human access requirements. Restoration elements will be monitored and, if necessary, adaptive management actions will be explored. Native plant maintenance will be required to ensure plant survival. Monitoring of plant survival, native plant replacement, and non-native invasive plant removal will be performed for approximately 5 years post-construction.

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

Snohomish County, Michael Rustay, mike.rustay@co.snohomish.wa.us. The project will be ready to move to final design and seek construction funding in 2022.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding. Current design elements are based on best available knowledge.

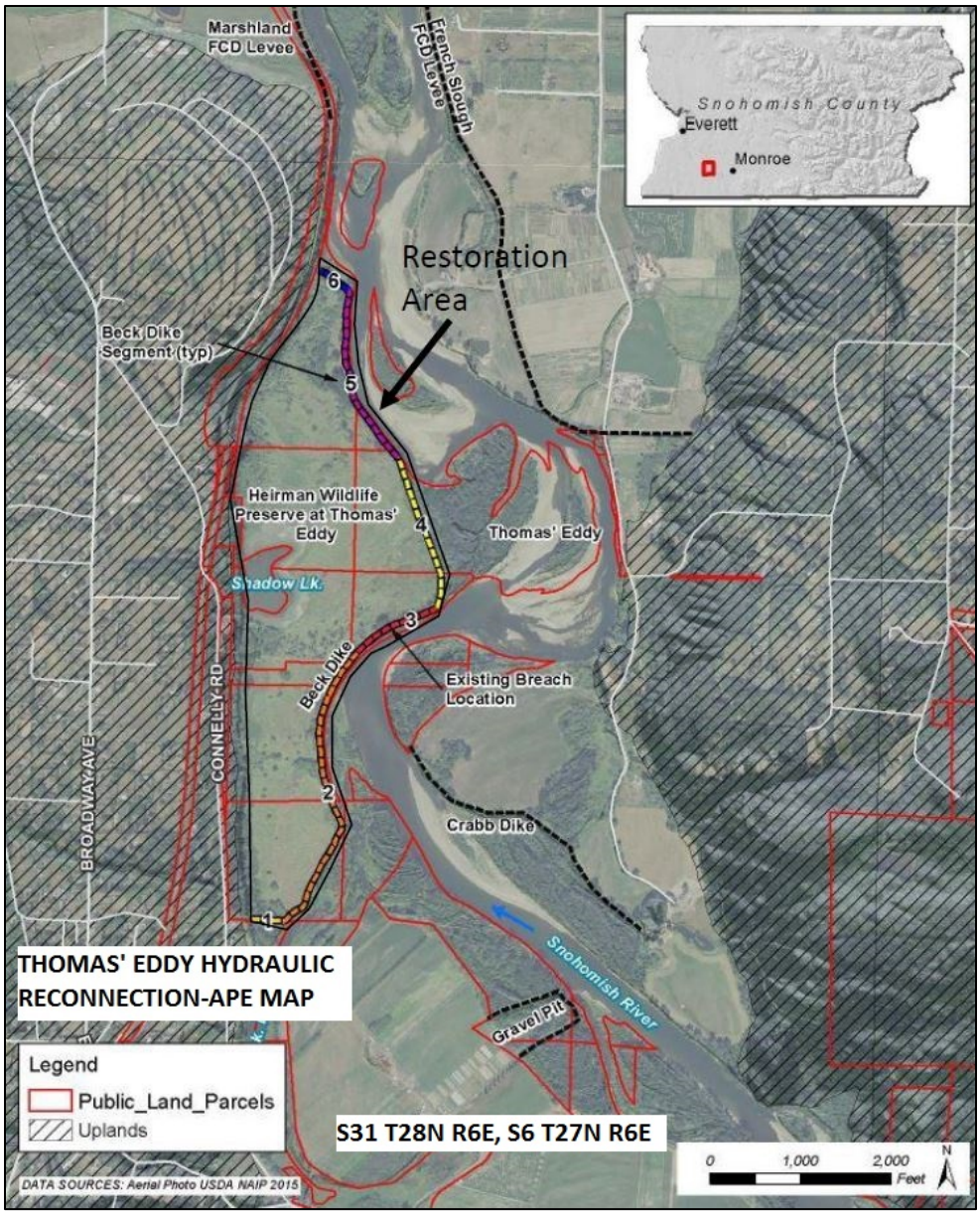


Figure 1. Site Plan for Thomas' Eddy Hydraulic Reconnection Project

WRIA 7 – Project Description
Snohomish Floodplain Acquisitions Phase 1(Lund Acquisition)

December 22, 2020

Project Name and Number
Snohomish Floodplain Acquisitions Phase 1 (Lund Acquisition) (7-P-H6)

WRIA 7 WRE Subbasin
Pilchuck

Narrative Description
This project will result in the acquisition of up to 57 acres and over 1.43 miles of riparian and floodplain property adjacent to the Pilchuck River and associated side channels for protection in perpetuity and floodplain forest restoration. The Lund property is located in a key area within the Middle Pilchuck River for salmon conservation efforts. This property contains the mainstem Pilchuck River and several side channels that are ideal for juvenile salmon rearing and flood refugia. There is considerable opportunity for enhancement along the riparian corridor and within the floodplain to establish a functioning floodplain forest. Restoration of functioning riparian and floodplain areas on this property aid in achieving salmon recovery goals. This is a dynamic area of the Pilchuck River, where the river naturally moves across the floodplain. Acquisition and restoration will prevent installation of rock or other impediments to natural process function. The acquisition of riparian property will also facilitate future restoration efforts, while allowing more flexible and nimble adjustment to the anticipated uncertainty of climate change and population growth. By working with the Snohomish Conservation District, the project sponsor can benefit from the long term relationship with the landowners, and leverage additional funding opportunities.

Quantitative or qualitative assessment of how the project will function.
Acquisition and restoration of the Lund property will address myriad limiting factors (floodplain/riparian function, water quality, etc.) for both Chinook and other salmonid species at virtually all adult and juvenile freshwater life stages from incubation to rearing and adult holding and spawning.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1.

Description of the spatial distribution of likely benefits.
Project implementation will benefit fish populations in the Pilchuck River Watershed. By allowing the landowner to divest in this property, there will be reduced flood and erosional risks to private landowners in this reach of the Pilchuck River.

Performance goals and measures.
- Protection and conservation of up to 57 acres of riparian and floodplain property.
- Protection and conservation of over 1.43 miles of the Pilchuck River and side channels.
- Species benefiting: Chinook, Steelhead, Coho, Bull Trout, Chum, Pink, Cutthroat and other fish species.
- Facilitate future restoration/enhancement of Pilchuck River instream habitat.

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

Acquisition and restoration of the Lund property will address myriad limiting factors (floodplain/riparian function, water quality, etc.) for both Chinook and other salmonid species at virtually all adult and juvenile freshwater life stages from incubation to rearing and adult holding and spawning. Species benefiting include Chinook (threatened), Steelhead (threatened), Coho, Bull Trout (threatened), Chum, Pink, Cutthroat and other fish species.

Identification of anticipated support for and barriers to completion.

Monetary and technical support will be provided by the RCO Salmon Recovery Funding Board, the Snohomish Technical Committee, the Snohomish Conservation District, and the Department of Ecology National Estuary Program.

Barriers to completion could include landowner acceptance of appraised property value and continued interest in pursuing the land transaction. However, the Snohomish Conservation District has a long relationship with the landowner, and we expect to continue moving forward towards acquisition and restoration goals.

Estimate of capital costs and reoccurring O&M costs (order of magnitude costs).

- Acquisition Costs: $900,000
- Restoration Costs: $300,000
- O&M Costs: Minimal

Project durability and resiliency.

Climate change and associated impacts will be factored into all current and future project elements. Acquisition and restoration will maintain and enhance resilience through habitat accessibility, diversity, quantity, and quality. The intent is to pursue natural process based solutions as much as possible to reduce maintenance requirements and ensure long term project function and durability.

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

The Tulalip Tribes are the proposed project sponsor for this work, and are ready to begin project planning and eventual implementation. Tulalip restoration project managers have extensive experience implementing restoration projects in this region. These projects have had varying scopes from very large, multimillion-dollar acquisition/restoration projects (Qwuloolt) to smaller fish passage and in-stream projects. We will draw from this experience and associated lessons learned while conducting these projects. The Snohomish Conservation District is a project partner who is currently conducting appraisals allowing acquisition in a timely manner. Acquisition is planned for early 2021.

Documentation of sources, methods, uncertainties, and assumptions.

Methods for acquisition will be those as required per RCO manuals. Planting and maintenance will occur per standard methodologies with a priority towards efficient and economical floodplain forest establishment. Uncertainties are primarily related to appraised land values and associated landowner negotiations.

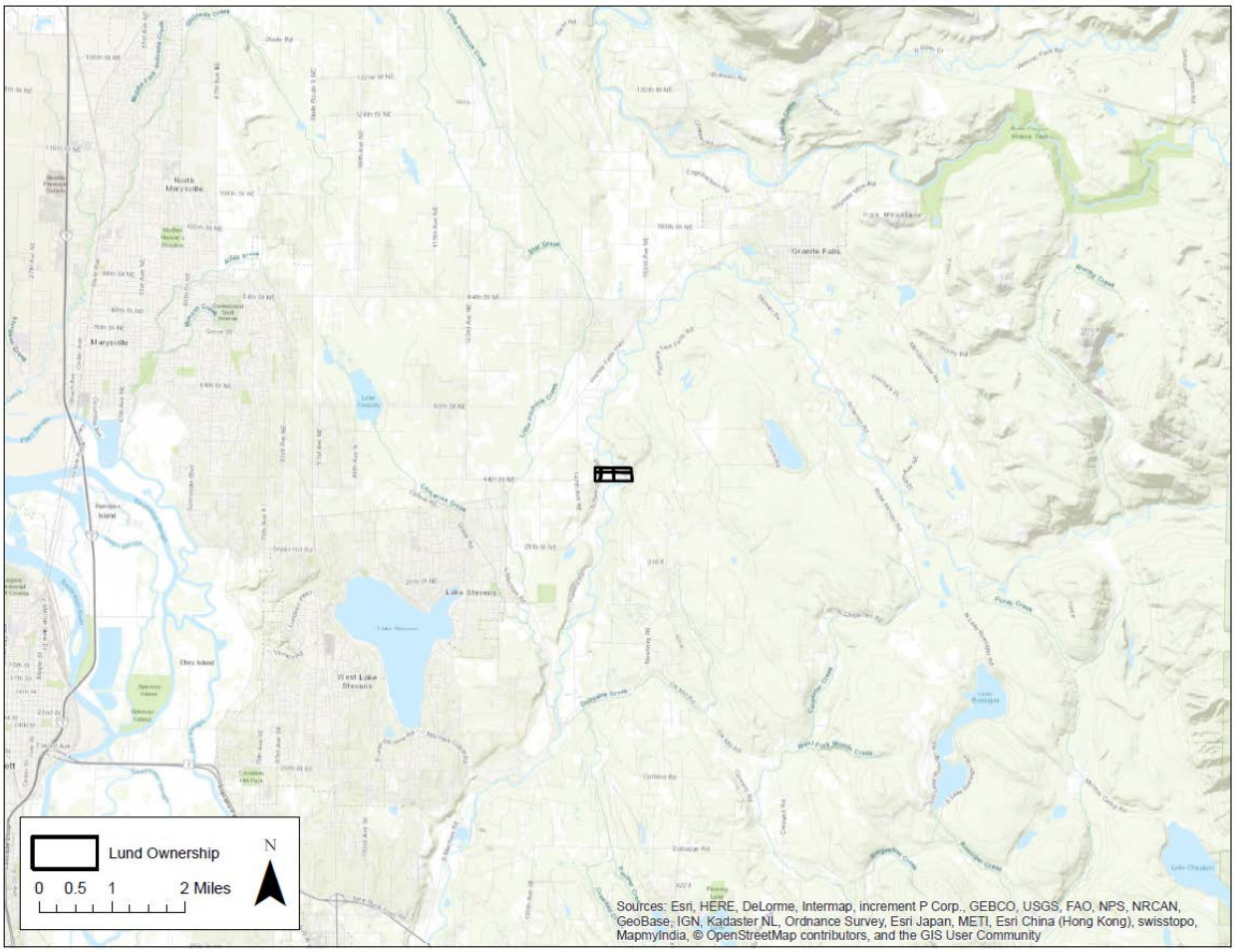


Figure 1. Vicinity Map for Snohomish Floodplain Acquisitions Phase 1 AKA Lund Acquisition

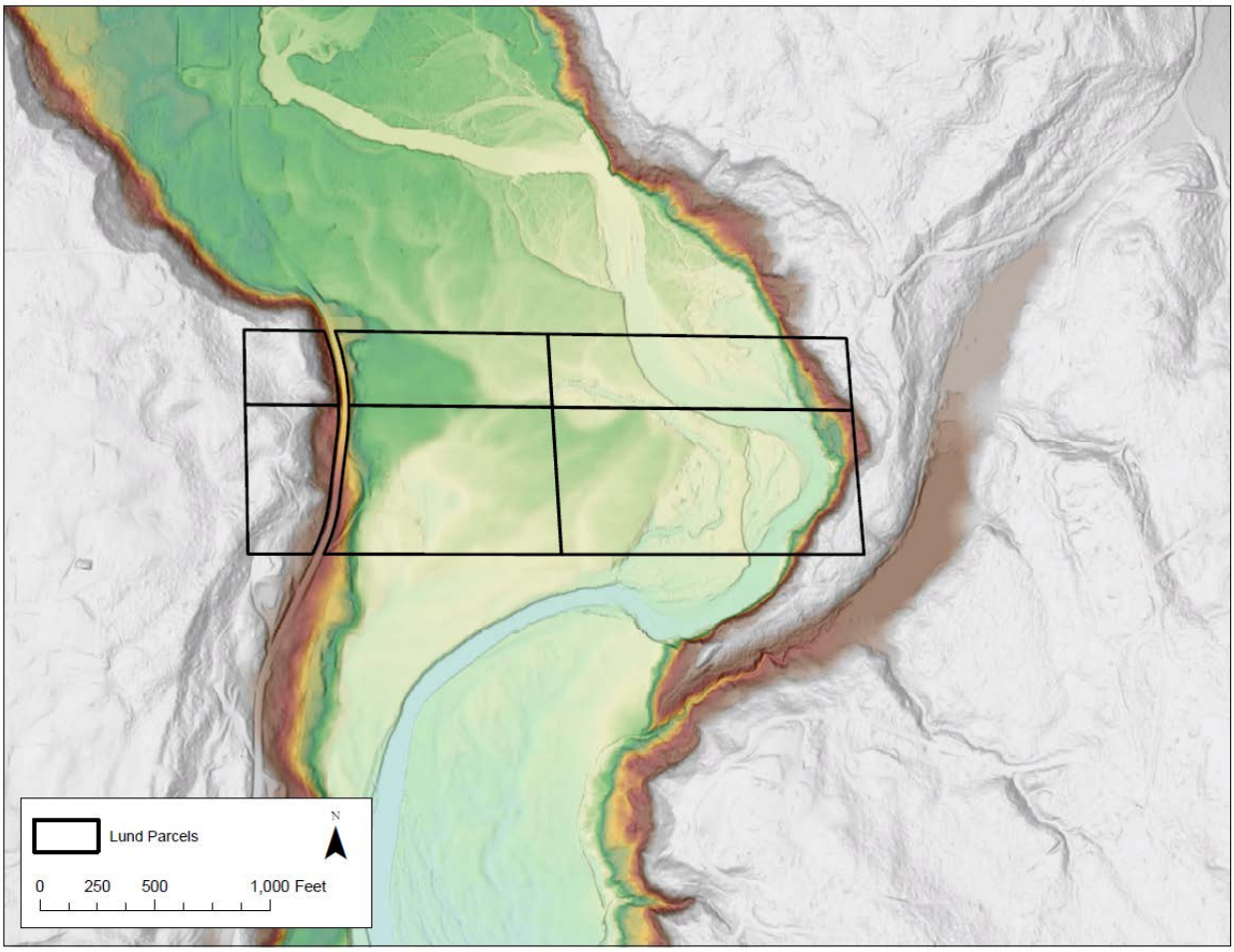


Figure 2. LiDAR for Snohomish Floodplain Acquisitions Phase 1 AKA Lund Acquisition

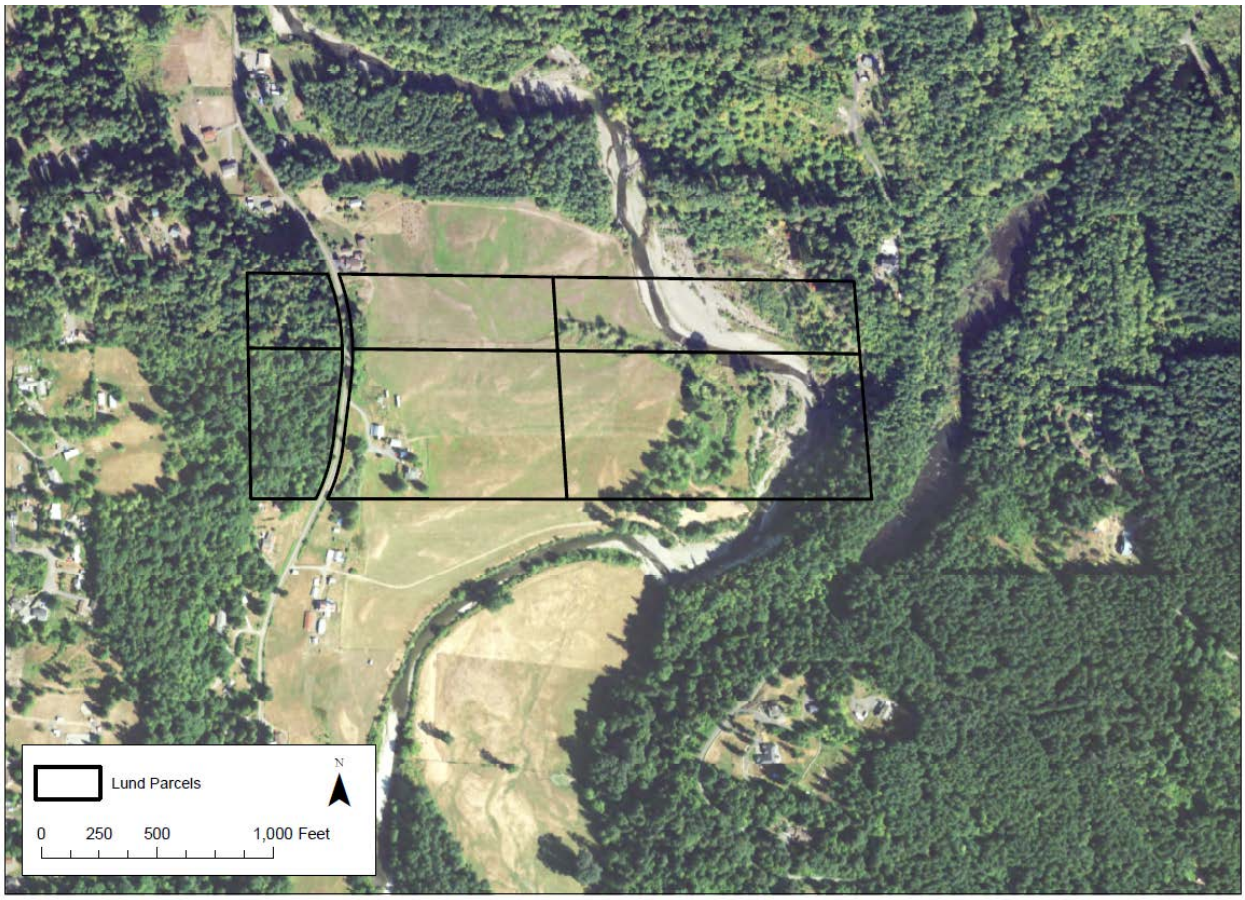


Figure 3. Ortho Image for Snohomish Floodplain Acquisitions Phase 1 AKA Lund Acquisition

Figure 4. Avulsion at the Snohomish Floodplain Acquisitions Phase 1 AKA Lund Acquisition Project Site

WRIA 7 – Project Description
Pilchuck River Armoring Removal and Riparian Restoration

December 22, 2020

Project Name and Number
Pilchuck River City Bank Armoring Removal (7-P-H7[4])

WRIA 7 WRE Subbasin
Pilchuck

Narrative Description
This project will result in the removal or "softening" of approximately 2,000 linear feet of bank armoring on and downstream of the former City of Snohomish water treatment facility associated with a water transmission main recently made obsolete with the removal of the Pilchuck River Diversion Dam. This bank armoring is located within the Middle Pilchuck subbasin, which has been prioritized for mainstem primary restoration. Restoration of functioning riparian and floodplain areas on this property will aid in achieving salmon recovery goals.

Quantitative or qualitative assessment of how the project will function.
Armoring removal and in-stream restoration will increase connectivity to onsite wetlands and off-channel habitat, increase flood storage, improve riparian conditions, improve in-stream habitat, and improve water quality.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1, Figure 2, and Figure 3.

Description of the anticipated spatial distribution of likely benefits.
Project implementation will benefit fish populations in the Pilchuck River Watershed, primarily within the Middle Pilchuck Sub Basin.

Performance goals and measures.
- Removal and/or modification of up to 2,000' of bank armoring.
- Removal of transmission main under the Pilchuck River Mainstem.
- In-stream habitat improvements including large woody debris installation.
- Riparian enhancement of up to 2,000' adjacent to the mainstem Pilchuck River.
- Species benefiting: Chinook, Steelhead, Coho, Bull Trout, Chum, Pink, Cutthroat and other fish species.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.
Pilchuck River armoring removal will address myriad limiting factors (floodplain/riparian function, in-stream habitat, water quality, etc.) for both Chinook and other salmonid species at virtually all adult and juvenile freshwater life stages from incubation to rearing and adult holding and spawning. Species

[4] Other project numbers associated with this project: 07-MPR-265; 2018-0425

benefiting include Chinook (threatened), Steelhead (threatened), Coho, Bull Trout (threatened), Chum, Pink, Cutthroat and other fish species.

Identification of anticipated support for and barriers to completion.

The Tulalip Tribes has a close working relationship with the City of Snohomish who owns easements and the transmission main adjacent to the subject armoring and is open to discussing this proposal. Initial conversations with the landowner (Younce) indicates significant interest in armoring modification and other enhancements on the subject property.

Barriers to completion could include future discussions with the landowner and the City over project designs and outcomes. However, we are confident that we can come to a mutually beneficial outcome with this project. It is helpful that the project would be entirely on City and one other private ownership (Younce).

Estimate of capital costs and reoccurring O&M costs.

- Planning Costs: $200,000
- Restoration Costs: $500,000
- O&M Costs: Minimal

Anticipated durability and resiliency.

Climate change and associated impacts will be factored into all current and future project elements. Restoration will enhance resilience through habitat accessibility, diversity, quantity, and quality. The intent is to pursue natural process based solutions as much as possible to reduce maintenance requirements and ensure long term project function and durability.

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

The Tulalip Tribes are the proposed project sponsor for this work, and are ready to begin project planning and eventual implementation. Tulalip restoration project managers have extensive experience implementing restoration projects in this region. These projects have had varying scopes from very large, multimillion-dollar acquisition/restoration projects (Qwuloolt) to smaller fish passage and in-stream projects. We will draw from this experience and associated lessons learned while conducting these projects. This project is currently in the scoping phase, though the outreach and design phase could start as soon as funding is secured.

Documentation of sources, methods, uncertainties, and assumptions.

Methods will be determined as part of the initial planning phase of this project. Uncertainties are primarily related to the design considerations and landowner negotiations.

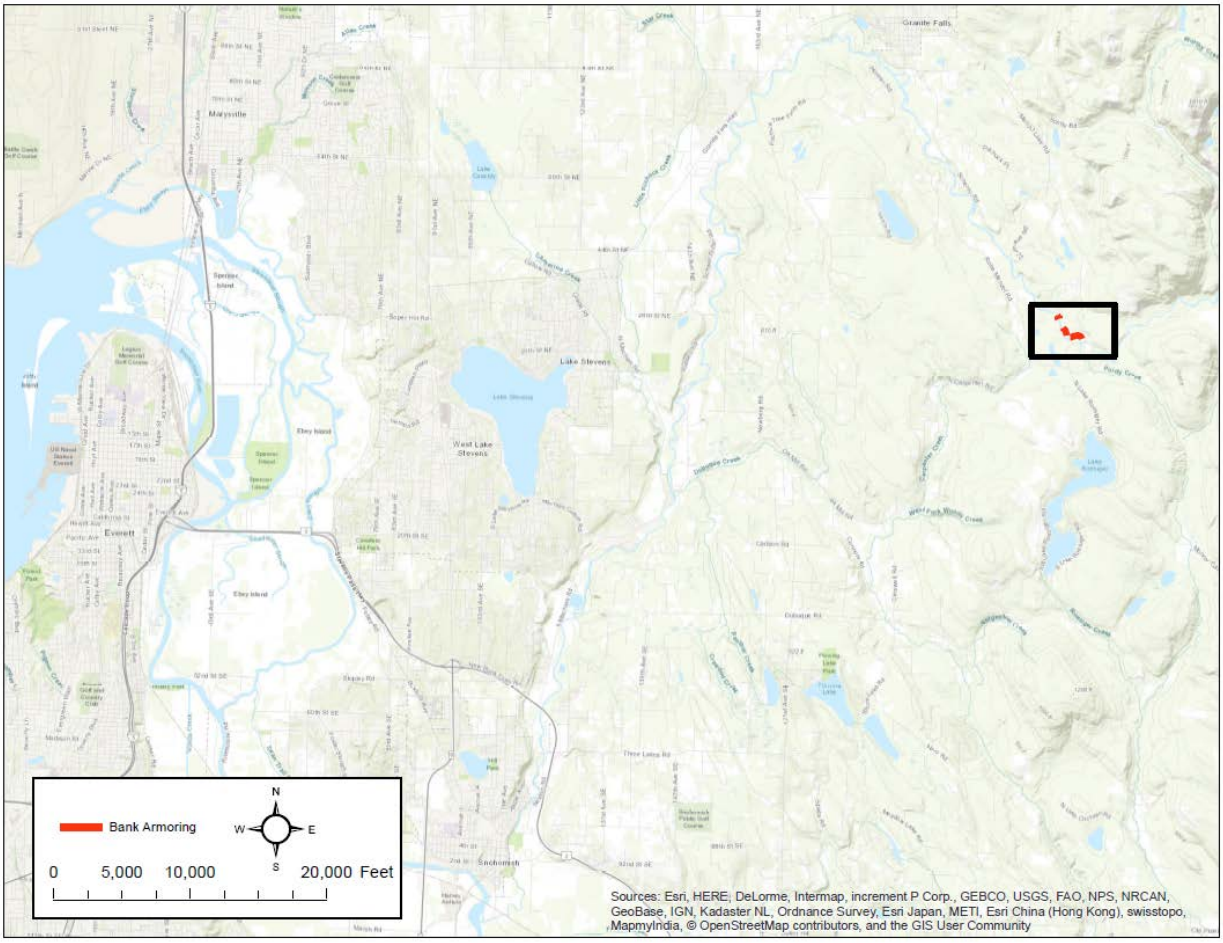


Figure 1. Project Vicinity Map

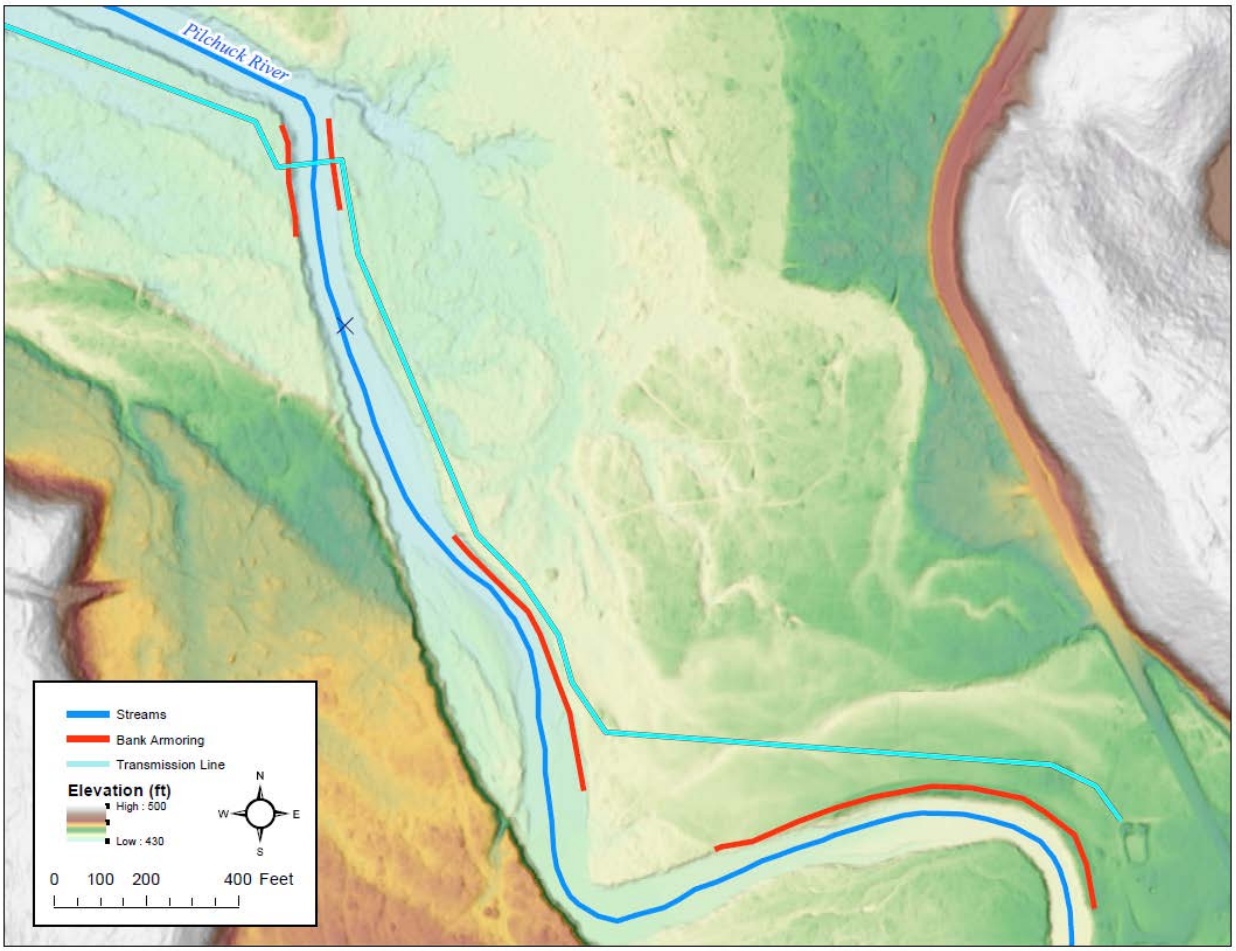


Figure 2. LiDAR for Project Vicinity

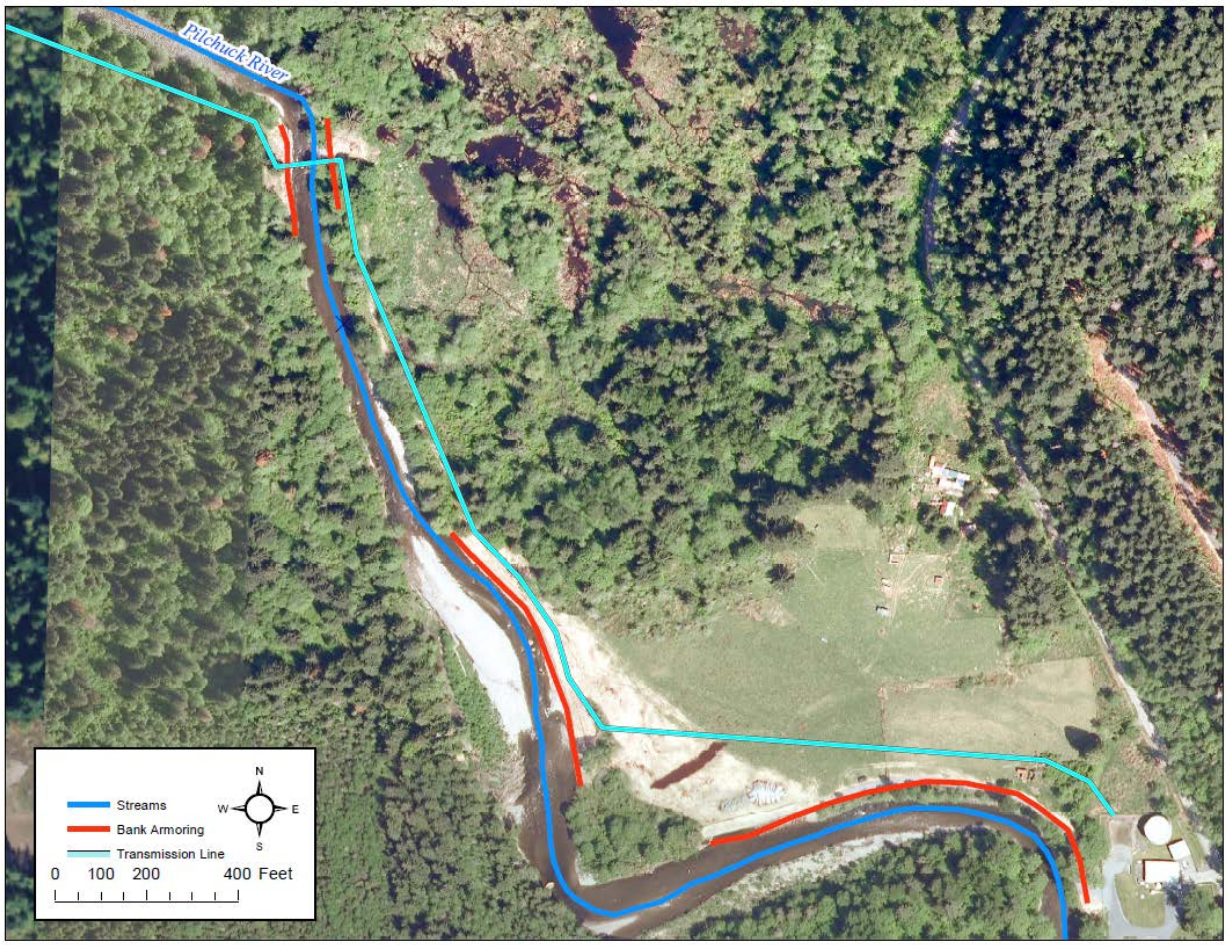


Figure 3. Ortho image for Project Vicinity

WRIA 7 – Project Description
Living with Beavers

December 22, 2020

Project Name and Number
Living with Beavers (7-P-H8)

WRIA 7 WRE Subbasin
Woods Creek, Pilchuck, Little Pilchuck, Snohomish Estuary/Mainstem subbasins.

Narrative description.
The Snohomish Conservation District coordinates a landowner education and assistance program to encourage landowners to allow beavers and their habitat to remain mostly un-modified on the landscape instead of trapping and removing the beaver and their habitat. This program consists of educating landowners on the importance of beaver ponds through workshops and one-on-one technical assistance site visits and project implementation assistance including design, permitting, and cost-share funding with large tree protection (cages), planting wetland plants, deceiver structures to prevent damming activities, and where appropriate, pond-leveler devices. These devices allow for fish passage but also limit the height of the beaver pond to reduce impacts to human infrastructure. The result of these activities has meant beaver ponds on private property across the county have been maintained or grown in size when they would have otherwise been drained.

A quantitative or qualitative assessment of how the project will function.
An ongoing study in the Skykomish River basin has shown that beaver ponds and the associated below-surface storage have significant potential to increase resilience to hydrologic change (Dittbrenner et al., 2018b – in process). Encouraging landowners to allow beavers to build ponds where they are currently expanding their populations is an extremely cost-effective approach to increasing water storage, recharging groundwater, increasing summer flows, and decreasing surface water temperatures. This project complements the Tulalip Tribes Beaver Reintroduction project, which repopulates beavers to areas in the upper watershed. Where landowners are not willing to allow beavers to remain, relocation efforts can provide benefits in the headwaters.

A map and drawings of the project location.
See Figure 1 below.

Description of the spatial distribution of likely benefits.
Maintaining and promoting beaver on the landscape is anticipated to regulate hydrology (increasing water storage, recharging groundwater, increasing summer flows) decrease surface water temperatures, and buffer the impacts of climate change in the focus subbasins (see Figure 1).

Performance goals and measures.
The program includes pro-active outreach to primarily private landowners in the focus subbasins to educate landowners and encourage them to allow beavers to remain on the landscape. Snohomish Conservation will provide technical assistance, permitting, and installation assistance for beaver control devices that protect culverts (beaver deceivers) and maintain a stable pond level (pond levelers).

Snohomish Conservation District will provide additional incentives to landowners for allowing beavers to remain on the landscape. These include free native plants that are appropriate for the new hydrologic regime as well as caging materials to protect large existing trees.

- Increased landowner tolerance of beavers and beaver presence in the focus subbasins.
- Install ten beaver control devices.
- Provide technical assistance on at least 30 site visits.

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

The focus subbasins were selected for their high potential to increase resilience to climate induced hydrologic changes as identified in the Watershed Characterization for WRIA 7 (2015) and the Snohomish Basin Protection Plan (2015). They also represent the nexus of priorities for salmon habitat restoration and water quality improvements (namely water temperature). As all of these priorities are intricately entwined, this focus area became the obvious choice for a comprehensive landscape-scale approach to watershed resilience. Climate change has already resulted in drastic changes to the hydrology of the Snohomish River, trending from a bimodal hydrograph with flood peaks in the fall and spring, to a unimodal hydrograph with intense floods in the middle of winter and low stream and river flows in summer months (Mauger et al., 2015). With the projected loss of snowpack in the upper watershed, it is essential that we take a comprehensive approach to storing and infiltrating water throughout the watershed to mitigate against these projected changes. Lessening water withdrawals in the summer, while providing a direct benefit to summer low flows, is only a piece in the puzzle and does not address the long-term needs for water storage and groundwater recharge in the larger watershed.

Details for each subbasin are as follows:

Pilchuck River –The Pilchuck River supports ESA listed Chinook and bull trout salmon and "restoration of hydrologic and sediment processes for peak and baseflows" is a Tier One priority in the Snohomish River Basin Salmon Conservation Plan. In addition, the Pilchuck River and French Creek basins are the focus for a TMDL for dissolved oxygen and temperature that the Department of Ecology is currently completing. Pressures in the basin include continuing development from the nearby urban centers of Lake Stevens and Snohomish leading to increasing water withdrawal from exempt wells.

French Creek – French Creek is part of the joint TMDL for dissolved oxygen and temperatures with the Pilchuck River. Lower French Creek was once a large scrub shrub wetland in the floodplain of the Snohomish River but has since been diked and drained for farming. Water quality through this lower watershed creates a fish passage barrier and drainage challenges due to upland development and subsiding farmland threaten agricultural viability.

Woods Creek – Woods Creek is home to several species of salmon including ESA listed Chinook and bull trout. Restoration of "hydrologic and sediment process for peak and base flow" in Woods Creek is a Tier One priority in the Snohomish River Basin Salmon Conservation Plan. In addition, Woods Creek is part of a TMDL in development for water temperatures in the Lower Skykomish River subbasin. Pressures in the basin include development from the nearby urban center of Monroe and conversion of larger agricultural tracts to a five acre rural residential development.

Lower Skykomish River – This section of the Skykomish River is home to several species of salmon including ESA listed Chinook and bull trout. Restoration of "hydrologic and sediment process for peak

and base flow" in the Skykomish River is a Tier One priority in the Snohomish River Basin Salmon Conservation Plan. In addition, the lower river is part of a TMDL in development for water temperatures. Pressures in the basin include development from the nearby urban center of Monroe and conversion of larger agricultural tracts to five acres rural residential development.

Identification of anticipated support for and barriers to completion.

One reason the Snohomish Conservation District has been so successful at achieving habitat restoration and water quality goals is their ability to engage private landowners and build community support for responsible stewardship of our natural resources. The District will capitalize on these strong relationships within the community to implement this project. The District has the staff expertise and partnerships to be able to successfully implement this program in the priority subbasins.

Estimate of capital costs and reoccurring O&M costs.

The project received $100,296 streamflow restoration funding in 2019 to fully fund the program in the four focus sub-basins. To continue an ongoing program, additional funding will be needed. Annual program costs are estimated at approximately $22,000 per year to provide landowner outreach, education and on-site technical assistance, permitting assistance, and cost-share project implementation of beaver management devices. Snohomish Conservation District typically provides cost share funding totaling $2,000 each year; this funding is provided by the Snohomish Conservation District Rates and Charges funding, a special assessment charge to some property taxpayers in Snohomish Conservation District's service area that is authorized under RCW 89.08.400. Snohomish Conservation District's Rates and Charges special assessment charge to property taxpayers is subject to Snohomish County Council approval.

Project durability and resiliency.

Human alterations to the landscape and the climate change have resulted in drastic and accelerated consequences to the health of our watershed. A combination of increased intensity and frequency of winter flood flows, a decrease in snowpack, a decrease in groundwater recharge, and a decrease in summer precipitation have created a new hydrologic regime. While the focus of this project is on restoring summer flow to our rivers, low flows are symptomatic of a much broader hydrologic problem – one that can only be addressed in a comprehensive way by working across the watershed to implement projects that protect or restore natural hydrologic processes and watershed functions to protect against the already realized impacts of climate change. This project aims to restore altered hydrology by promoting beavers on the landscape.

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

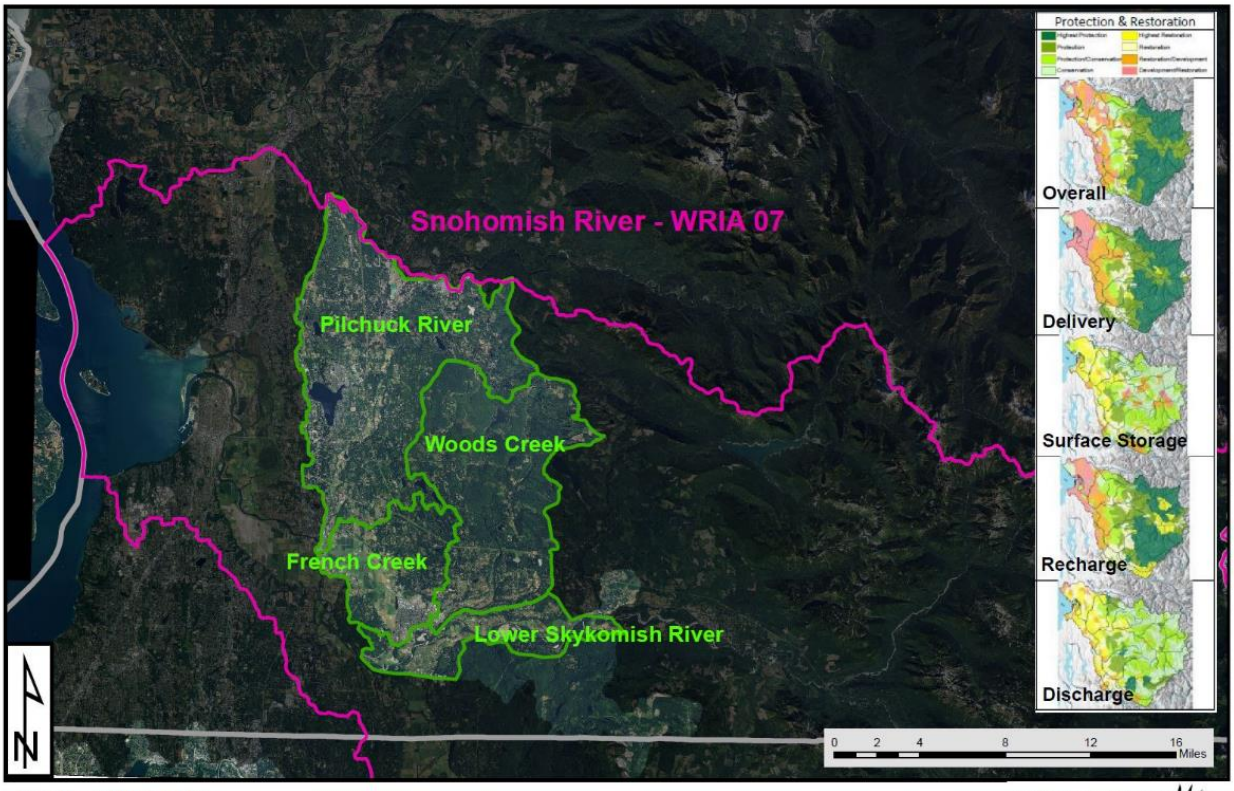
Snohomish Conservation District. Kristin Marshall, kristin@snohomishcd.org. The project sponsor began implementation of the project in 2016 with support of National Estuary Program. A new grant agreement was signed in 2019 with streamflow restoration funding to implement this project.

Documentation of sources, methods, uncertainties, and assumptions.

Dittbrenner et al. 2018a. Modeling intrinsic potential for beaver habitat to inform restoration and climate change adaptation. PLoS ONE 13.

Dittbrenner et al. 2018b (in process). Hydrologic and temperature effects of beaver in headwater streams. Ch.3 of dissertation. School of Environmental and Forest Sciences, UW.

Mauger et al. 2015. State of Knowledge: Climate Change in Puget Sound. Climate Impacts Group, University of Washington.



Focus Sub-basins
Community-based water storage restoration - Snohomish River

Inset at right from Watershed Characterization for WRIA 07: Assessment and Recommendations for Protection of Water Flow Processes. Department of Ecology, 2015.

SNOHOMISH CONSERVATION DISTRICT

Figure 1. Project focus area.

WRIA 7 – Project Description
Small Farm Storage Initiative

December 22, 2020

Project Name and Number
Streamflow Restoration - Small Farm Storage Initiative (7-P-H9)

WRIA 7 WRE Subbasin
Pilchuck River, Estuary & Snohomish Mainstem, and Skykomish Mainstem

Narrative Description
Snohomish Conservation District (SCD) and Department of Ecology (Ecology) recognize the opportunity to leverage individual landowners to get involved in the larger goal of storing water in the landscape to improve streamflows. Many small farmers have opportunities on their land to simultaneously improve water management and contribute to streams and rivers during critical periods. SCD and Ecology set out to develop pilot projects that would explore costs, feasibility, and the storage capacity of individual landowners. The idea is that while each individual may not store enough water to have a significant impact on streams, if the concepts this project develops are easily replicable and scalable, landowners can collectively store large amounts of water across the watershed to contribute to streamflow during low flow periods.

SCD has developed a short-list of pilot projects designed to meet the requirements to increase replicability. To make these projects more accessible to interested landowners, the selected project concepts are low cost in terms of design and maintenance and carry a low permitting burden. The idea is that these storage designs can be incorporated into a suite of existing BMPs to be applied by environmentally conscious landowners (eg: rain gardens, rain catchment, riparian and wetland forest buffers, beaver management).

Some project concepts SCD is exploring include:

- Storage ponds to hold water, serve as seasonal habitat, and release water back into the watershed in the dry months of late summer
- Infiltration ponds to slow the rate at which heavy rain events make their way to streams and rivers, reducing flood damages, spreading rainwater-driven flows over a longer period of time, and increasing ground water
- Water offsets for agricultural use, using either storage tanks or ponds to capture water during high-flow periods in the winter to reduce farmer's needs for use of limited water resources in the summer

Quantitative or qualitative assessment of how the project will function.
Project functions include increases to streamflow during summer months, storm water storage, seasonal habitat, and reduced draw on water resources by private landowners and small farmers. Many of the potential pond sites examined during site-selection identified opportunities to store 1/3 to 2 acre-feet per year (AFY) of rainwater by capturing water in manufactured landscapes, wetlands, or other storage features. By capturing this water and either using it to infiltrate into the watershed during dry summer months or to reduce ground water use in the dry season, each landowner can make an

incremental contribution to larger streamflow restoration goals. No water offset is assumed for purposes of this plan.

A map and drawings of the project location.

See Figures 1-6 below.

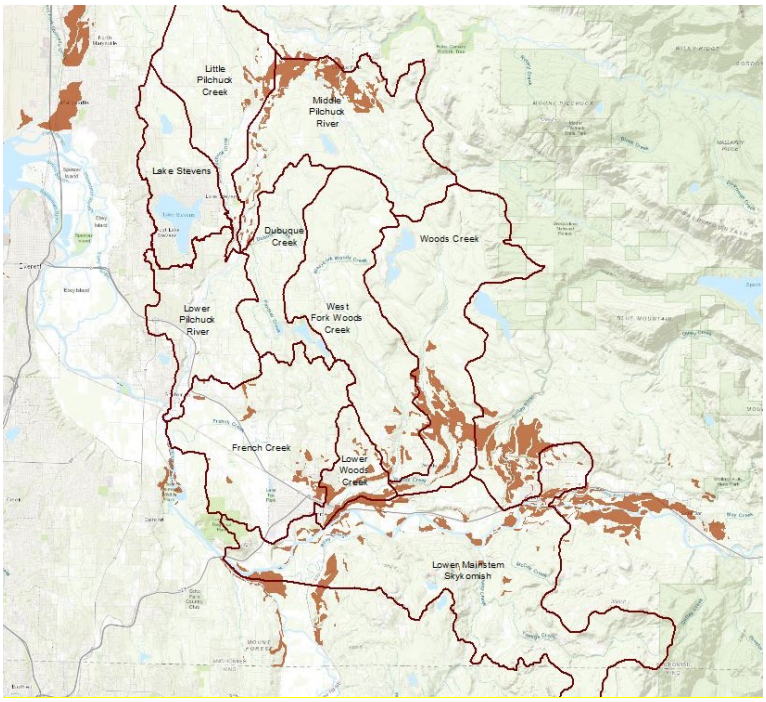


Figure 1. Project focus area - Puget Sound Watershed Characterization high and medium high recharge areas intersected with ideal, high infiltration soils

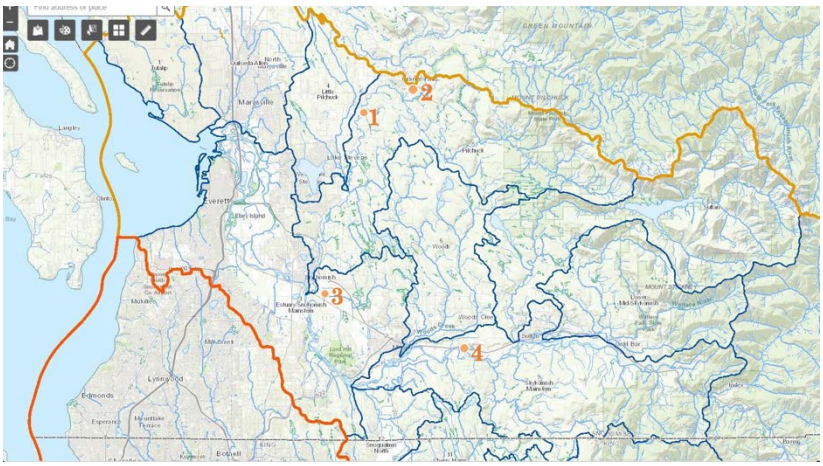


Figure 2. Site Overview with included Pilot examples

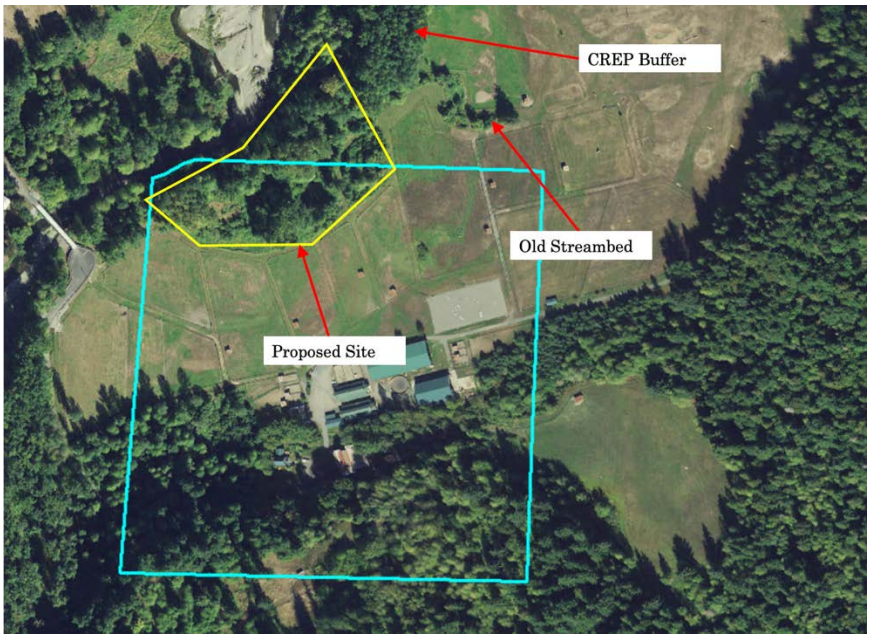


Figure 3. Pilot Site 1

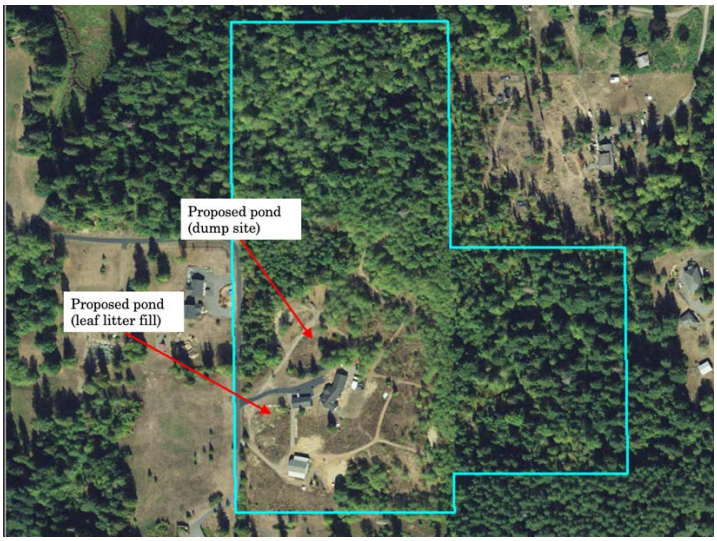


Figure 4. Pilot Site 2

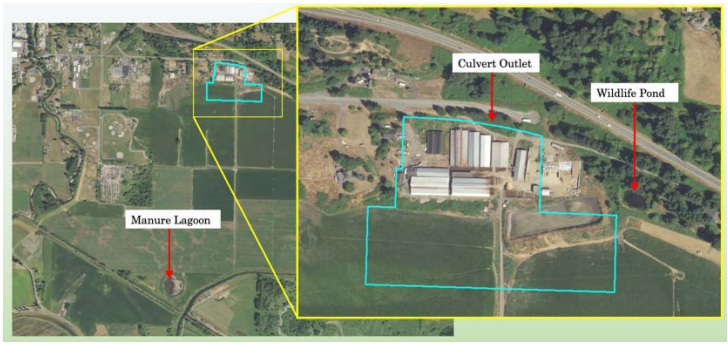


Figure 5. Pilot Site 3

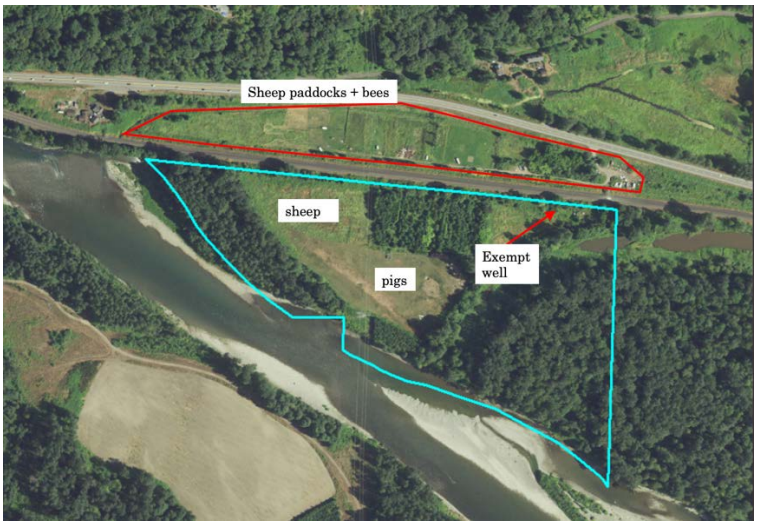


Figure 6. Pilot Site 4

Description of the anticipated spatial distribution of likely benefits.

This project will identify sites across the WRIA 7 focus subbasins within the Puget Sound Watershed Characterization Project high and medium high recharge importance delineations and ideal soil types. These individualized sites will sit across important waterways including but not limited to the Pilchuck River, Woods Creek, French Creek, and the Skykomish River. Project sites will augment streamflow through infiltration in important recharge areas and by reducing landowner demand on groundwater through exempt wells and springs. Not only will small scale projects recharge small streams and rivers, but constructed wetlands and planted ponds will provide important habitat for amphibians, birds, and insects.

Performance goals and measures.

The performance goal is to recharge streams and rivers at low-flow periods. While these projects are still in the design phase, suggested metrics for infiltration pond projects could include proxy measures such as pond storage area, acres planted, groundwater levels, and waterway (stream/river) discharge. For storage projects, rainfed water supply use could be measured.

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

By increasing the duration/persistence of water in of small scale side channels and streams, these restoration actions are expected to benefit documented Chinook, coho, chum, sockeye and pink salmon as well as bull trout and cutthroat, and steelhead trout. Chinook, steelhead and bull trout are listed as threatened under the U.S. Endangered Species Act. Planted ponds will also serve as habitat for a range of amphibians, insects, and birds.

Identification of anticipated support and barriers to completion.

Two of these pilot projects are currently funded by Department of Ecology's Streamflow Restoration Grant. With proven project concepts, additional funding could come from future Streamflow

Restoration program funding, implemented with conservation rates cost-share, or be included in Floodplains by Design agricultural resilience work.

Estimate of capital costs and reoccurring O&M costs.

Example costs for pond with 1-2 acre feet of storage. Some pilot projects are expected to be lower cost due to landowner capacity to volunteer equipment/time. Design costs are not included.

Storage Pond

Excavation: $3,000 per 10,000 square foot

Liner: $12,500 per 10,000ft2

Planting: $4,000 per for 4, 000 square foot of planting

- Roughly $20,000 for lined ¼ acre pond
- As low as $7,000 for unlined pond
- If using compacted fill instead of liner- $10,000

Shipping Container Water Holding Concept

$2,000 container + $2,000 liner = $4,000 total cost per container

5 containers = $20,000

Water bladder = $7,500

5 bladders + plumbing = $40,000 - $45,000

Operation and Maintenance for first 10 years should be minimal with primarily passive pond designs, at approximately $1,000 to maintain plantings per year. In the case of agricultural water offsets, maintenance would be the landowners' responsibility.

Anticipated durability and resiliency.

The project is expected to be durable and resilient. As landscape level features, ponds should persist in the landscape with minimal maintenance for a minimum of 20 years. Life expectancy of agricultural water storage projects is dependent on factors including design and maintenance, but they should last a minimum of 10 years.

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

Snohomish Conservation District (SCD) is the project sponsor. SCD engineers are ready to begin project designs for water storage projects at the selected project sites.

Documentation of sources, methods, uncertainties, and assumptions.

Desk Analysis: Step 1

- Set out with the goal of refining sites by optimal conditions for storage and infiltration via GIS
- Considered Puget Sound Watershed Characterization delineations between levels of Importance for groundwater recharge
- Refine high and medium-high recharge importance Assessment Units with permeable soils (sandy/gravelly) to identify suitable groundwater recharge sites (within focus subbasin)
- We did not incorporate slope data in our analysis (though originally the plan) because:
    - While Western Washington subsurface water flow typically follows topographic gradients, vertical and lateral subsurface flow can often be controlled by bedrock and

other sub-surface features contrary to general topographic gradients -- beyond the scope of our analysis
    - Even if subsurface water flow direction does not follow the general terrain gradient due to unknown subsurface features, it is unlikely that recharge water would be discharged outside of the target watershed/WRIA7
    - Since most areas identified do not lie on steep slopes, it is more efficient to determine whether slope plays a significant or even prohibitive role in site selection on a site-by-site basis (avoid slopes greater than 6%)

Desk Analysis: Step 2

- Imported SalesForce SCD cooperator data to GIS
- Intersected cooperators with focus subbasins (377)
- Used GIS parcel map to select parcels that intersected with H+MH recharge importance and suitable soils, resulting in 117 parcels
- "Crowdsourced" cooperator name list among SCD staff, identifying 17 property owners with:
    - Sufficient space for a project
    - Potential existing structures or land features for water storage
    - Likely willingness to proceed
- Selected 17 sites
- Used satellite images and GIS data to rank sites based on acreage, zoning, land use, and existing structures/potential available space
- Used LIDAR + slope data to find sites with enough flat area to infiltrate water rather than running it off, and that could support ponds etc.
- Reached out to 7 highest ranked landowners to start discussions, identified 4 landowners with 5 top projects

WRIA 7 – Project Description
Wetland Restoration

December 22, 2020

Project Name and Number
Wetland Restoration (7-P-H10)

WRIA 7 WRE Subbasin
Woods Creek, Pilchuck, Little Pilchuck, Snohomish Estuary/Mainstem

Narrative description.
The Snohomish River watersheds historically supported large populations of Pacific salmonids, including threatened Puget Sound Chinook salmon and steelhead trout, and the commercially important coho salmon. The landscape that supported these fish populations included extensive forests that grew along complex rivers, streams, and estuaries rich with wide floodplains, extensive wetlands, large wood log jams, and beaver ponds. In the mid-1800s, Euro-American settlers began to heavily modify the landscape including extensive alterations for agricultural and forestry purposes. Many of these modifications were located on the river corridor and within the floodplains of the Snohomish and Stillaguamish River systems and continue to impact water quality, salmon production, and hydrologic processes today. Especially as climate change impacts the Snohomish watershed, restoration of wetlands is needed to restore and protect hydrology. A large portion of the converted wetlands are located on private land where restoration of wetlands is completely voluntary, which poses a substantial barrier to wetland restoration.

Snohomish Conservation District will complete eighteen acres of wetland restoration planting on degraded wetlands on privately owned land in the Pilchuck River, French Creek, Woods Creek, and Lower Skykomish River watersheds, with the goal of improving water storage and groundwater recharge. Snohomish Conservation District will work with private landowners and restoration crews, including Washington Conservation Corps and Veterans Conservation Corps crews, to complete site preparation and maintenance of installed vegetation and to control invasive vegetation. The planting plan for each wetland will be determined based on location, historic condition, soil type, existing hydrologic regime, and invasive vegetation present but will be designed for maximum water storage and/or infiltration.

A quantitative or qualitative assessment of how the project will function.
In addition to storing above and below ground water, wetlands have been shown to significantly contribute to groundwater resources, thus regulating surface water flow throughout watersheds (Carter, 1986; Bradley and Brown, 1997; ven der Kamp and Hayashi, 1998; Mitsch and Gosselink, 2000). Wetlands throughout the Snohomish River watershed have been degraded or completely lost as wetland areas have been converted to make way for human land-uses such as development and agriculture. In the focus subbasins, there are numerous locations where farms have been left fallow due to difficulties draining the land. The District will use aerial imagery, soil maps, and several wetland datasets to identify high potential wetland restoration sites and reach out to landowners to solicit support to complete wetland planting.

A map and drawings of the project location.

See Figure 1 below.

Description of the spatial distribution of likely benefits.

The project will restore degraded wetlands in the focus subbasins to improve surface water storage, increase groundwater recharge, decrease surface water runoff, increase summer stream flows, and ultimately increase hydrologic resilience to climate change in the focus subbasins (See Figure 1 below). Although the first phase of planting includes only 18 acres of planting across a large geographic area, Snohomish Conservation District is currently in the process of completing a prioritization and site selection exercise to identify wetland restoration opportunities that are expected to provide the greatest potential hydrologic benefits. As additional funding is secured, Snohomish Conservation District and other project sponsors may use this prioritization to expand implementation across the project area.

Performance goals and measures.

The first phase of the project is anticipated to achieve the following goals:

- Create eighteen acres of restored wetlands through installation of native trees and shrubs.
- Performance measures of 80% survival of bare root, 50% survival of livestakes, and less than 20% invasive species cover by 2024.

Additional planting of prioritized sites will continue beyond 2024 as additional funding is secured.

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

The focus subbasins were selected for their high potential to increase resilience to climate induced hydrologic changes as identified in the Watershed Characterization for WRIA 7 (2015) and the Snohomish Basin Protection Plan (2015). They also represent the nexus of priorities for salmon habitat restoration and water quality improvements (namely water temperature). As all of these priorities are intricately entwined, this focus area became the obvious choice for a comprehensive landscape-scale approach to watershed resilience. Climate change has already resulted in drastic changes to the hydrology of the Snohomish River, trending from a bimodal hydrograph with flood peaks in the fall and spring, to a unimodal hydrograph with intense floods in the middle of winter and low stream and river flows in summer months (Mauger et al., 2015). With the projected loss of snowpack in the upper watershed, it is essential that we take a comprehensive approach to storing and infiltrating water throughout the watershed to mitigate against these projected changes.

Details for each subbasin are as follows:

Pilchuck River –The Pilchuck River supports ESA listed Chinook and bull trout salmon and “restoration of hydrologic and sediment processes for peak and baseflows” is a Tier One priority in the Snohomish River Basin Salmon Conservation Plan. In addition, the Pilchuck River and French Creek basins are the focus for a TMDL for dissolved oxygen and temperature that the Department of Ecology is currently completing. Pressures in the basin include continuing development from the nearby urban centers of Lake Stevens and Snohomish leading to increasing water withdrawal from exempt wells.

French Creek – French Creek is part of the joint TMDL for dissolved oxygen and temperatures with the Pilchuck River. Lower French Creek was once a large scrubshrub wetland in the floodplain of the

Snohomish River but has since been diked and drained for farming. Water quality through this lower watershed creates a fish passage barrier and drainage challenges due to upland development and subsiding farmland threaten agricultural viability.

Woods Creek – Woods Creek is home to several species of salmon including ESA listed Chinook and bull trout. Restoration of "hydrologic and sediment process for peak and base flow" in Woods Creek is a Tier One priority in the Snohomish River Basin Salmon Conservation Plan. In addition, Woods Creek is part of a TMDL in development for water temperatures in the Lower Skykomish River subbasin. Pressures in the basin include development from the nearby urban center of Monroe and conversion of larger agricultural tracts to five acre rural residential development.

Lower Skykomish River – This section of the Skykomish River is home to several species of salmon including ESA listed Chinook and bull trout. Restoration of "hydrologic and sediment process for peak and base flow" in the Skykomish River is a Tier One priority in the Snohomish River Basin Salmon Conservation Plan. In addition, the lower river is part of a TMDL in development for water temperatures. Pressures in the basin include development from the nearby urban center of Monroe and conversion of larger agricultural tracts to five acres rural residential development.

Identification of anticipated support for and barriers to completion.

One reason the Snohomish Conservation District has been so successful at achieving habitat restoration and water quality goals is their ability to engage private landowners and build community support for responsible stewardship of our natural resources. The District will capitalize on these strong relationships within the community to implement this project. The District has the staff expertise and partnerships to be able to successfully implement this program in the focus areas.

Estimate of capital costs and reoccurring O&M costs (order of magnitude costs).

The project received $220,240 streamflow restoration funding in 2019 to implement this project. Snohomish Conservation District will complete 18 acres of wetland planting and restoration with this funding. Additional funding of approximately $12,500 to $15,000 per acre is needed to complete additional wetland planting to achieve widespread streamflow benefits associated with wetland restoration.

Project durability and resiliency.

Human alterations to the landscape and the climate have resulted in drastic and accelerated consequences to the health of our watershed. A combination of increased intensity and frequency of winter flood flows, a decrease in snowpack, a decrease in groundwater recharge, and a decrease in summer precipitation have created a new hydrologic regime. This project aims to address human alterations to degraded wetlands in the focus areas by restoring them to a more natural and resilient state. Restoration of wetland habitat is expected to contribute to long-standing improvements in overall hydrologic processes and function in the watershed and build resilience in the watershed as climate change continues to alter the hydrologic regime of the Snohomish watershed. Restored wetlands are protected from future degradation or loss by several regulatory programs, including protections from Sections 402 and 404 of the federal Clean Water Act; Washington state regulations including the Water Pollution Control Act, Shoreline Management Act, and State Environmental Policy Act; and Snohomish and King County Critical Areas Ordinances as part of implementation of the Growth Management Act.

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

Snohomish Conservation District. Kristin Marshall, kristin@snohomishcd.org. The project sponsor began implementation of the project in 2016 with support of NEP funding. A new grant agreement was signed in 2019 with streamflow restoration funding to implement this project and additional funding from the Department of Ecology's Combined Water Quality Program has been secured to provide floodplain wetland and riparian planting funding for three specific sites identified during the first phase of the project.

Snohomish Conservation District has completed a preliminary wetland site prioritization and selection process to identify priority wetland planting opportunities on private land within the project area; final prioritization and site selection for the first 18 acres of wetland restoration will be completed in early 2020.

Documentation of sources, methods, uncertainties, and assumptions.

Carter. 1986. An overview of the hydrologic concerns related to wetlands in the United States. Canadian J. of Botany.

Bradley and Brown. 1997. Modeling of hydrological processes in a floodplain wetland. In Groundwater/Surface Water Ecotones: Biological and Hydrological Interactions and Mgt Options.

Mitsch and Gosselink. 2000. The value of wetlands: importance of scale and landscape setting. Ecological Economics.

Van der Kamp and Hayashi. 1998. The groundwater recharge function of small wetlands in the semi-arid northern prairies. Great Plains Research.

Mauger et al. 2015. State of Knowledge: Climate Change in Puget Sound. Climate Impacts Group, University of Washington.

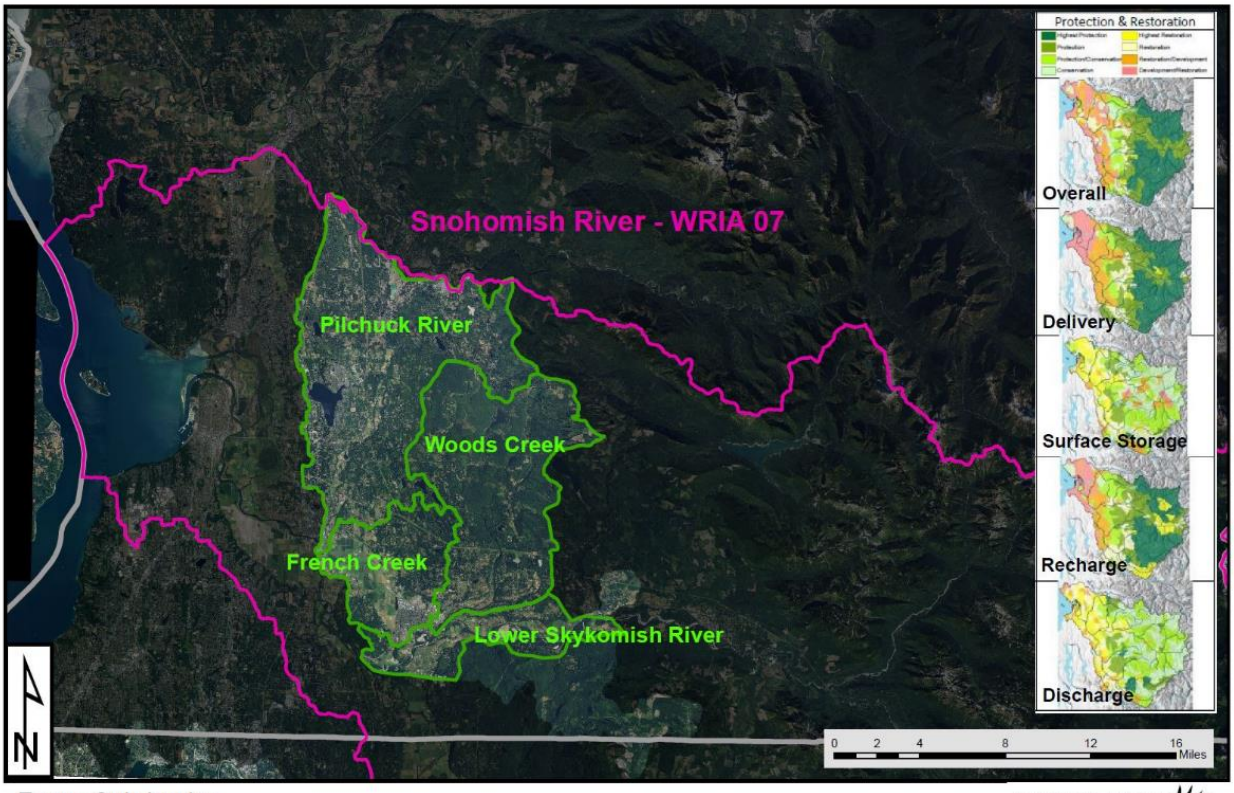


Figure 1. Project focus area.

WRIA 7 – Project Description
Woods Creek Riparian Restoration Partnership

December 22, 2020

Project Name and Number
Woods Creek Riparian Restoration Partnership (7-W-H11[5])

WRIA 7 WRE Subbasin
Woods Creek

Narrative description.
Woods Creek is identified as a high priority watershed in regional salmon planning efforts and water quality improvement plans. For these reasons, several project partners, including the Snohomish Conservation District, Sound Salmon Solutions, Wild Fish Conservancy, and Adopt a Stream Foundation partners have developed several collaborative plans to prioritize and set implementation goals for several of the limiting factors that threaten salmon populations, water quality for wildlife and humans, and streamflow in the watershed. Project partners completed additional analysis and prioritization of the needs of the basin and developed work plans to guide project implementation in the basin including a 2015 fish passage barrier assessment (Wild Fish Conservancy and Snohomish Conservation District) and the *Woods Creek Action Plan* (Snohomish Conservation District 2012); these plans were informed by the *Woods Creek Watershed Habitat Conditions Report* (Snohomish County Surface Water Management 2013), water quality studies, and the salmon recovery plan.

Snohomish Conservation District, Wild Fish Conservancy, Sound Salmon Solutions, and Adopt A Stream Foundation will implement prioritized riparian and wetland plants, log jam installations, and fish passage barrier corrections to restore 45 acres of riparian forest and instream habitat along the mainstem of Woods Creek and correct between 3 and 5 fish passage barriers to improve juvenile and adult access to spawning and rearing habitat.

A quantitative or qualitative assessment of how the project will function.
Quantitatively, this project proposes riparian plantings along the mainstem of Woods Creek of up to an additional 45 acres, installation of log jams along the mainstem in conjunction with riparian plantings, and correction of an additional 3 to 5 fish passage barriers. Project activities will increase habitat connectivity and provide shade and create pool habitat along the creek to protect water temperatures and directly benefit prey availability of pre-migrant and outmigrating juvenile salmonids.

A map and drawings of the project location.
See Figure 1 below.

Description of the spatial distribution of likely benefits.
The Woods Creek watershed is divided into the Lower, West Fork (named Carpenter Creek at the headwaters), and East Fork Woods Creek subbasins (Figure 1). The two nearly equal sized subbasins of the West and East Forks come together to form Lower Woods Creek at river mile 3.9. On the East Fork, there is a natural waterfall at river mile 4.2 preventing anadromous fish passage. Both the Snohomish

[5] Other project numbers associated with this project: 07-RPR-022

County Surface Water habitat conditions analysis and this riparian enhancement action plan focus analysis on the Lower, West Fork and East Fork of Woods Creek to the waterfall. These reaches will be referred to as the mainstem. The mainstem was further divided into eleven analysis reaches based on both the gradient of the channel and the land-use of the surrounding area (Figure 1).

The project will restore riparian habitat along the mainstem of Woods Creek by planting riparian and wetland habitat to provide shade which will protect water temperatures and outmigration success of juvenile salmonids; installing large wood and log jams to provide refuge habitat and create pools to provide streamflow benefits; and replacing fish passage barriers to improve fish access to spawning and rearing habitat.

Performance goals and measures.

Unknown at this stage of design.

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

Woods Creek is home to several species of salmon including ESA listed Chinook and bull trout. Restoration of riparian function within Woods Creek will improve water temperatures which is of high value since Woods Creek is part of a TMDL in development for water temperatures in the Lower Skykomish River subbasin. This watershed is the largest Puget Lowland watershed in the Skykomish River basin and supports runs of Chinook (threatened), steelhead (threatened), bull trout (threatened), coho (species of concern), chum, and pink salmon.

Identification of anticipated support for and barriers to completion.

One reason the Snohomish Conservation District, Wild Fish Conservancy, Sound Salmon Solutions, and Adopt A Stream Foundation have been so successful at achieving habitat restoration and water quality goals is their ability to engage private landowners and build community support for responsible stewardship of our natural resources. The project partners will build upon these strong relationships within the community as well as the history of successful project construction in this watershed to garner additional landowner support to implement the next phase of this project. The partners have the staff expertise and partnerships to be able to successfully implement this program in the focus areas.

Estimate of capital costs and reoccurring O&M costs (order of magnitude costs).

Project sponsors have secured several grant funds to implement the first phases of project implementation. The project secured $250,000 of grant funding from Department of Ecology and NOAA to complete initial prioritization, landowner outreach, and 45 acres of riparian restoration. The Salmon Recovery Funding Board (SRFB) and the Washington State Conservation Commission has provided approximately $400,000 to correct four fish passage barriers and complete preliminary design of a fifth barrier correction project, and there was additional funding secured to complete several log jam installations in conjunction with the riparian planting projects.

Additional funding is needed to implement large wood, fish passage barrier, riparian, and wetland restoration actions. At least $950,000 in additional funding is needed for the next phase of planting, large wood installation, and fish passage barrier removal project construction.

Project sponsors have included in the construction cost estimates the costs associated with maintaining planting projects for three to five years, after which time the plantings are expected to achieve a free-to-grow state and maintenance is expected to be minimal. Planting and large wood projects are designed to require limited to no operation and maintenance once initial planting maintenance is completed.

O & M costs of fish passage barrier correction projects is the responsibility of the landowner once the project is complete.

Project durability and resiliency.

The project elements that are proposed as part of this cooperative project are designed to work with and contribute to restored natural processes. Maintenance of planting projects is needed for a period of three to five years once the native plants are installed to ensure a high plant survival rate; maintenance includes mechanical, chemical, and manual weed control, watering, plant replacement. The project area is naturally very wet so that watering will likely be quite limited. 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; log jams will be monitored for a period of 5 years as well. Fish passage barrier correction projects are inspected annually by the project sponsor for at least two years, and annually by the landowner after that period.

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

Snohomish Conservation District, Wild Fish Conservancy, Sound Salmon Solutions, and Adopt A Stream Foundation are collaborating as project sponsors of coordinated, strategic restoration work in the watershed. Primary contact for the partner collaborative for Streamflow Restoration Plan is Snohomish Conservation District. Kristin Marshall, kristin@snohomishcd.org.

Riparian and wetland restoration prioritization has been completed. Fish passage barrier correction prioritization has been completed. Landowner outreach and project design is ongoing. Project sponsors are actively working with several willing landowners who are committed to implementing habitat restoration projects on their land once grant funding is received by sponsors. Project sponsors can immediately proceed with final project design, permitting (if needed), and project implementation once additional grant funding is received.

Documentation of sources, methods, uncertainties, and assumptions.

Carter. 1986. An overview of the hydrologic concerns related to wetlands in the United States. Canadian J. of Botany.

Mitsch and Gosselink. 2000. The value of wetlands: importance of scale and landscape setting. Ecological Economics.

Mauger et al. 2015. State of Knowledge: Climate Change in Puget Sound. Climate Impacts Group, University of Washington.

Snohomish Conservation District. 2012. Woods Creek Action Plan for Riparian Restoration. Lake Stevens, WA.

Snohomish County Public Works Surface Water Management. 2013. Woods Creek Watershed Habitat Conditions Report. Everett, WA.

Wild Fish Conservancy and Snohomish Conservation District. 2015. Unpublished Woods Creek fish passage barrier inventory and prioritization. Duvall, WA.

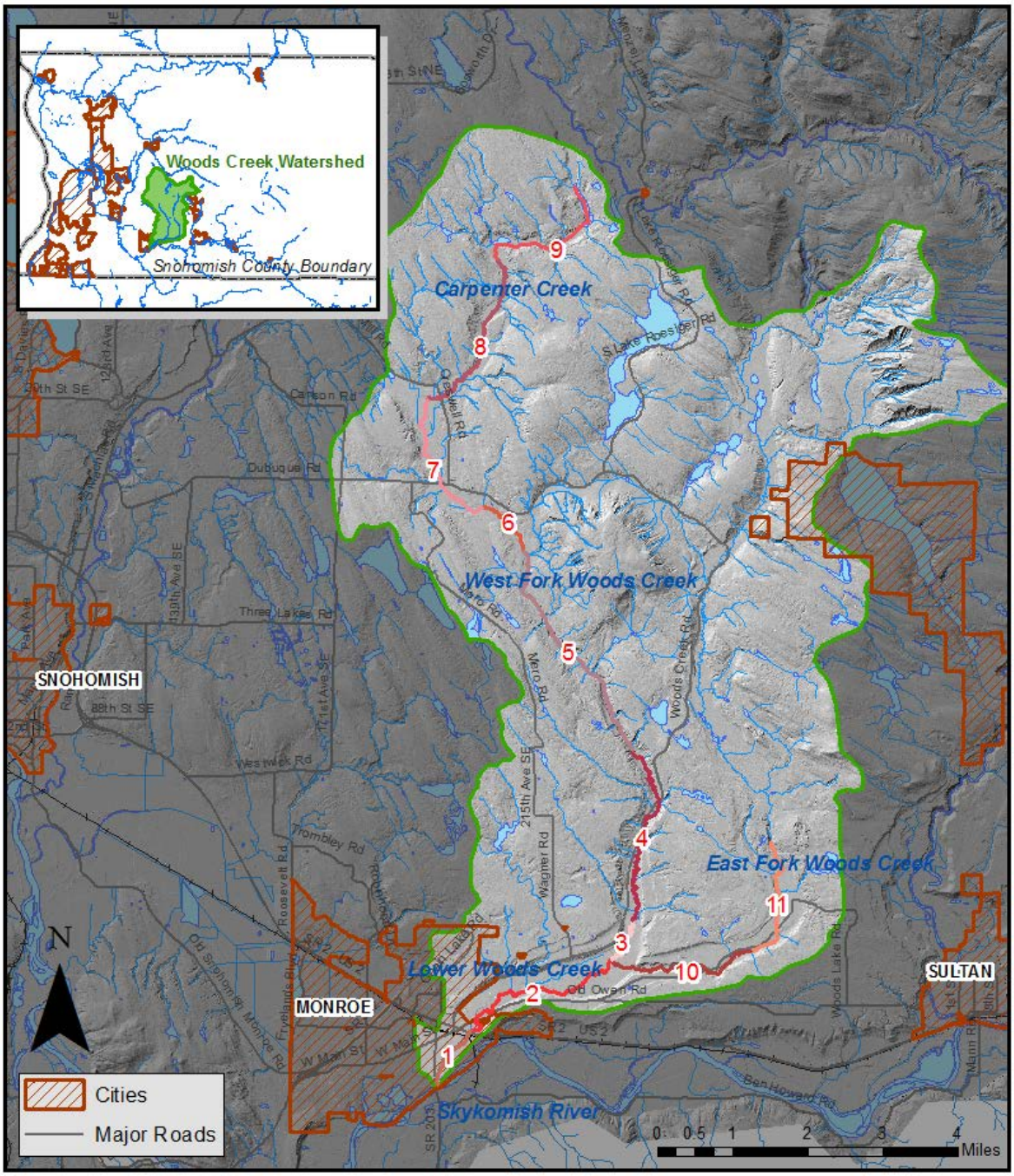


Figure 1. Project focus area.

Note: The Woods Creek watershed (boundary highlighted in green) flows into the Skykomish River at the City of Monroe. The mainstem of Woods Creek (Lower, West Fork, Carpenter, and East Fork) was divided into 11 analysis reaches (shades of red).

WRIA 7 – Project Description
Expansion of Sultan River Side Channel Network (Sultan River Floodplain Activation)

December 22, 2020

Project Name and Number
Expansion of Sultan River Side Channel Network (Sultan River Floodplain Activation) (7-S-H12)

WRIA 7 WRE Subbasin
Sultan

Narrative description
This project is a salmon habitat restoration project that will use a combination of physical interventions and flow redistribution to re-engage and restore select portions of the Sultan River floodplain. Of the 16 miles of river downstream of Culmback Dam, over 80 percent or approximately 13 miles, lies within a confined canyon. The lowermost 3 miles, just upstream of the confluence with the Skykomish River, is an alluvial floodplain. This area, near the town of Sultan, is populated and includes a combination of residential properties, park lands, and agricultural areas. The proposed project will manipulate and manage the distribution of flow into the floodplain environment within park and agricultural areas and establish a defined path for the return of these flows to the river. The activated, more frequently watered off-channel habitat will provide juvenile salmonid rearing habitat and refugia during high flow conditions. This is an expansion of an existing side channel network that currently provides prime rearing habitat. In addition to the redistribution of flows laterally from the main channel, the physical interventions will provide structural complexity and hydraulic diversity in the main channel. The project will provide increased diversity in spawning habitat important for building resiliency in existing and future salmonid populations.

Quantitative or qualitative assessment of how the project will function
The goal of this project is to expand the lateral migration of the river into off-channel areas to effectively increase the value and utility of these areas for rearing primarily for juvenile Chinook and Coho salmon. The intent and objective of the design is to route flow in a manner that will ensure the persistence of these areas. The degree to which the high flow channel remains seasonally wetted will be informed by detailed hydraulic and hydrologic modelling. A defined outlet and return to the river will ensure that rearing fish are not trapped or stranded when flows recede.

Specific design elements: 1) Increase flow delivery to floodplain by 5-8 cfs during low flow, 2) Expand active channel and side channel areas by at least 50,000 square feet, 3) Place at least six new log structures, 4) Place 3-4 boulder clusters, and 5) Increase substrate diversity over existing conditions.

Map and drawings of the project location
WRIA 7 Snohomish Basin – Sultan Subbasin. The project is in the Lower Sultan River, between river mile (RM) 0.5 and 1.8. The Sultan River is a major tributary to Skykomish River. The project site is shown in relation to surrounding physical features in Figure 1.

Description of the spatial distribution of likely benefits
Expand active channel and side channel by 50,000 square feet.

Performance goals and measures

The goal of this project is to expand the lateral migration of the river into off-channel areas to effectively increase the value and utility of these areas for rearing primarily for juvenile Chinook and Coho salmon. A secondary goal of this project is to increase the dynamism of the main channel and expand the range of spawning habitats available to anadromous fish in the lower river.

General measures include: 1) Design main channel to provide for diverse adult holding and spawning habitat over a range of hydrologic conditions, 2) Design to effectively expand the range of hydrologic conditions over which side channels receive inflow from the main river by manipulating the hydraulic inlet controls, 3) Incorporate the use of LWD structures to increase both adult and juvenile habitat availability in the mainstream and side channels, and 4) Provide design for expansion potential off-channel refuge and rearing habitat in side channels.

Descriptions of the species, life stages and specific ecosystem structure

Chinook salmon use the entire length of the Sultan River for spawning and rearing. The lower 3 miles, in proximity to the proposed site, is geomorphically distinct from other portions of the river. In contrast to the confined, canyon nature of the upper river, the lowermost reach of the Sultan River is broad, hydraulically diverse, and contains a wide variety of substrate sizes favorable to spawning by a variety of species beyond Chinook salmon including Pink, Coho, and Chum salmon as well as winter-run Steelhead Trout. In years when Pink salmon are present and abundant, Chinook tend toward using the upper reaches of the Sultan. In even years when Pink salmon are absent, Chinook are more frequently observed using the lower river. The lower Sultan River also provides important rearing habitat for the aforementioned species.

Identification of anticipated support for and barriers to completion

Landowners at the project site have been notified and are preliminarily supportive of this project to restore natural conditions for the benefit of salmonids. The Aquatic Resource Committee for the Sultan River has been notified and is also supportive of this project and its ability to advance salmon recovery. Identified uncertainties include funding sources and continued landowner willingness to use property for this project.

Estimate of capital costs and reoccurring O&M costs

Estimated total of design, permitting, and construction is approximately $1.1 million. Ongoing maintenance and monitoring for the first 5 years is approximately $10,000 per year.

Project durability and resiliency

As a regulated river, Culmback Dam affords the ability to moderate high flow events in the Sultan River and store water for the augmentation of summer flows. This level of flow control coupled with the regulation of temperature during periods of reservoir stratification adds an element of resiliency when facing the hydrologic extremes that are anticipated with climate change.

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

Snohomish County PUD. Keith Binkley, Natural Resources Manager, KMBinkley@snopud.com or Dawn Presler, Sr. Environmental Coordinator, DJPresler@snopud.com. The preliminary design concept for this project has been identified and discussed with landowners and an Aquatic Resource Committee familiar with the Sultan River.

Documentation of sources, methods, uncertainties, and assumptions

There is extensive habitat and species data collected in the Sultan River as part of the operations of the Jackson Hydroelectric Project. This information is available for public review at: https://www.snopud.com/PowerSupply/hydro/jhp/jhpfish/fishery.ashx?p=2069

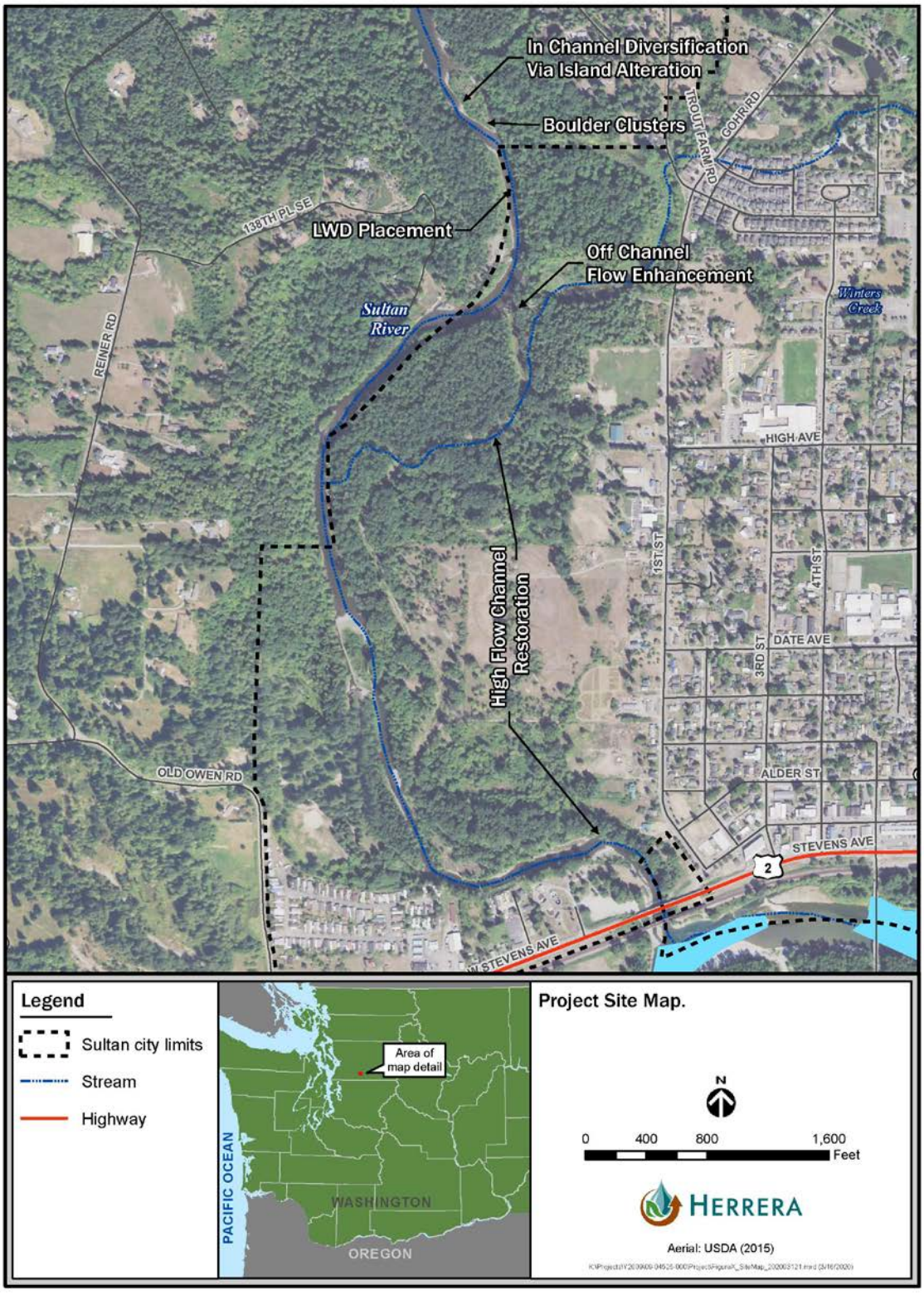


Figure 1. Sultan River Floodplain Activation Project Site Plan

WRIA 7 – Project Description
Haskel Slough Connectivity Habitat Project

December 22, 2020

Project Name and Number
Haskel Slough Connectivity (7-SM-H13[6])

WRIA 7 WRE Subbasin
Skykomish Mainstem

Narrative Description
Tulalip Tribes will complete designs, outreach and implement restoration on Haskel Slough, an approximately 2.4-mile-long (71 acre) side channel of the Skykomish River near Monroe, Washington. The slough provides critical spawning and rearing habitat for Chinook salmon and other listed fish species. There is a deteriorating training dike at the upstream end of the slough that prevents surface flow connectivity with the exception of extreme flood events. The goal of the restoration project is to enhance juvenile salmon rearing and flood refugia habitat in Haskel Slough by modifying the inlet dike to promote increased connectivity, water quantity and water quality. Additional project benefits will include floodplain water storage, and prevention of safety and infrastructure damage resulting from catastrophic dike failure.

As part of the planning phase, Tulalip Tribes will conduct a landowner willingness assessment and feasibility analysis including development of potential connectivity alternatives, associated geomorphic analyses, HEC-RAS 2d hydraulic modelling, extensive community outreach, a preferred alternative, and final designs. Restoration will include inlet dike modification, downstream crossing removal/replacement/modification, and riparian planting. The intent is to maximize side channel activation and water quantity at the maximum range of river discharge fluctuation while maintaining or improving flood risks to landowners and infrastructure.

Quantitative or qualitative assessment of how the project will function.
This project will function primarily by modifying the Haskel Slough inlet dike to maximize side channel activation and water quantity at the maximum range of river discharge fluctuation (low and high flows) while maintaining or improving flood risks to landowners and infrastructure. This may require levee setbacks/construction, modifications or replacement to downstream crossings of Haskel Slough, and channel reconfiguration. The intent is to increase juvenile salmon rearing habitat connectivity, quantity and quality in a key area within the Snohomish River Basin.

A map and drawings of the project location.
This project proposes restoration within Haskel Slough, a side channel of the Skykomish River near Monroe, Washington. The project site is shown in relation to surrounding physical features in Figure 1 and Figure 2.

[6] Other numbers associated with this project: 20-11140

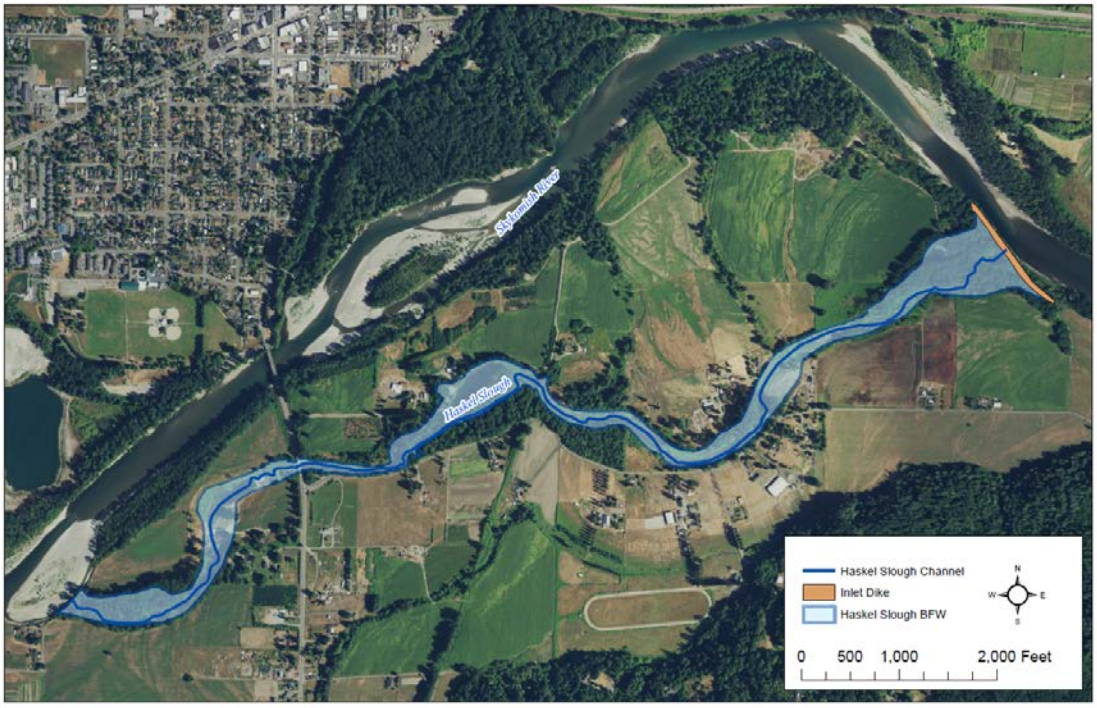


Figure 1. Haskel Slough Site Plan Overview

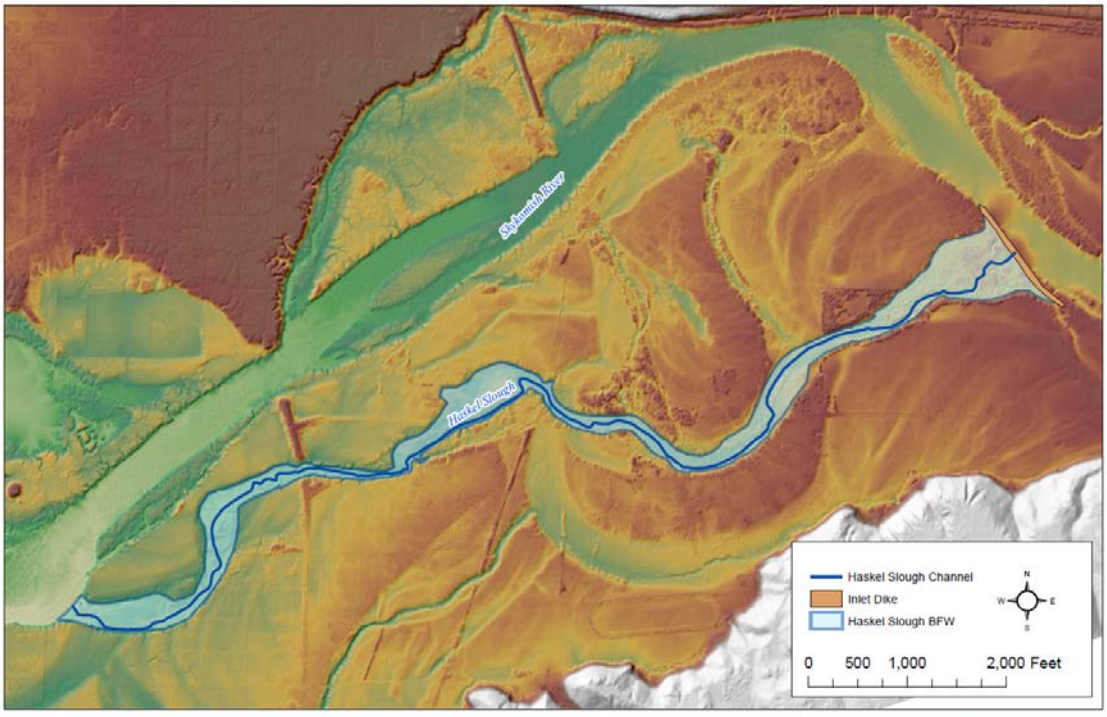


Figure 2. Haskel Slough Site with LIDAR

Description of the anticipated spatial distribution of likely benefits.

Project implementation will benefit fish populations in the Skykomish and larger Snohomish River Watersheds. Flood benefits will occur within the lower Skykomish River reach in the vicinity of the City of Monroe and the Tualco Valley. Increased flow/low flow will be observed within Haskel Slough itself.

Decreased catastrophic flood risk will benefit landowners/infrastructure adjacent to Haskel Slough by preventing unplanned inlet dike failure.

Performance goals and measures.

Increase connectivity of 2.4 Miles of priority off-channel habitat.

- Increase connectivity of 71 Acres of priority off-channel habitat.
- Increase water quantity and quality of priority off-channel habitat.
- Increase safety resulting from engineered dike modification.
- Increase protection of infrastructure through engineered dike modification.

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

The proposed project will address myriad limiting factors (floodplain/riparian function, water quality, etc.) for both ESA listed Chinook, Steelhead, Bull Trout and other salmonid species at virtually all adult and juvenile freshwater life stages from incubation to rearing and adult holding and spawning. The WRIA 7 Salmonid Limiting Factors Analysis identifies natural floodplain function as impaired within the Skykomish Mainstem due to road, railroad, and dike encroachment that limit natural floodplain processes and block access to and formation of habitat features. There is a training dike on the inlet to Haskel Slough that significantly inhibits connectivity and water quantity. Riparian conditions are relatively intact in Haskel Slough, though there are considerable opportunities for riparian restoration. The Limiting Factors Analysis identifies the restoration of channel migration zone functions and side channel habitat access, along with restoration of riparian function as the primary recommended recovery actions.

Identification of anticipated support and barriers to completion.

This initial phase of the project will include the primary consultation of stakeholders including landowners and the local community. However, this project has been discussed with various stakeholders including Snohomish County, PCC Farmland Trust, Snohomish Conservation District, WDFW, and others. There is significant interest in pursuing project alternatives in Haskel Slough and an acknowledgement that this is an important area to focus restoration and conservation efforts.

The largest constraint for this project will likely be landowner, stakeholder and community agreement on the preferred alternative and project implementation to ensure a multi-benefit outcome. For this reason we propose early and consistent engagement through community/stakeholder outreach from the initial phase through project implementation. Other considerations will include stream crossings on Haskel Slough (including the Highway 203 bridge), landowner access, continued agriculture, and reducing flood hazards.

Estimate of capital costs and reoccurring O&M costs.

- Planning Costs (outreach/preliminary-final designs): $400,000
- Implementation Costs: $3,000,000
- O&M Costs: Minimal

Anticipated durability and resiliency.

Climate change and associated impacts will be factored into all current and future project elements. Increased connectivity in Haskel Slough will provide additional resilience through increased habitat accessibility, diversity, quantity, and quality. The intent is to pursue natural process based solutions as

much as possible to reduce maintenance requirements and ensure long term project function and durability.

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

The Tulalip Tribes are the proposed project sponsor for this work and are ready to begin project planning and eventual implementation. Tulalip restoration project managers have extensive experience implementing restoration projects in this region. These projects have had varying scopes from very large, multimillion-dollar acquisition/restoration projects (Qwuloolt) to smaller fish passage and in-stream projects. We are currently collaborating with PCC farmland Trust to acquire a large portion of Haskel Slough and adjacent riparian areas to promote conservation/restoration and agriculture. We will draw from this experience and associated lessons learned while conducting these projects. Extensive data has been collected from this site on juvenile fish use, as Tulalip operates a rotary screw trap near Haskel Slough to assess out-migrating salmon smolts. Therefore, we have extensive knowledge of the local landowners, fish use, and geomorphic context.

Documentation of sources, methods, uncertainties, and assumptions.

As this project is in the initial planning and outreach stages, there are several uncertainties regarding the exact method of implementation and landowner willingness for some landowners adjacent to Haskel Slough. However, there is significant momentum for project planning and implementation tasks, and we are confident that the project will result in significant benefits to ESA listed fish species and the surrounding community.

WRIA 7 – Project Description
East Monroe Heritage Site Acquisition

December 22, 2020

Project Name and Number
East Monroe Heritage Site Acquisition (7-SM-H14)

WRIA 7 WRE Subbasin
Skykomish River Main Stem

Narrative Description
This project includes land acquisition of 43 acres of land located along the main stem of the Skykomish River at the eastern edge of the Monroe city limits. The property consists of a 210-foot feeder bluff, 7-acres of Class II and Class III wetlands, ¾ -mile salmon-bearing oxbow channel, and upland habitat that has been historically farmed. The City of Monroe is seeking to preserve the property as open space and to use the site for flood water storage and displacement. The project will prevent further floodplain development or fill, protect intact riparian and off-channel habitat not currently protected, minimize increases in impervious surface, and prevent urban sprawl. Land acquisition would assist the city in protecting the entire Skykomish River floodplain within Monroe, which includes Al Brolin Park, Sky River Park and the soon to be acquired Cadman site. The four-part open space network provides for a diverse riparian corridor while keeping surface and ground water clean and localized.

Quantitative or qualitative assessment of how the project will function.
Acquiring the East Monroe Heritage site prevents further floodplain development and fill as well as protects off-channel habitats not currently protected. The current property owners purchased the site with the intent of developing the property for commercial use. The property owner is seeking entitlement to change the zoning to proceed with development which proposes the fill of approximately 11-acres of upland habitat to bring the site out of the floodplain. Due to the lack of proximity to the Monroe public water system, a developer would likely need to provide water service to the site through onsite well drilling. Developers of multi-family dwelling units and larger sporting goods stores have shown interest in developing the property as well. Acquisition of the property would sustain critical surface water and groundwater networks from being endangered or depleted.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1.

Description of the anticipated spatial distribution of likely benefits.
Once land is acquired, future projects would begin to take place. Projects would involve the preservation and enhancement of the site, focusing initially on riparian restoration of the oxbow channel. Enhancement would include restoration to remove large amounts of Himalayan Blackberry and other invasive species present, plant a diversity of native species to enhance habitat, provide added shade benefit to the oxbow channel, and improve the culverts linking the oxbow to the Skykomish River to increase fish passage.

Performance goals and measures.

The performance goals and measures will be based on the improved reconnection of off-channel habitat to the river, the function of the culverts acting as a fish and wildlife passage, the increase in native habitat and canopy present and the decrease of invasive species existing at the site. The City would include the property in its water quality monitoring program to document the improvement in water quality and its benefit to aquatic habitat.

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

The six mile reach of the Skykomish River east of Monroe is critical for Chinook spawning and rearing, and has been determined a major transportation corridor for Chinook, Coho and other salmons species. Chinook Salmon are a priority species and protected under the Endangered Species Act (ESA).

The riparian habitats present provide a vital corridor for wildlife movement and dispersal as well as all the major elements (food, water, and shelter) needed for survival. 85% of Washington's terrestrial vertebrate species use riparian zones for essential life activities with the density of wildlife in riparian areas being comparatively high. Riparian areas provide breeding habitat for birds and amphibian and reptile species are widespread throughout these areas. They also have a greater diversity of mammalian species due the diverse vegetation.

The site's oxbow channel and wetlands provide a movement corridor for species such as marbled murrelets and harlequin ducks to nesting areas outside the project area. They also provide movement corridors for small species such as amphibians and invertebrates to larger species such as bobcats, coyote, and deer. Forested areas also provide needs such as shelter and forest elements provide dens, foraging, and travel ways for many species.

Improvement of the on-site culverts to improve linkage between the oxbow channel and the river will also improve floodwater storage, as well as sediment and organic material transport.

Identification of anticipated support and barriers to completion.

Funding is the primary barrier at this time. Sound Salmon Solutions and the Snohomish Conservation District have eagerly expressed interest in partnering with the City in restoration efforts once the property is purchased.

Estimate of capital costs and reoccurring O&M costs.

Estimated cost to acquire the five parcels of land is $3 million.

Anticipated durability and resiliency.

Once invasive species are removed and native plants are planted, maintenance will be required to ensure plant survival. Invasive species management will also be required. On-going maintenance and monitoring is anticipated to be performed for five years. The city will be responsible for management of the site.

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

City of Monroe. Sponsor contact: Megan Darrow, mdarrow@monroewa.gov. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding.

Figure 1. Site Plan for East Monroe Heritage Site

WRIA 7 – Project Description
Shinglebolt Slough

December 22, 2020

Project Name and Number
Shinglebolt Slough Restoration (+ South Slough) (7-SM-H15[7])

WRIA 7 WRE Subbasin
Skykomish Mainstem

Narrative Description
This project will reconnect the eastern, filled, upstream section of Shingle Bolt Slough by excavating ~12,500 cubic yards of material along the remnant flood channel alignment. The rip rap and berm along 600-900 feet of Skykomish River east of historical and existing bridge infrastructure would be removed. In total, 1,600 feet of side channel would become fish-accessible during spring out-migration flows. This would also provide some flood relief to the City of Sultan and other Mann Road infrastructure through the removal of floodplain fill and a wider floodplain flood flow inundation connection. Land acquisition is being addressed separately.

The slough channel (2,600 feet) downstream of Mann Road is on Snohomish County property that was acquired with the Conservation Futures program for recreation and habitat restoration. This downstream portion of Shingle Bolt Slough has shrunk in size but remains in contact upstream at flood flows and downstream receives hyporheic flow before re-entering the Skykomish River. Large wood jams will be placed in this channel. In addition to the channel restoration there will be ~ 20 acres of riparian vegetation restoration and invasive weed control. Upstream and downstream portions total 5,300 lineal feet of side channel restoration or enhancement. At nearby South Slough, we are proposing to install 7 small jams and 9 wood structures within the 2,500 feet of South Slough side channel to enhance the Chinook rearing habitat.

Quantitative or qualitative assessment of how the project will function.
Project functions include flood water storage, floodplain recharge, floodplain sediment storage, fish rearing and refuge (including cold-water refuge), shading functions and long-term wood recruitment and storage and potential beaver habitat – in short, restoration of formerly functional floodplain and connected channel area. No potential offset volumes have been estimated, though channel restoration with roughness to store channel flow is consistent with GeoEngineers' depiction of conceptual change in stream and groundwater table morphology following in-channel projects (B. August; Jan 28, 2020).

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

Description of the anticipated spatial distribution of likely benefits.
Removal of the Skykomish River revetment and berm at the upstream end of the project will increase flood storage more frequently across approximately 15 acres of floodplain. The floodplain will store

[7] Other project numbers associated with this project: 07-MPR-137

sediment and recharge groundwater as well as passively and actively be re-forested. Separately an existing side channel inlet from the Skykomish River will be connected to 1,600 lineal feet of excavated side channel that will also include wood placement. The side channel and roughness will act to recharge floodplain groundwater for later discharge and flow maintenance. Downstream, the existing Snohomish County portion of Shingle Bolt Slough will be roughened with wood structures to both store more surface water and create scour pools during flooding, and thereby contact hyporheic flow and colder water temperature during low flow.

Performance goals and measures.

The performance goal is to reconnect channels, more frequently at lower flows as well as at higher flows. This will act to infiltrate/surcharge saturation of the floodplain (as per Geoengineers conceptual description). Infiltration is difficult to measure directly; proxy measures include area treated, groundwater levels, and slough outlet discharge. Other goals and measurements include acres planted, wood structures placed, water temperature benefit (relative to mainstem Skykomish). Additional similar treatments and goals/objectives are planned at South Slough.

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

The Skykomish River is an important resource for fish and the following salmonid species are known to be present and would be expected to use floodplain side channels and ponded off-channel habitat areas for rearing at various times of the year: Chinook, Coho, Chum, Pink salmon as well as Steelhead trout. Chinook and Steelhead are priority species under the Endangered Species Act (ESA). These juvenile salmon species are expected to benefit from increased side channel area, improved habitat structure and cover, increased refuge from flooding depth and velocity, and cold-water refuge in summer.

Identification of anticipated support and barriers to completion.

This project is currently listed in Snohomish County's Floodplains by Design project as well as the Skykomish River Reach Scale Plan. Snohomish County intends to implement the project, when funding is available.

Estimate of capital costs and reoccurring O&M costs.

Shinglebolt + South Slough design & construction (South Slough is <10% of costs): $3,234,544

Operation & maintenance (first 10 years): $250,000

Anticipated durability and resiliency.

The project is expected to be durable and resilient. The structural integrity of placed wood will be less over 15-20 years, but the site will receive new wood recruitment and grow alder and cottonwood rapidly. Indicators of anticipated durability and resiliency will be greater floodplain forest cover and age, increased floodplain sedimentation, limited channel sedimentation due to flow routing, and points of scour at placed wood that maintains flow alignment, and sustained colder relative water temperature between the mainstem and side channel.

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

Snohomish County Public Works, Brett Gaddis, brett.gaddis@co.snohomish.wa.us, is the project sponsor and is ready to proceed pending land acquisition (to be separately funded).

Documentation of sources, methods, uncertainties, and assumptions.

Unknown at this stage of design.

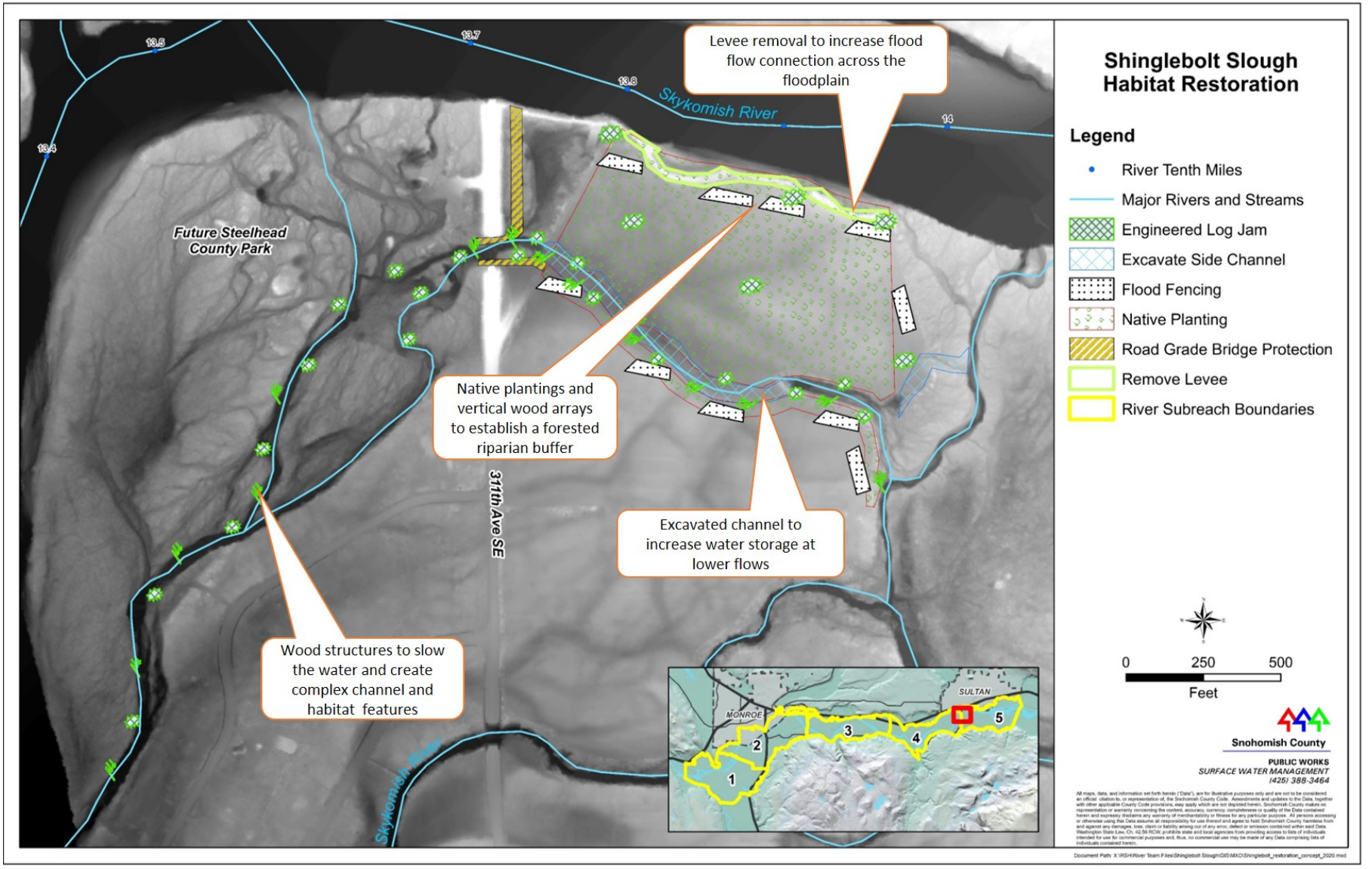


Figure 1. Conceptual Plan View with Benefits labeled

WRIA 7 – Project Description
Snohomish Confluence Project + Left Bank Floodplain Reconnection at RM 1.5

December 22, 2020

Project Name(s)
Snohomish Confluence Project + Left Bank Floodplain Reconnection at RM 1.5 (7-SM-H16[8])

WRIA 7 WRE Subbasin
Skykomish Mainstem

Narrative Description
Tulalip Tribes and partners propose to restore and enhance floodplain connection, abandoned side channels, and connections to Riley Slough at and just upstream of the junction of the Skykomish and Snoqualmie Rivers that is described as the Snohomish Confluence Project. This proposal requests funds for project planning and property acquisition to complete these floodplain restoration actions. These actions have the potential to measurably increase rearing and spawning habitats for Chinook, Steelhead, Coho, Pink and Chum salmon. Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Bank protection upstream and adjacent to the project area has redirected flows in the Skykomish River, which has contributed to abandonment of side channels, and altering the lower end of Riley Slough leading to dramatic reductions in Coho spawning in Riley Slough tributaries. Project partners include the property owner where the floodplain connection and side channel enhancement would take place, Snohomish County, and Ducks Unlimited. The first two phases, which include acquisition and planning, are already funded through the Salmon Recovery Funding Board/Puget Sound Acquisition and Restoration Fund. Funding is needed for final design and construction.

Quantitative or qualitative assessment of how the project will function.
Qualitatively, this project will restore floodplain connection within the Riley Slough at and just upstream of the junction with the Skykomish and Snoqualmie Rivers. This proposal is for final design, permitting, and construction. Future floodplain restoration actions within this section of river will provide additional rearing and spawning habitats for several species of salmonids.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1.

Description of the spatial distribution of likely benefits.
This project includes future restoration within the lower 3000 ft. of Riley Slough and 2000 ft. of side channel of the Skykomish River at the confluence with Riley Slough. This proposal is for final design, permitting and construction.

[8] Other project numbers associated with this project: 2018-0799

Performance goals and measures.

Performance goals and measures include:

- Reestablishing a connection between the Skykomish and Riley Slough, reconnecting the upstream end of a disconnected side channel on the Skykomish River.
- Improving channel and riparian conditions along approximately a mile of river and stream channel.
- Monitoring the physical conditions (e.g. cross-sectional area, aggradation, flow) of the side channel and slough and measuring spawning and juvenile utilization in Riley Slough and the side channel, for at least a five year period, will help determine whether the restoration efforts were effective.

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

Floodplain restoration actions within the Riley Slough are designed to measurably increase rearing and spawning habitats for Chinook, Steelhead, Coho, Pink and Chum salmon. Chinook and Steelhead are priority species, protected under the ESA.

Identification of anticipated support for and barriers to completion.

Based on previous conversations with agencies and members of the Sustainable Lands Strategy, support for the project is strong. Ultimately what is built will depend on modeling, planned drainage assessments, and views expressed by neighbors, which may result in less than optimum improvements.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit and construct the project is $900,000.

Project durability and resiliency.

If constructed properly and after five years of maintenance it is hoped the project area will naturally adjust to existing conditions and function without requiring additional future maintenance. Additional actions to ensure durability and resiliency include monitoring the physical conditions (e.g. cross-sectional area, aggradation, flow) of the side channel and slough and measuring spawning and juvenile utilization in Riley Slough and the side channel, for at least a five year period. Maintenance of enhanced riparian areas, in the form of weed control and plant replacement are likely and will ensure a riparian planting success.

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

Tulalip Tribes. Sponsor contact: Daryl Williams, dwilliams@tulaliptribes-nsn.gov and Kurt Nelson, knelson@tulaliptribes-nsn.gov. The sponsor is ready to proceed with design and implementation.

Documentation of sources, methods, uncertainties, and assumptions.

Data collected, modeling and assessments will inform the methods used, uncertainties and address some assumptions.

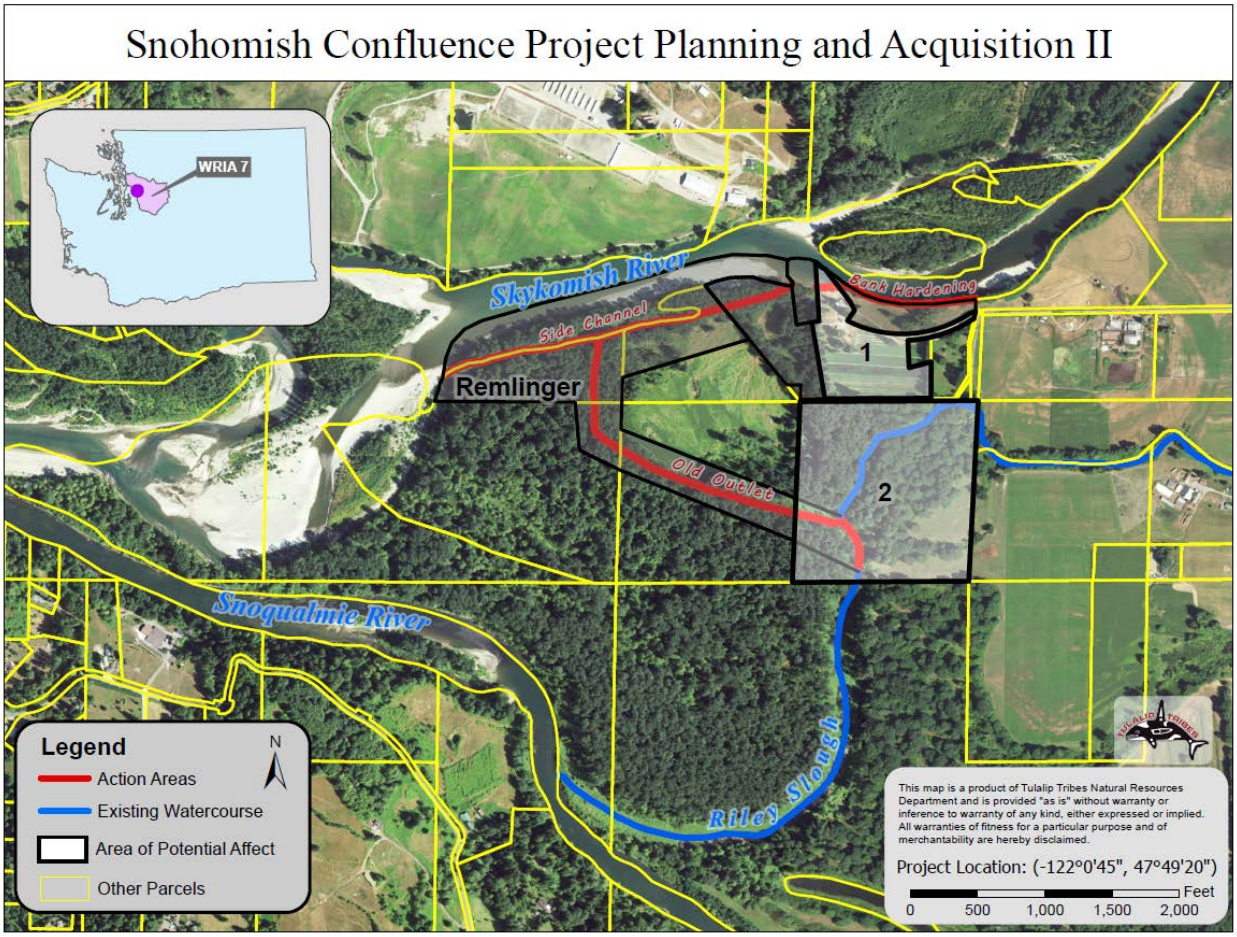


Figure 1. Site Map for Snohomish Confluence Project + Left Bank Floodplain Reconnection at RM 1.5

WRIA 7 – Project Description
Miller River Alluvial Fan Restoration Project

December 22, 2020

Project Name and Number
Miller River Alluvial Fan Restoration Project (7-USK-H17)

WRIA 7 WRE Subbasin
Upper Skykomish

Narrative Description
The Miller River Alluvial Fan Restoration Project, as conceptualized, is expected to be completed in phases and will include the following elements:

- Removal of existing riprap and compromised road areas, revetments;
- Up to 18.5 acres of restored riparian habitat through floodplain reconnection, reactivation of 2,700 linear feet of side channels, improved ecosystem function, and processes;
- Improved aquatic habitat complexity and quality in up to 250 lineal feet of main channel complex;
- Mitigation of climate change impacts on ESA-listed salmonid species in the lower Miller River and in the South Fork Skykomish River downstream;
- Reduced flood risk and long-term flood hazard management costs; and
- Increased recreational opportunities for local communities.

There are potentially four alternatives and could be phases of this project, each coinciding with a zone in the project footprint. All phases could be constructed simultaneously; however, it is envisioned that this project would be implemented in four phases. King County has acquired the lands required for the project footprint of the first three phases. The description above represents the outcomes of implementing the three phases within three geographical zones of the project footprint. A fourth phase would include revetment removal, along with a setback revetment for flood mitigation, and reactivation of side channels, further increasing the hyporheic input to the lower Miller River.

Quantitative or qualitative assessment of how the project will function.
It is expected that there will be additional annual storage through floodplain reconnection. This project will improve overall watershed hydrology, which will in turn improve downstream water quality, and potentially moderate and augment summer low flows.

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.
Approximately 18.5 acres of floodplain restored, and more than 20 acres of area connected to floodplain.

Performance goals and measures.
This proposed floodplain restoration project can help increase floodplain water levels and provide benefits such as increased water storage and resilience to climate change impacts.

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

The project will provide for the conservation, protection and restoration of natural systems within this area for fish and wildlife habitat. This reach of the lower Miller River serves as a significant habitat area for listed Chinook salmon, resident bull trout, and steelhead, and provides large wildlife corridor ungulates, beaver, bald eagles, songbirds and other native species. The watershed also supports wild runs of Coho, Chinook, Pink, and Chum salmon and Steelhead downstream of the project site. Chinook and Steelhead are priority species, protected under the ESA. This proposal addresses several priority ecological actions identified in the Snohomish Plan such as: restoring hydrologic and sediment processes, restoring of wetland functions, enhancing riparian areas, protecting water quality and restoring shoreline conditions (Snohomish Salmon Plan page 11-84 & 11-86, 2005). These restoration actions in the headwaters are critical to a watershed approach to restore habitat forming hydrologic processes for salmon downstream. The project is identified in the Snohomish Basin Salmon Recovery Forum's 4-year Work Plan.

Identification of anticipated support for and barriers to completion.

King County is planning to conduct more in-depth feasibility to refine the project scope in 2020 -21. The County has acquired properties for phases 1 – 3 of the project and engaged in stakeholder discussions with King County Roads which has negotiated terms for their work adjacent to the project site with BNFS Railroad. It is expected that King County's River and Floodplain Management Section and Ecological Restoration and Engineering Services will convene to complete a refined feasibility project, and design and construct this project.

Estimate of capital costs and reoccurring O&M costs.

The total cost for three phases of design and construction is estimated to be approximately $4.6 M. The fourth phase would add approximately $2.6 M in construction costs. Operation and maintenance costs are not known at this time.

Project durability and resiliency.

The benefits of the projects are anticipated to occur both locally and downstream of the project site. The importance of and potential for these benefits are supported by multiple leading publications, including: (1) the Snohomish River Basin (WRIA 7) Salmon Conservation Plan (Salmon Plan), (2) the Snohomish Basin Protection Plan (Protection Plan), and (3) Climate Change Impacts to Salmon Issue Paper (Climate Paper).

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

This project is sponsored by King County and programmed to begin feasibility and project scope refinement in late 2020.

Documentation of sources, methods, uncertainties, and assumptions.

Restoration Opportunity Report: South Fork Skykomish River Basin Restoration Feasibility Project (Herrera Environmental Consultants, 2013).

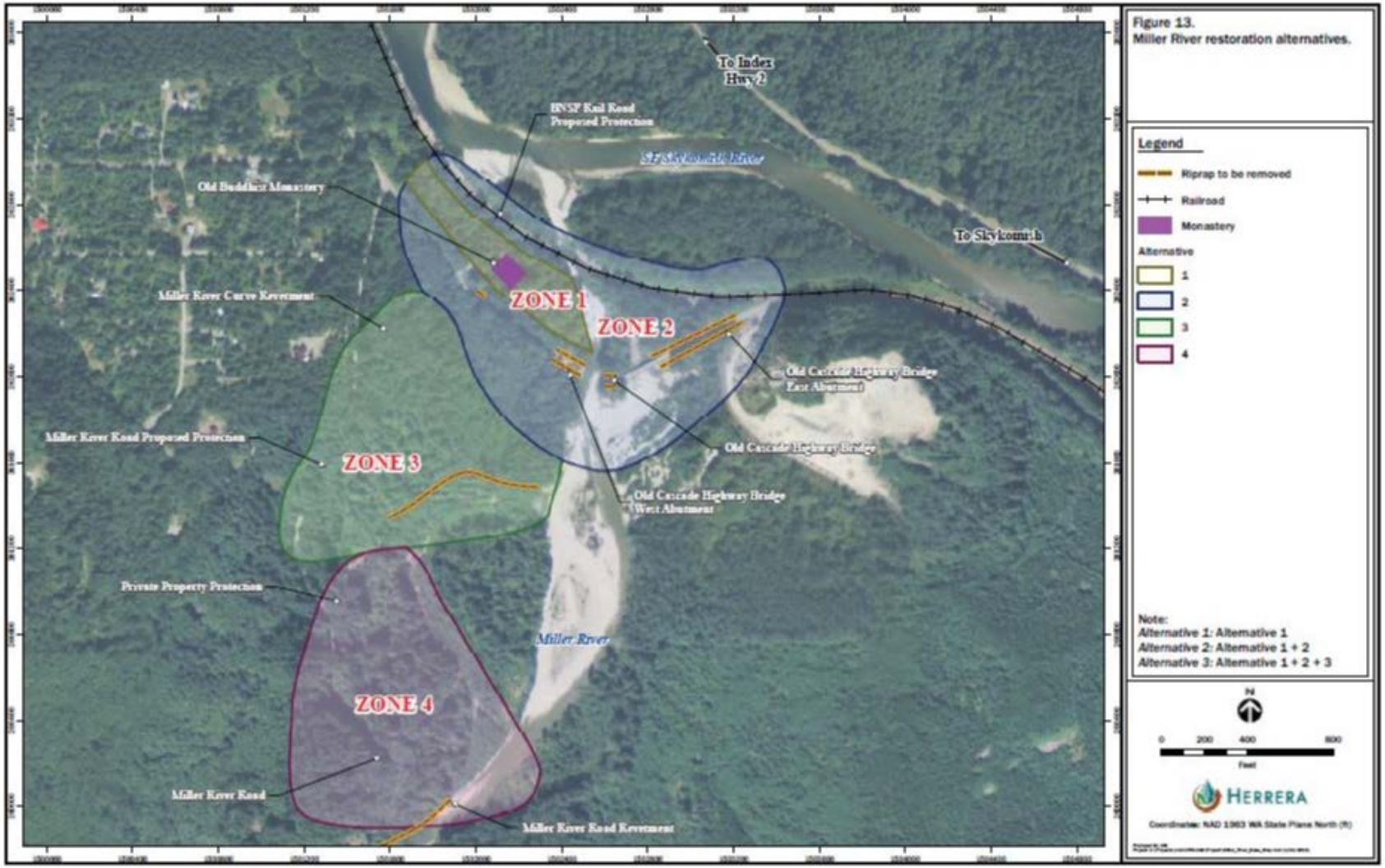


Figure 1. Miller River Alluvial Fan Restoration Project Site Plan

WRIA 7 – Project Description
Tulalip Tribes Beaver Reintroduction Program

December 22, 2020

Project Name and Number
Tulalip Tribes Beaver Reintroduction Program (7-USK-H18)

WRIA 7 WRE Subbasins
Lower Mid-Skykomish, Upper Skykomish, Raging River, and Upper Snoqualmie

Narrative Description
This proposal consists of a restoration project that aims to protect hydrologic processes and function in the Snohomish Watershed through the relocation of beavers from areas of human conflict to headwater tributaries for the improvement of fish rearing habitat and freshwater storage.

Quantitative or qualitative assessment of how the project will function.
By relocating beaver to streams above or within the anadromous zone, we will be protecting hydrologic processes such as stream temperature, impounded surface water area and infiltration (decreasing winter peak flow/increasing summer low flow), the reduction of bank erosion (reducing fine sediment inputs), in-stream, off channel, and low-flow habitat, bank and floodplain connectivity, and ecosystem resilience to regional effects of climate change through adaptively managing sites and populations. Our primary goal is to restore hydrologic processes necessary to long term survival of imperiled fish populations.

A map and drawings of the project location.
See Figure 1.

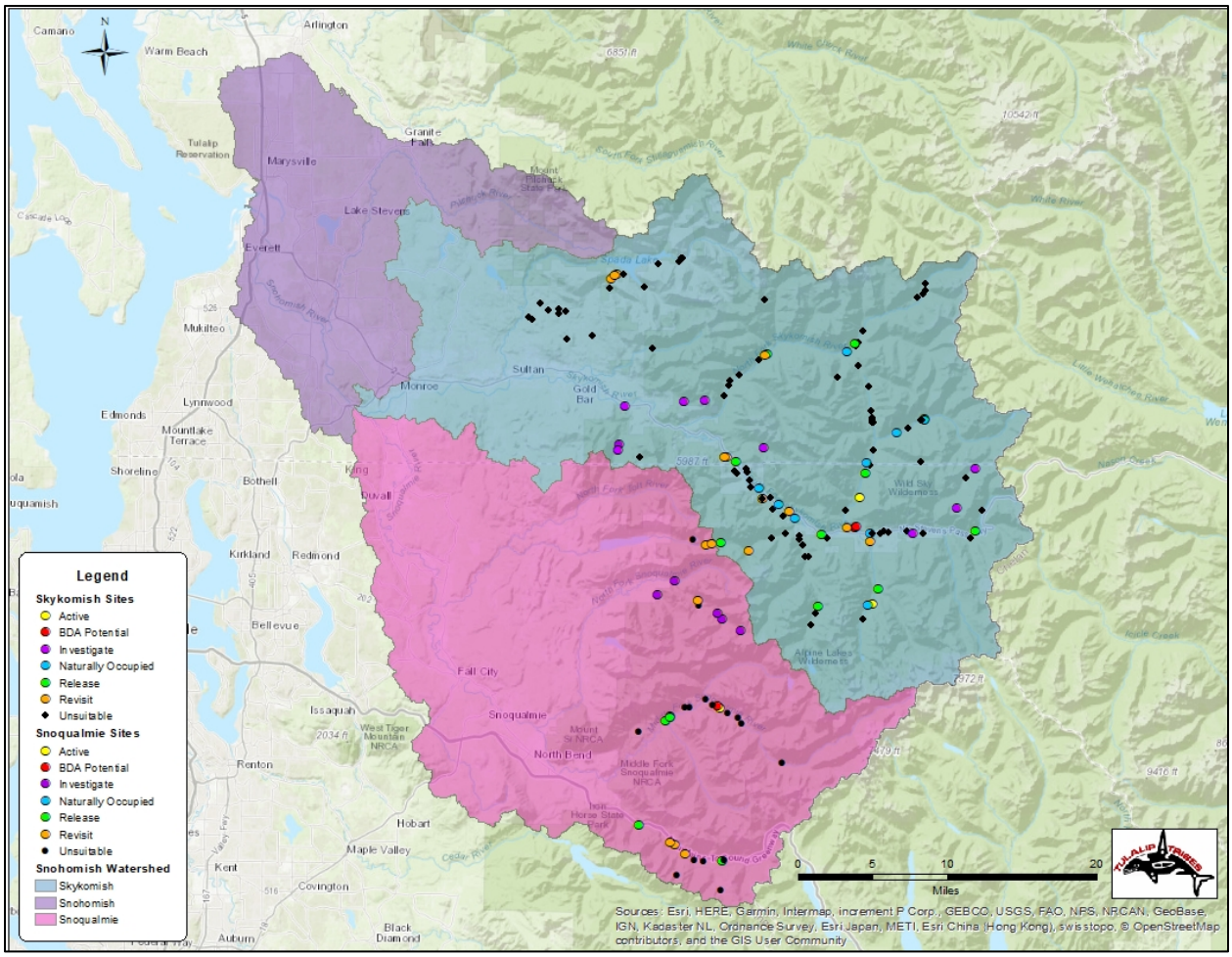


Figure 1. Location of every site that has been identified using the BIP model, visited, and ranked for beaver occupancy and suitability for relocation.

Description of the anticipated spatial distribution of likely benefits.

Beavers will be relocated to carefully selected tributaries to the Skykomish and Snoqualmie rivers on the Mount Baker-Snoqualmie National Forest. The effects of a successful beaver establishment typically encompass an approximate ¼ mile of instream and riparian habitat and water cooling and flow control benefits can extend downstream of the establishment. The hope is that established beavers will reproduce to further expand the recolonization of this portion of their historic range.

Performance goals and measures.

- Restore beaver to strategic locations in the Snohomish Watershed.
- Increase the area of in-stream habitat by increasing the water holding capacity of relocation streams via beaver-built dams, thereby increasing channel complexity.
- Improve public perception of beaver by educating landowners on their ecological benefits to the landscape and encouraging landowners to maintain beaver on their property. Offering field-based opportunities for students and other NR professionals.
- Install BDAs in potential relocation reaches lacking sufficient impounded water for beaver release.

- Success is ensured through monitoring and adaptively managing sites and populations, collaborating with regional beaver management practitioners, and educating the public on the importance of living with beavers.

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

See Table 1.

Species	Life History Present (egg, juvenile, adult)	Current Population Trend (decline, stable, rising)	Endangered Species Act Coverage (Y/N)
Chinook	Egg, juvenile, adult	Decline	Y
Bull trout	Egg, juvenile, adult	Stable	Y
Coho	Egg, juvenile, adult	Decline	Y
Steelhead	Egg, adult	Decline	Y
Chum	Egg, adult	Stable	N
Pink	Egg, adult	Stable	N

Table 1. Species, life stages, and current population trend benefitted by the project

Identification of anticipated support and barriers to completion.

An ongoing obstacle is beaver retention at selected sites. The rigorous site selection process does not always translate to permanent establishment or even dam building. Beavers are highly mobile and although they may abandon our selected stream reach it is possible that they are establishing elsewhere and providing unmonitored benefits. We have seen little evidence of post-relocation predation within monitored sites. We have also found that sites often take "supplementation" to achieve establishment, with the relocation of multiple families over a couple of years, with newly introduced beavers building off of the progress of the previous. Given our perceived retention limitation, we hope to find a way to track beaver movement post-relocation. Beavers are incredibly difficult to track given their abrasive and sheltered environments and they respond poorly to internal transmitters. We are exploring ways to use eDNA to track individuals in relocation segments. DNA samples are taken from each captured animal so that could be used as a reference for detection post-relocation.

Estimate of capital costs and reoccurring O&M costs.

On average, the Tulalip Beaver Project costs approximately $80,000 to operate on an annual basis. This cost encompasses equipment needs and wages for staff to trap, house, and relocate beavers and identify and monitor trap and relocation sites. Existing funding : RCO: $67,522 (exp. 12/21) - tied to WRIA 7; PIFA: $166,628 (exp. 12/21) – WRIA 7 and WRIA 5.

New: Tribal Forest Protection Act/638 Agreement: $37,800 (exp. 9/23) - tied to S. Fork Stilly

Anticipated durability and resiliency.

The Tulalip Beaver Project has been active since 2014 and is largely reliant on availability of grant funds. Past and current sources that we have leveraged include but are not limited to: EPA, USFWS, DOE, RCO, King County CWM, TFPA, Ecotrust, etc.

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

The Tulalip Beaver Project is an ongoing project of the Wildlife Program within the Natural Resources Department of The Tulalip Tribes. The project manager is Molly Alves, malves@tulaliptribes-nsn.gov.

Documentation of sources, methods, uncertainties, and assumptions.

Enhance streamflow

Geomorphic models that relate to sediment transport and hydrology often minimize the role of beaver despite "their widely recognized role in shaping stream ecosystems" (Naiman et al. 1988, Gurnell 1998, Pollock et al. 2004, Pollock et al. 2014, Burchsted et al. 2010).

Beaver dams can cause small to large order streams to move around them as "surface water runoff and groundwater seepage during both high- and low-flow periods" (Westbrook et al., 2006).
When beaver dams breach or complexes become unoccupied, channel sinuosity, sediment accumulation, and hydraulic roughness can persist from the "formation of complex patterns of pools and riffles" (Demmer & Beschta, 2008).

Surface water storage

Beaver dams impound and reduce stream velocity during storm events, retaining flow to reduce storm-water run-off and increasing water retention (Bergstrom, 1985; Grasse & Putnam, 1950; Johnston & Naiman, 1987; Parker, 1986). By creating large differences in velocity, even small and young dams can flood a relatively large surface area (Rosell et al., 2005; Johnston & Naiman 1987). Beaver ponds can dramatically influence the amount of open water area in watersheds (Hood and Bayley 2008; Karran et al., 2017).

Aquifer recharge

Using hydrometric methods, it is determined that larger fluxes of water along looping flow pathways return to riparian areas above dams rather than returning to the stream below the dam, suggesting that "beaver dams generate recharge to the groundwater flow system" (Janzen & Westbrook, 2011). Researchers have proven using small groundwater wells that beaver dams "attenuate the water table decline in the drier summer months" by up to 30% due to increased bank infiltrations that decrease hydraulic gradient and transfer upstream of the dams (Westbrook et al., 2006; Lowry and Beschta, 1994; Naiman et al., 1986).

In the Tulalip Beaver Project study area, we have historically done extensive streamflow, surface water and groundwater storage monitoring. Our affiliated researcher Ben Dittbrenner has seen beaver dams increase groundwater storage 2.4 times a unit of surface water storage (Dittbrenner, 2019). These numbers are calculated from gathering stream area and length data, estimated pond volumes, as well as the change in groundwater elevations throughout a site both pre and post beaver reintroduction has occurred.

Water Quality

Regardless of the size of a complex, beaver dams and beaver impoundments have been shown to release cooler water downstream as it returns from sub surface (Dittbrenner, 2019). In addition, beaver ponds can stratify water temperatures by showing recorded temperatures higher in temperature than at the bottom of the pond (Rosell et al., 2005; Margolis et al., 2001; McRae & Edwards, 1994). This unique change to water temperature can improve water quality for macroinvertebrates and fish.

Beaver complexes play a large role in water chemistry and may increase productivity of small freshwater streams. Researchers have found that increased sediment accumulation in beaver ponds results in approximately 1000 times more nitrogen than adjacent riffle areas (Rosell et al., 2005; Naiman & Melilo, 1984). In small order streams, beaver ponds may increase phosphorous and create anerobic zones that are rich in dissolved nutrients resulting in increased primary production (Rosell et al., 2005; Klotz 1998; Dahm & Sedell, 1986). Margolis et al. (2001a), showed beavers can play an important role in neutralizing inputs of strong acids in regions where atmospheric pollution is high (Rosell et al., 2005; Smith et al., 1991; Cirmo & Driscoll 1993). Beaver complexes retain these biogeochemical and water chemistry benefits on site with only a portion of the chemical elements exiting downstream (Naiman et al., 1994).

Beavers have been noted to increase E. Coli and fecal coliform concentrations in grazing systems. Researchers have noted that beaver ponds cause entrapment of organisms and bacteria in the bottom sediment by reducing the velocity of stream flow. However, a large factor remains the age of dams and their ability to trap sediment. The same researchers showed "the highest number of beaver ponds and also had significantly lower fecal coliform and streptococci concentrations" in the water suggesting an ability to act as a filtration system (Skinner et al. 1984).

Sedimentation

"Accumulation rates of sediments [in beaver ponds] far exceed published rates from boreal forest landscapes" and "organic matter content is significantly higher in older ponds" (Butler & Malanson, 1995).

Snohomish River Basin Salmon Conservation Plan

"Physical processes, such as the movement of water and sediment, and biological processes, such as the growth of vegetation and predator-prey relationships, create and maintain the conditions that salmon need to reproduce, grow and thrive. Recovery actions that address the underlying, natural process problems rather than just the symptoms of habitat loss are most likely to be successful over the long-term."

Section 4.3 – "Coho use small, low gradient coastal and tributary streams for spawning and rearing. They need more off-channel habitat, such as oxbows, side-channels, and beaver ponds than Chinook."

Section 5.2 – "Healthy and harvestable Coho salmon populations are unlikely over the long-term without significant actions that maintain and restore access, adequate flows, sediment conditions, large woody debris loading, nutrient levels, and temperatures in lowland tributaries where Coho spawn and rear, and in headwater sub-basins that contribute to healthy downstream habitat conditions. Coho rearing, which occurs primarily in beaver ponds, backwater pools, and side-channel sloughs, is thought to be a limiting."

Snohomish Basin Protection Plan

"Beavers are native to the Basin and were once ubiquitous around the region...Beavers are one of the key animals that can affect the quantity and quality of water in an aquatic system. In unpopulated places, their manipulation of the landscape is appropriate and welcomed but in populated and agricultural areas, that manipulation can create challenges. However, the beavers' ability to create water storage helps protect hydrology."

"The Tulalip Tribes are working to improve water storage in the headwaters of the Basin in order to ameliorate the hydrologic shifts caused by climate change. This effort involves trapping beavers and releasing them in appropriate areas on USFS land. Once released, the beavers will create a complex

series of dams that will store runoff and/or snow melt in the upper watershed and moderate flows during high-flow and flood events."

Salmon Recovery Funding Board – Salmon Recovery Grants - Manual 18
Specifically recognizes beaver reintroduction as a viable tool for performing in-stream and riparian habitat restoration. "These projects focus on restoring priority wetland or in-stream habitat within specific sub watersheds identified as priorities in local watershed or recovery plans. Site projects where valuable but degraded habitat exists and where beaver reintroduction would benefit salmonid habitat functions and values. Use beaver as a tool for restoring salmon habitat at specific priority locations. Relocate beavers from undesirable locations to areas where they can function to improve salmonid habitat."

WRIA 7 – Project Description
Cherry Creek – Climate Resilient Watershed Project

December 22, 2020

Project Name and Project Number
Cherry Creek - Climate Resilient Watershed (7-CH-H19)

WRIA 7 WRE Subbasin
Cherry/Harris

Narrative Description
The Cherry Creek watershed is 17,640-acres, located north and east of the City of Duvall. The primary land uses are forestry, rural-residential, and agricultural. Cherry Creek itself is over 12 miles in length, with the lower two miles located in the King County Agricultural Production District. Annually, flows in Cherry Creek have not changed significantly since the 1940's but an upward trend in peak flows suggest that these peaks may be indicators for the future (ESA, 2020). The watershed experienced two statistically very uncommon flow events in December 2019 and February 2020 that are the highest observed flows in the limited hydrologic record.

Lower Cherry Creek is an alluvial fan characterized by heavy sediment deposition. The stream exits a high-energy environment at the base of steep slopes and enters a low-energy one, losing the ability to adequately transport sediment and forming deposits. The frequent channel migration, avulsion, and relic channels observed in Cherry Valley are associated with alluvial fans (King County, 2020b).

Cherry Creek is also characterized by summer low flows and a projected increase in rural residential growth associated with new domestic exempt wells.

The Project consists of a suite of actions intended to address attenuation of peak flows, seasonal low flow concerns, floodplain reconnection, and agricultural resiliency in the Cherry Creek watershed. While individual project phases and elements may not directly contribute to NEB, the suite of projects proposed are inter-reliant on each other for sequencing and budgeting reasons, and taken together as a whole, they are expected to contribute to NEB.

Lower Cherry Creek Farm, Fish, Flood Projects
There are several projects at varying stages of funding and implementation planned for the lower Cherry Valley area. Project partners include Wild Fish Conservancy, Snoqualmie Tribe, Tulalip Tribe, Washington Department of Fish and Wildlife, Snoqualmie Valley Watershed Improvement District, and landowners. These project address floodplain reconnection, fish passage, habitat improvement, and agricultural resiliency.

1. Cherry Creek Phase II (CP 1)
Wild Fish Conservancy is the project sponsor. Phase II of the Cherry Creek restoration project is located near the confluence with the Snoqualmie River and includes improvement of instream and riparian habitat conditions along approximately 600 feet of the lower mainstem of Cherry Creek, just upstream of Phase I (completed in 2019). The restoration project includes removing bank armoring, installing two large wood habitat structures, three smaller instream structures, and re-contouring the banks to create planted habitat benches. This work will improve drainage of the adjacent

pastures and increase the conveyance and flood storage capacity within the reach. This work enables the *Levee Rebuilding, Phase B* project, which will use the spoils generated by the channel naturalization to improve the existing, damaged levee which has failed catastrophically several times within the past decade. The project goal is to increase the quantity and quality of juvenile rearing habitat for coho, chum, Chinook, pink, winter steelhead and coastal Cutthroat. This project was allocated PSAR funding in 2020 for $545,320 with a sponsor match of $134,840.

2. Levee Rebuilding in Cherry Valley, Phase B (CP 2)

Drainage Improvement District 7 is the project sponsor. This second phase of levee improvement construction (Phase B) will be coordinated with the nearby *Cherry Creek Phase II* restoration project by Wild Fish Conservancy. The levee project will include final design, permit acquisition, and constructed levee improvements along about 2,000 feet of the left bank of Cherry Cheek. Private property has been damaged when the levee has breached, and the peak flood season corresponds with heavy use of the WDFW wildlife unit by hunters. The result of the project is that floodwater will overtop the levee in a controlled manner during large floods, slowly filling the valley with floodwater and reducing the risk to life and property. The area that will benefit from these improvements covers about 800 acres. This project was awarded in September 2020 for a total of $325,000 from the King County Flood Control District. The rebuilt levee would eventually be moved as part of project 4 below (Cherry Creek Setback Levee, WDFW, PP1).

3. North Fork Cherry Creek, Culvert Replacements (CP 3)

Wild Fish Conservancy is the project sponsor. The project is intended to improve fish passage and reduce flooding at 300th Ave NE, a private road crossing the valley at the eastern extent of the project area. Flooding occurs sub-annually in this area, inundating three farms and cutting off access to four businesses and 40 residences. A pasture access road and two associated culverts will be removed and two additional culverts crossing 300th AVE NE will be replaced with large bridges to improve flood conveyance and fish passage. This project was awarded $231,100 from the King County Flood Control District in separate grant rounds for preliminary design (completed) and final design and permits (in progress). This project was also awarded a $99,300 Cooperative Watershed Management Grant for final designs and permits. Construction funds needed to complete the project are estimated at $785,866.

4. Cherry Creek Setback Levee, WDFW (PP 1)

This project is currently in planning stages and includes ongoing coordination to develop and evaluate options for a future levee-setback project in the WDFW wildlife unit. The project includes reconnection of Cherry Creek with its floodplain would include the watercourse known as Waterwheel Creek within the levee setback and will reduce flood risk and improve conditions for farming by modernizing an agricultural pump drainage system.

5. Cherry Creek Floodplain Reconnection (CP 4)

The SVWID is the project sponsor. The WID has been working with landowners in lower Cherry Valley to address dangers to human and aquatic life resulting from an avulsion on Cherry Creek prior to its confluence with the North Fork. The WID is currently completing Phase 1 of emergency actions intended to address the avulsion impacts. Beyond 2020 emergency actions, there is a commitment from landowners and the WID to implement the proposed Floodplain Reconnection project that will provide Cherry Creek with approximately 8-acres of additional, accessible floodplain habitat area. The WID developed a floodplain reconnection plan to 75% design in consultation with WDFW, Corps

of Engineers, Snoqualmie Tribe, Tulalip Tribe, Wild Fish Conservancy, King County WLRD, and landowners. The next step, post 2020 emergency actions, is to permit and fund implementation of the Floodplain Reconnection plan. The emergency actions being conducted in 2020 include minimum actions needed to re-establish fish passage and reduce flood impacts to critical infrastructure. The avulsion on the primary channel of Cherry Creek, upstream of the confluence with the North Fork rerouted flows to the interior of the Drainage District 7 levee. Stream flow was impacting approximately 300-acres of agricultural land and associated infrastructure, including a primary access road to residences, residences, and critical utilities. The 2020 emergency actions include increasing conveyance upstream and downstream of the avulsion site through removal of cobbles and other material, replacement and import of large wood into the excavated channel sections, planting of riparian vegetation throughout the project area at locations that will not be impacted as part of future project actions, and a temporary earthen berm at the avulsion site to be removed as part of implementation of the Floodplain Reconnection Plan. The Floodplain Reconnection Plan is currently at 75% design. The project elements include removal of sections of an existing berm downstream of the avulsion site, removal of the temporary earthen berm, excavation of a new side channel at the location of an existing overflow swale, and setback berm.

Water Storage in Upper Cherry Creek Watershed

SVWID has embarked on an assessment of potential small-scale storage projects that could benefit water supply and provide minimal benefit to instream flows within the SVWID service area. One of the ideas identified through this assessment is the potential for enhancing natural storage in the headwaters of key tributaries to the Snoqualmie River. The tributaries that were evaluated as part of the small-scale storage assessment include those that are closed to further appropriation under the instream flow rule (WAC 173-507-030) including Griffin Creek, Harris Creek, Patterson Creek, and the Raging River; and streams and tributaries with instream flow limitations under the rule including Langlois Creek, Sold berg Creek, and an unnamed tributary to Cherry Creek.

The intent of increasing natural storage in the upper watershed is to enhance groundwater recharge and flow attenuation to improve flows throughout the tributary and mainstem during low-flow periods. Increasing natural storage would also enhance fish and wildlife habitat, including habitat for Endangered Species Act (ESA)-listed fish species.

Several potential small-scale storage sites were identified on land in the upper Cherry Valley watershed managed by Department of Natural Resources (DNR). The WID and Anchor QEA staff met with DNR staff in March 2020 to discuss general project concerns on DNR land, and conducted watershed site visits in late May 2020. Two sites were identified with the potential to provide additional water storage. See attached map.

- Stop #2 – This was a small wetland/pond with a 24-inch culvert that went under the adjacent DNR forest road. It looked like we could either put some kind of controlled outlet to create a foot or two of additional storage, or we could do some kind of Beaver Dam Analog or other type of natural storage upstream of the culvert.
- Stop #4 – This was the site we had not identified previous to the site visit, but we happened to go past the pond area we were looking for and saw this wetland area where the stream crosses the DNR road close to where we turned around. The site is on the tributary to Cherry Creek downstream of a few of the larger ponds that we looked at. It looked like we could either put some kind of controlled outlet on the upstream end of the culvert to create a foot or two of

additional storage, or we could do some kind of Beaver Dam Analog or other type of natural storage upstream of the culvert.

SVWID has received Streamflow Restoration funding in 2019 for 57,500 for preliminary design.

Quantitative or qualitative assessment of how the project will function.

Preliminary estimates show the Water Storage in Upper Cherry Creek Watershed element of the project has the capacity to store approximately 37 acre-feet per year (AFY). Estimates are based on the conceptual configuration of the storage facility and topography at the selected site. The project is still in feasibility stage and the type of storage that will be constructed is unknown at this time. No water offset is assumed for the purposes of this plan.

A map and drawings of the project location.

The project site is shown in relation to surrounding physical features in Figure 1. Water storage areas in Upper Cherry Creek Watershed are shown on Figure 2.

Description of the spatial distribution of likely benefits.

These projects are targeted within the lower Cherry Valley area. Restoration efforts are proposed near the confluence of Cherry Creek with the Snoqualmie River, which will result in approximately 800 acres of floodplain improvements. One proposed project will reconnect the floodplain of Cherry Creek with Waterwheel Creek to reduce flooding impacts in that area. An additional project focuses on an avulsion site within Cherry Creek which has caused significant flooding triggering the implementation of a floodplain reconnection project that will provide Cherry Creek with approximately 8-acres of additional accessible floodplain habitat.

Performance goals and measures.

- A potential list of performance goals and measures includes:
- Protection and conservation of Cherry Creek riparian and floodplain habitat
- Protection of residential access, pastures, hunting grounds, businesses, private residences, and critical utilities
- Increase the quantity and quality of juvenile rearing habitat for coho, chum, Chinook, pink, winter steelhead and coastal Cutthroat

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

Cherry Creek is a large rural tributary to the Snoqualmie River and contains the potential to support moderate levels of Chinook spawning. Cherry Creek is well documented as important habitat for coho spawning and rearing, and presumed foraging and overwintering habitat for bull trout. Existing habitat concerns in the Cherry Creek watershed include fish passage barriers, degraded water quality (Cherry Creek is Category 4A for bacteria, temperature, and dissolved oxygen), lack of riparian vegetation and instream large woody debris, limited floodplain connectivity, and seasonal low flows. For Cherry Creek, habitat restoration for Chinook recovery will be most beneficial in the lower part of the sub-basin between the confluence of Cherry Creek and the Snoqualmie River and up to the extent of the 100-year floodplain. Actions above this area will have additional benefit to coho.

Identification of anticipated support for and barriers to completion.

The main barrier pertains to funding. Current ongoing collaboration exists between the Wild Fish Conservancy, Snoqualmie Tribe, Tulalip Tribe, Washington Department of Fish and Wildlife, Snoqualmie Valley Watershed Improvement District, and landowners. Feasibility and permitting have not yet been completed for the Water Storage in the Upper Cherry Creek Watershed portion of the project, which includes wetland areas.

Estimate of capital costs and reoccurring O&M costs.

Unknown at this time.

Project durability and resiliency.

Climate change and associated impacts will be factored into all current and future project elements. These projects are designed to have flood hazard benefits throughout the valley and in one case, specifically protect 300th Ave NE, a private road crossing the valley. The intent is to pursue natural process-based solutions as much as possible to reduce maintenance requirements and ensure long term project function and durability.

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

Each sub-project sponsor is listed in the description. SVWID is willing to consider filling the role as the overall project coordinator.

Several projects are ready to proceed with implementation and in some cases have already received grant funding:

- Cherry Creek II allocated PSAR funding in 2020 for $545,320 with a sponsor match of $134,840
- Levee Rebuilding in Cherry Valley, Phase B has been awarded $325,000 from the King County Flood Control District in September 2020.
- North Fork Chery Creek culvert replacement project and Cherry Creek Setback Levee are in the planning stages and in the process of evaluating designs.
- Cherry Creek Floodplain Reconnection Plan is at 75% Design and is ready to permit and fund implementation
- Water Storage in Upper Cherry Creek Watershed has received Streamflow Restoration funding in 2019 for 57,500 for preliminary design.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding. Current design elements are based on best available knowledge. There is significant momentum for continued project planning and implementation as collaboration has been successful with significant engagement with local agencies and the surrounding community. There are also some uncertainties for project design as related to permitting.

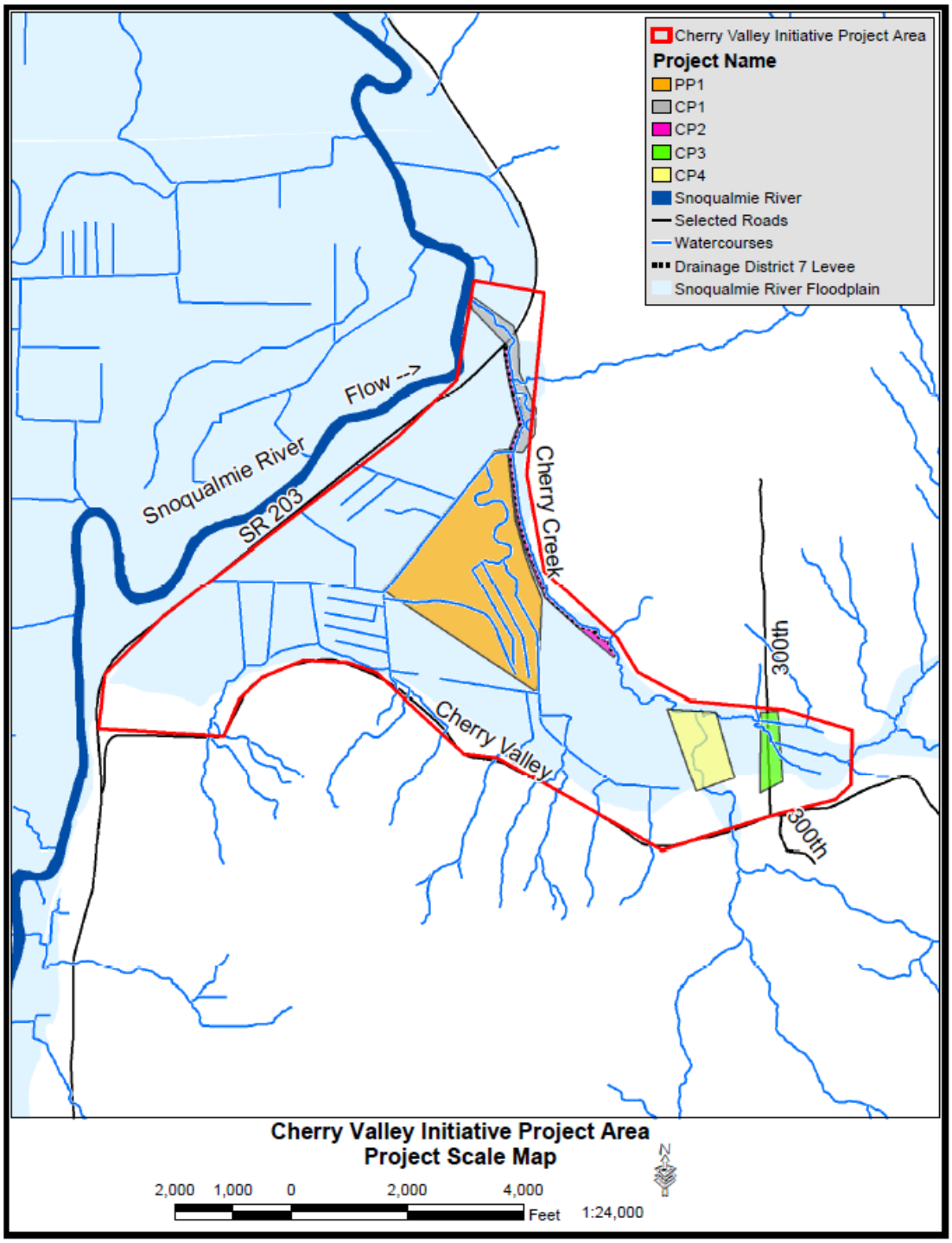


Figure 1. Cherry Valley Initiative Project Area

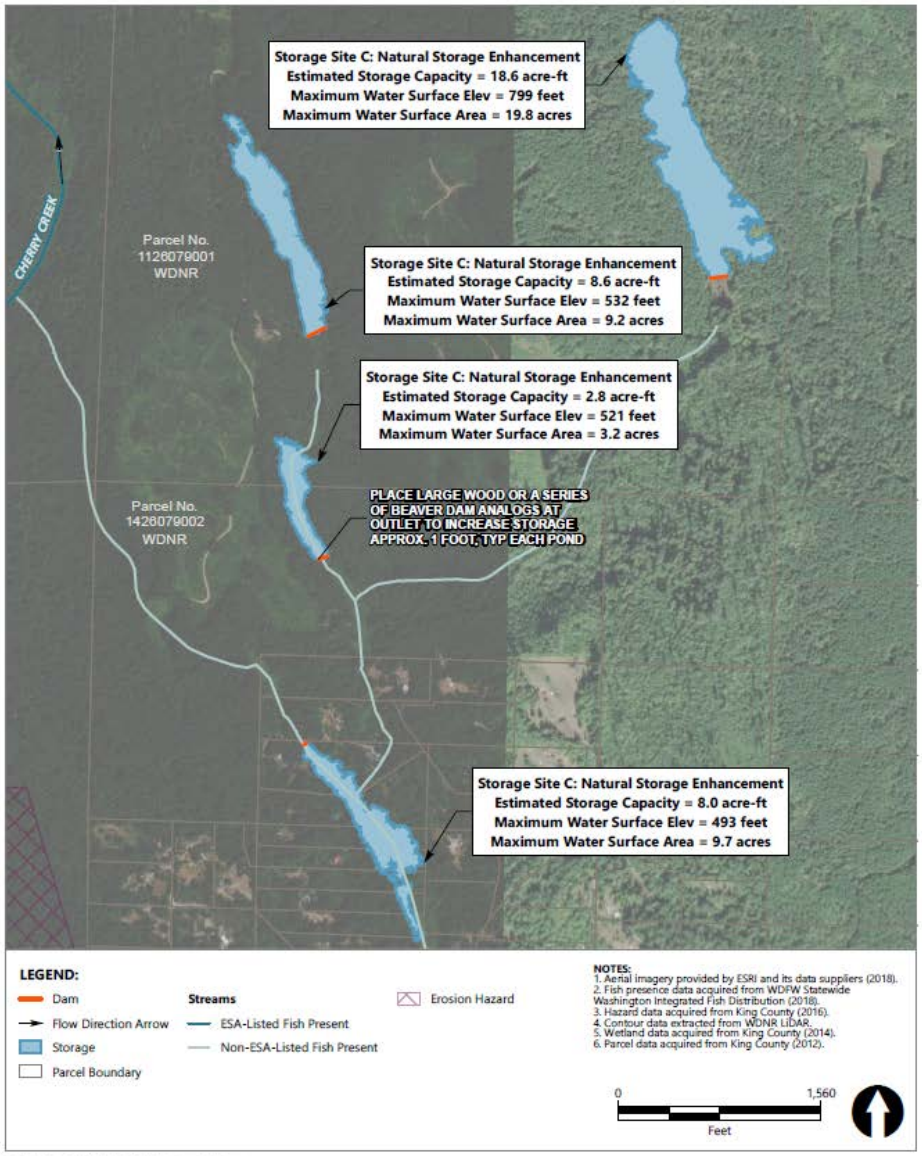


Figure 2. Water Storage in Upper Cherry Creek Watershed

WRIA 7 – Project Description
Camp Gilead Levee Removal Phase 2

December 22, 2020

Project Name
Camp Gilead Levee Removal Phase 2 (7-SN-H20[9])

WRIA 7 WRE Subbasin
Snoqualmie North

Narrative Description
The phase 1 project, completed in 2008, removed approximately 400 feet of revetment and levee. The levee segment had artificially impounded a small creek, creating a ponded area of about 4 acres that had no outlet for fish. Since the first phase, the river has migrated a short distance into the restored bank exposing some additional portions of revetment that was missed in phase 1. As well, it has deposited a large amount of gravel in the river at and downstream of the phase 1 project creating an extension to the creek channel within the river itself, providing some unique rearing habitat. The river channel is not able to migrate in this reach due to revetments and levees on both banks. The phase 2 project would continue the left bank revetment removal downstream of phase 1 on the rest of King County's property for approximately 675 feet. The project may be able to remove an additional 1,000 feet of revetment on private property downstream of King County's property, though negotiations with the landowner have not occurred yet. The 1,675 feet of revetment does not appear to protect any infrastructure and appears ideal for removal. Removal of the additional length of revetment would allow channel migration into the left bank and greatly improve channel edge habitat in general, but much more so in this location than many others due to the presence of the small stream channel that comes out through the phase 1 project area and flows along the revetment.

The projects will improve juvenile rearing and adult spawning habitat for three ESA-listed fish: Chinook salmon, steelhead, and bull trout.

Quantitative or qualitative assessment of how the project will function.
The projects will improve ecosystem function on the Snoqualmie River by reconnecting floodplain habitat, restoring riparian areas and restoring edge habitat for salmon. These projects employ a process based river restoration approach by removing barriers to river channel migration allowing the river to create salmon habitat in a long term sustainable way.

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.
These project efforts will restore floodplain habitat within the lower Snoqualmie River. The project is located in one of the core spawning reaches of the Snoqualmie for Chinook and steelhead, so that the benefits to spawners and especially early rearing juveniles is very high. Additionally, of all the core

[9] Other numbers associated with this project: P-7-263

spawning and early rearing reaches of the Snoqualmie, this is the furthest downstream. Therefore, all out-migrating juveniles from the Tolt River core area, Fall City Reach core area, and raging River core area, will benefit from improved rearing in this reach.

Performance goals and measures.

Specific measures unknown at this stage. Projects like this one evolve over several years as river processes are able to act upon the unarmored bank. Typical measures that King County utilizes on similar projects include the length and area of suitable edge habitat conditions for juveniles at various flow levels, as defined by suitably low velocity. Edge habitats include bar edges, undercut banks, backwaters, etc. Data and methods from previously completed projects demonstrate that these measures coincide strongly with fish utilization of the project area.

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

These restoration actions are expected to benefit documented Chinook, Coho, Chum, and Pink salmon as well as Bull, Cutthroat, and Steelhead trout. Chinook salmon and Bull trout are priority species protected under the U.S. Endangered Species Act.

Identification of anticipated support and barriers to completion.

This project will occur primarily on county-owned land within Tolt-McDonald Park, and will build upon an earlier project. Access for construction is reliant on gaining permission from the downstream landowner, Camp Gilead. King County has had a good relationship with the camp in the past, based on our experience during phase 1.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit, construct and monitor the two levee setback projects is $1,500,000.

Anticipated durability and resiliency.

Because the project involves the removal of armoring and no setback facility, the natural asset value of the site will increase over time. The project is unlikely to require any adaptive management actions or adjustments over time. The one minor exception to this will be the downstream terminus of the removal where we will need to ensure that remaining revetments that protect the privately owned Camp Gilead remain intact.

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

King County is the sponsor of this project. Lead staff: Andrea Mojzak. King County has capacity to initiate this project within the next 1-4 years, depending on funding availability.

Documentation of sources, methods, uncertainties, and assumptions.

Unknown at this phase of the project.

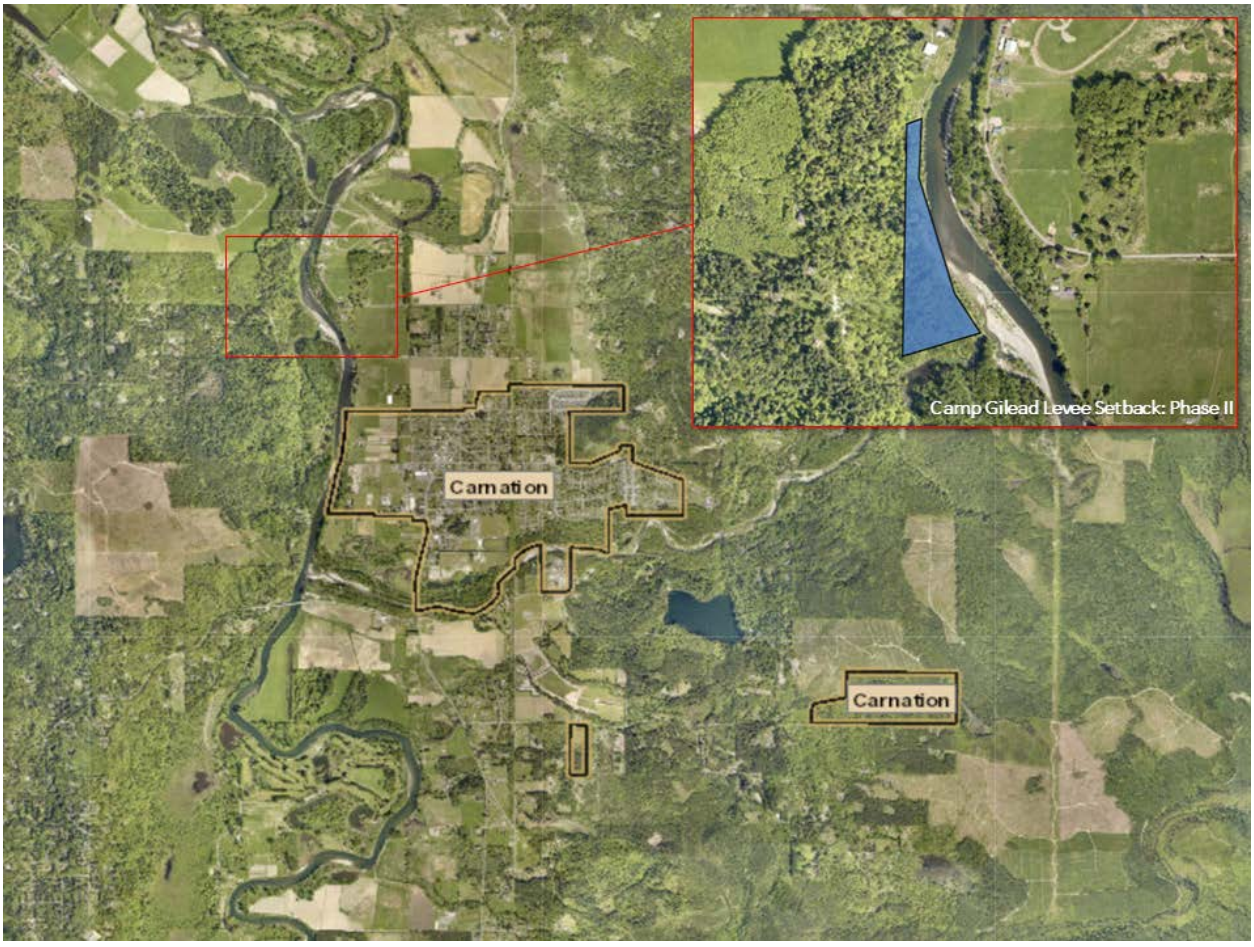


Figure 1. Site Plan for Camp Gilead Levee Setback Phase 2 Project

WRIA 7 – Project Description
McElhoe-Pearson Restoration Project

December 22, 2020

Project Name and Number
McElhoe-Pearson Restoration Project (7-SN-H21[10])

WRIA 7 WRE Subbasin
Snoqualmie North

Narrative Description
The McElhoe Pearson restoration project site is located north of the City of Carnation. Previous restoration actions at this site occurred in 2012 as part of Phase 1 and included connecting the Snoqualmie River channel to an existing wetland feature to provide 500 feet of off-channel rearing and flood refuge for juvenile salmon.

Potential Restoration Actions for Phase 2 include:

- Removal of 1500 ft of the McElhoe Pearson levee that was notched in Phase 1 to fully reconnect up to 12 acres of floodplain, a portion of which is currently connected by the Phase 1 project as a backwater/wetland habitat. Some levee setback protection would be necessary as part of this proposal.
- Create a "flow through" channel, essentially notching the levee in a second location further upstream and potentially removing the short cross-levee to improve hydraulic and habitat connectivity while leaving the bulk of the levee in place.

These proposed Phase 2 projects will improve juvenile rearing and adult spawning habitat for three ESA-listed fish: Chinook salmon, steelhead, and bull trout.

Quantitative or qualitative assessment of how the project will function.
Both projects will improve ecosystem function on the Snoqualmie River by reconnecting floodplain habitat, restoring riparian areas and restoring edge habitat for salmon. Proposed levee removal considered as part of Phase 2 could reconnect up to 12 acres of floodplain. A second alternative project action would create a "flow through" channel would also expand floodplain habitat within this project area, but without restoring floodplain processes to the same degree as the first alternative. The project location is located within the "Snoqualmie at Carnation" reach, one of the two most important reaches for restoration as identified in the Snohomish Basin Salmon Conservation Plan (Salmon Plan).

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1 below. The yellow project footprint shown is the maximum extent of proposed project actions.

[10] Other project numbers associated with this project: 07-MPR-321

Description of the anticipated spatial distribution of likely benefits.

These project efforts will restore floodplain habitat within the lower Snoqualmie River. This reach is within a heavily used spawning area for Chinook and steelhead. Where early rearing habitat is considered the most significant bottleneck for Chinook. The reach is the furthest downstream of the four most important Chinook spawning areas in the Snoqualmie – thus, nearly all out-migrating juveniles will benefit from the increase in habitat quantity and quality resulting from this project.

Performance goals and measures.

Unknown at this stage of design. Will be developed once project activities are determined.

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

These restoration actions are expected to benefit documented Chinook, coho, chum, and pink salmon as well as bull, cutthroat, and steelhead trout. Chinook salmon and bull trout are priority species protected under the U.S. Endangered Species Act. As noted above, this reach is designated as 'Mainstem Primary Restoration" in the Salmon Plan, making it a tier 1 priority for restoration, with a focus on increasing early rearing habitat quantity and quality while also improving spawning habitat quality.

Identification of anticipated support and barriers to completion.

The main barriers pertain to funding and potential acquisition of an adjacent residential parcel. Design feasibility is the next step in order to determine Phase 2 project actions.

Estimate of capital costs and reoccurring O&M costs.

The total cost for a potential "flow through" system to design, permit, construct and monitor is estimated at $918,000. Removal of the levee and setback protection could cost upwards of $6 million. Reoccurring O&M costs are unknown at this time of design.

Anticipated durability and resiliency.

Unknown at this phase of the project. Climate change and associated impacts will be factored into all current and future project elements. The intent is to pursue natural process-based solutions as much as possible to reduce maintenance requirements and ensure long term project function and durability.

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

King County is the sponsor of this project. Staff Contact: Andrea Mojzak. Project initiation is dependent on successful future acquisition of a privately owned parcel. No timeline is available.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding. Since Phase 2 design concepts are still in feasibility, documentation is not readily available at this project stage.

Figure 1. Site Plan for McEhlhoe Pearson Habitat Restoration Phase 2 Project Footprint

WRIA 7 – Project Description
Lower Tolt LB Floodplain Reconnection (SR 203 to Confluence)

December 22, 2020

Project Name and Number
Lower Tolt LB Floodplain Reconnection (SR 203 to Confluence) (7-SS-H22[11])

WRIA 7 WRE Subbasin
Snoqualmie South

Narrative Description
This project is a feasibility study to determine options for fully or partially removing existing levee/revetment in order to improve floodplain connection within a 20-acre area near Carnation, Washington.

These restoration actions will benefit documented Chinook, Coho, Chum, and Pink salmon as well as Bull, Cutthroat, and Steelhead trout. Chinook salmon and Bull Trout are priority species protected under the U.S. Endangered Species Act.

Quantitative or qualitative assessment of how the project will function.
This feasibility study is intended to determine options to improve floodplain connection and riverine process within a 20-acre area of disconnected floodplain. These efforts are aimed to provide new off-channel habitat for salmon.

A map and drawings of the project location.
See Figure 1.

Description of the anticipated spatial distribution of likely benefits.
This project proposes to evaluate restoration options to improve floodplain connection with the Tolt River at SR-203 and the confluence with the Snoqualmie River through full or partial removal of the existing levee/revetment within a 20-acre area. These efforts will provide salmon access to off channel waterbodies.

Performance goals and measures.
Deliverables for this feasibility study will include analysis of project costs and benefits, including short and long-term physical and ecological changes produced from partial or complete removal off existing revetment structures. In addition, an analysis of alternatives for anticipated project obstacles, including flood concerns, road and bridge placement, and retention of existing boat launch facilities will be provided.

[11] Other project numbers associated with this project: 07-MPR-259

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

These future restoration actions are expected to benefit documented Chinook, Coho, Chum, and Pink salmon as well as Bull, Cutthroat, and Steelhead trout. Chinook salmon and Bull trout are priority species protected under the U.S. Endangered Species Act. The project's proposed restoration of floodplain habitat are designed to provide aquatic habitat for macroinvertebrates and rearing fish.

Identification of anticipated support and barriers to completion.

The future restoration actions will have to address multiple barriers, which will be evaluated in the feasibility study.

The short distance between the existing revetment and NE Tolt Hill Rd raises the potential for project obstacles. The distance from the revetment to NE Tolt Hill Rd ranges from approximately 60 meters to 150 meters throughout the proposed project area. This short distance may limit options for placement of a setback levee. Multiple project alternatives concerning the road, placement of a setback levee, and the existing bridge should be evaluated in the feasibility study.

On the south side of NE Tolt Hill Rd, existing homes and farms lie adjacent to the proposed project site. Concerns from neighbors about flooding and setback placement need to be addressed.

In addition, there is currently a publicly accessible boat launch and parking lot within the proposed project area. Options for moving or replacing this public facility should also be evaluated.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost for this feasibility level evaluation will be approximately $250,000.

Anticipated durability and resiliency.

Not applicable at this stage of design.

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

Snoqualmie Tribe, Ryan Lewis (Restoration Manager), ryan.lewis@snoqualmietibe.us. The project is ready to begin feasibility level evaluation.

Documentation of sources, methods, uncertainties, and assumptions.

Unknown at this project stage.

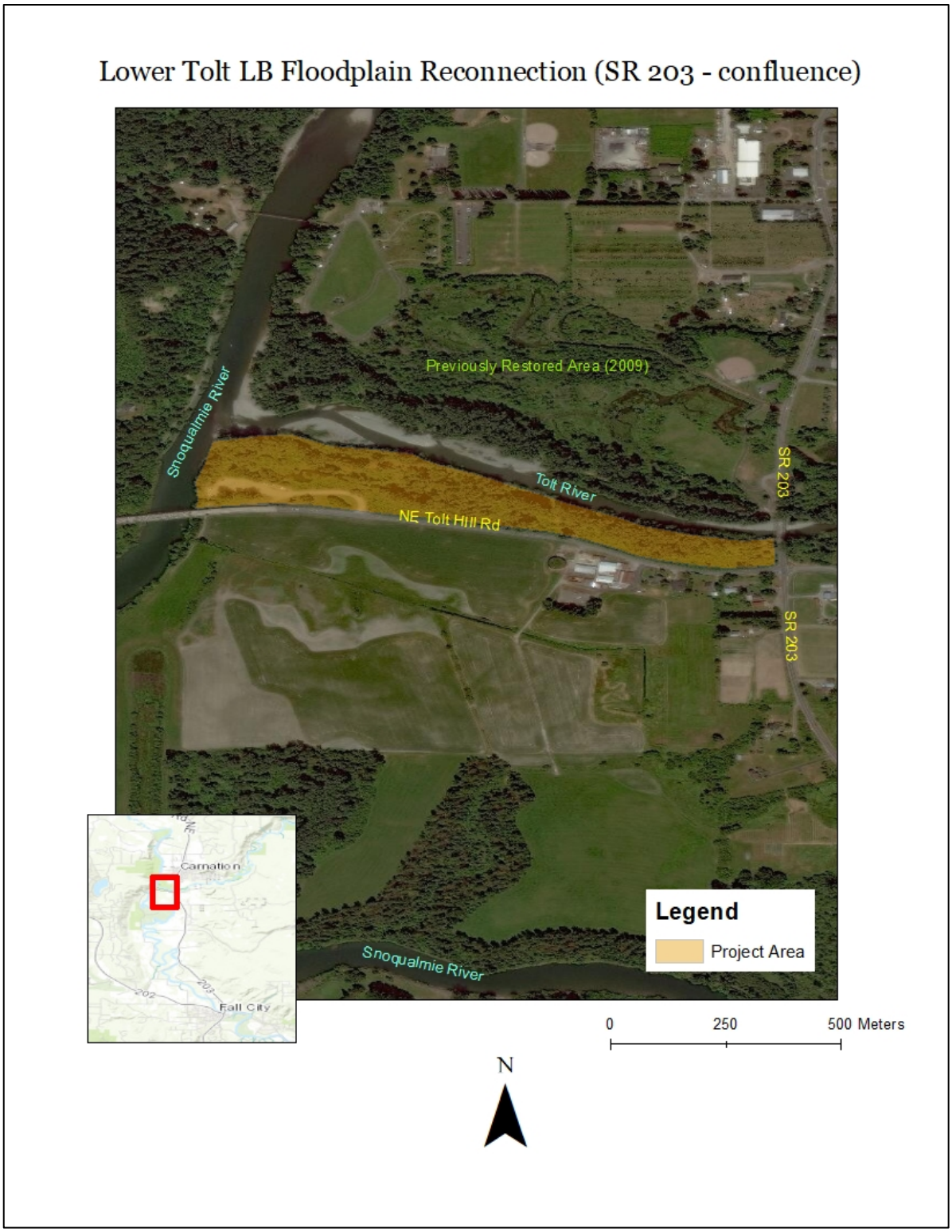


Figure 1. Proposed Project Location

WRIA 7 – Project Description
Fall City Floodplain Reconnection Design and Construction – Left Bank and Right Bank

December 22, 2020

Project Name and Number
Fall City Floodplain Reconnection Design and Construction – Left Bank and Right Bank (7-SS-H23[12])

WRIA 7 WRE Subbasin
Snoqualmie South

Narrative Description
This project includes two adjacent floodplain reconnection projects located along the lower Snoqualmie River at rivermile 34.5. The Barfuse project will remove and set back 2000 feet of levee which will reconnect and restore up to 45 acres of floodplain habitat. The Hafner project will remove and set back 1000 feet of levee which will reconnect and restore up to 55 acres of floodplain habitat. The river is physically and hydrologically disconnected from its floodplain as a result of channel confinement by levees on both sides of the river. The projects will improve juvenile rearing and adult spawning habitat for three ESA-listed fish: Chinook salmon, Steelhead, and Bull Trout. The existing levees protect adjacent farmland, homes and Neal Road.

Quantitative or qualitative assessment of how the project will function.
The projects will improve ecosystem function on the Snoqualmie River by reconnecting floodplain habitat, restoring riparian areas and restoring edge habitat for salmon. This project will restore 2,600 feet of mainstem river edge habitat and channel migration potential, improve the connection of 145 acres of floodplain, install new setback facilities, and restore native vegetation to 45 acres of floodplain.

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.
These project efforts will restore a combination of 100 acres of floodplain habitat within the lower Snoqualmie River.

Performance goals and measures.
Not defined at this stage of project.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.
These restoration actions are expected to benefit documented Chinook, Coho, Chum, and Pink salmon as well as Bull, Cutthroat, and Steelhead trout. Chinook salmon and Bull trout are priority species protected under the U.S. Endangered Species Act.

[12] Other numbers associated with this project: 2018-0296

Identification of anticipated support and barriers to completion.

Current ongoing collaboration exists between King County (project sponsor), individual farmers, Fall City Community Association, Tulalip Tribes, Snoqualmie Tribe, KCD, SVWID, Snoqualmie Valley Preservation Alliance, Sno-Valley Tilth, Snoqualmie Forum, Snoqualmie Watershed Forum, Wild Fish Conservancy, KC Agriculture Commission, City of Duvall, WDFW, Ecology and WSDA. The main barrier pertains to funding.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design, permit, construct and monitor the two levee setback projects is $15,250,000. Reoccurring O&M costs will be minimal and limited to plant survival monitoring and invasive species removal.

Anticipated durability and resiliency.

The project is designed to mimic sustainable, pre-settlement conditions and accommodate seasonal hydrologic changes. The project is designed to have flood and erosion hazard benefits to protect Neil Road, the sole access County road.

Once the native plants are installed, maintenance will be required to ensure plant survival. Monitoring of plant survival, native plant replacement, and non-native invasive plant removal will be performed for approximately 5 years post-construction.

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

King County is the sponsor of this project. Staff Contact: Andrea Mojzak. This project has secured $550,000 in funding and has a timeframe of readiness of 3 years. The project is currently ranked #1 for FbD and for PSAR-Large Capital.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding. Current design elements and water offset calculations based on best available knowledge. Additional information on King County's webpage for the project: https://kingcounty.gov/services/environment/animals-and-plants/restoration-projects/projects/fall-city-floodplain-restoration.aspx

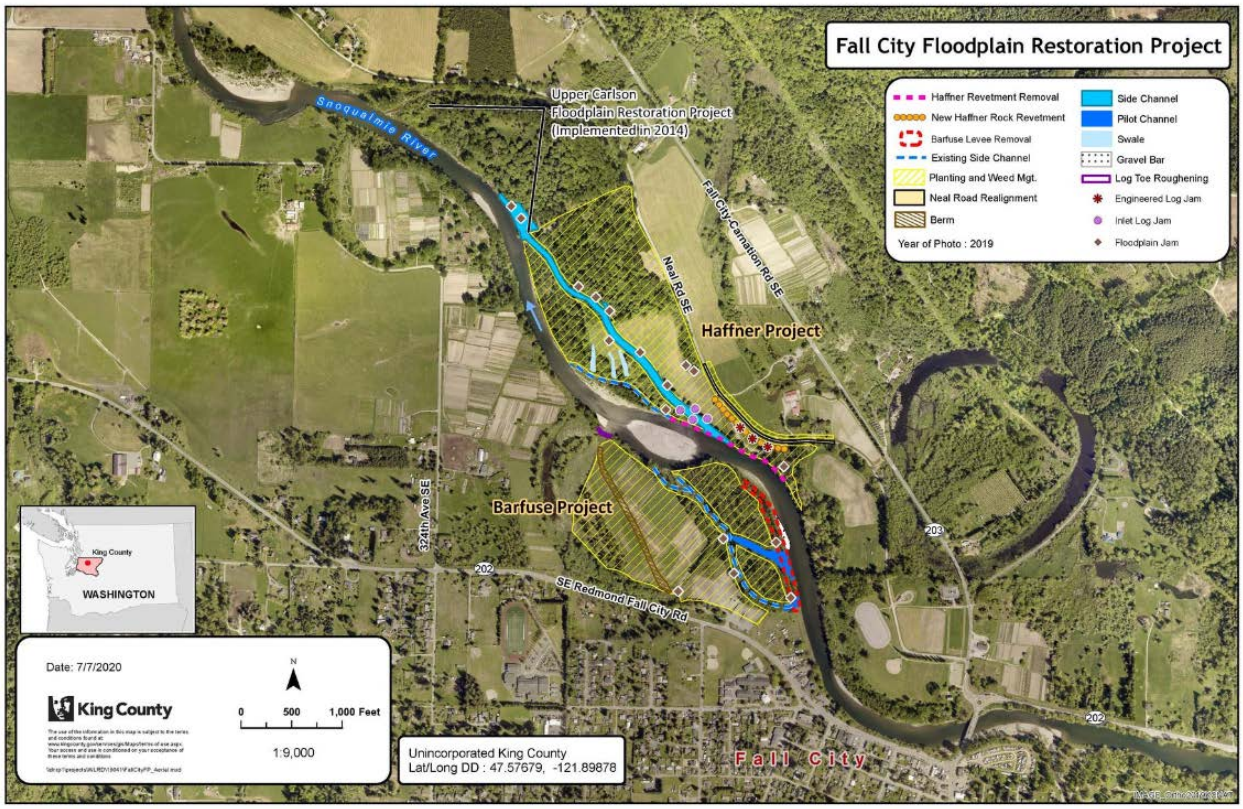


Figure 1. Site Plan for Fall City Floodplain Restoration Project

WRIA 7 – Project Description
Patterson Creek Floodplain Restoration (Sub-Watershed 2C) and Patterson Creek Floodplain Acquisitions

December 22, 2020

Project Name and Number
Patterson Creek Floodplain Restoration (Sub-Watershed 2C) and Patterson Creek Floodplain Acquisitions (7-PA-H24[13])

WRIA 7 WRE Subbasin
Patterson

Narrative Description
This project includes restoration of up to 30 acres of floodplain through riparian restoration and

increased channel complexity. This will require acquisition of 18 acres along Patterson Creek at river mile 7. These actions are located outside of the City of Redmond, Washington along Redmond-Fall City Road, within the WRIA 7 Patterson Creek subbasin. The first phases of this project are already under way. King County has secured the opportunity to design a project in the downstream portion of the project area on parcels owned by WDFW as well as a homeowner's association open-space tract. Additional funding is needed for construction and for subsequent phases of acquisition and restoration. The first phase will revegetate roughly 24 acres of riparian areas surrounding Patterson Creek with native vegetation. The project area is dominated by reed canary grass with small inclusions of native pasture grasses. Planting will start in these "islands" of native grasses and expand to revegetate the rest of the area. Future phases involve additional acquisition at the upstream end of the project area and additional design and construction.

This project could be particularly beneficial to documented Chinook, Coho, Steelhead, Chum, Pink, and resident Cutthroat Trout that utilize this stream as 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.
Quantitatively, this project will include restoration of up to 30 acres of floodplain through riparian restoration and increased channel complexity along Patterson Creek through acquisition of 18 acres of land at river mile 7.

Native riparian plantings will provide shade along this stream sections to protect water temperatures and directly benefit prey availability of pre-migrant and outmigrating juvenile salmonids.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1.

[13] Other project numbers associated with this project: 07-RSR-038

Description of the spatial distribution of likely benefits.

This project includes restoration of up to 30 acres of floodplain through riparian restoration and increased channel complexity. This will require property acquisition of 18 acres along Patterson Creek at mile 7.

Performance goals and measures.

Potential performance goals and measures will be based on length of levee removed and area of floodplain reconnected to the river.

The project is consistent with the principles of RCW 90.94.030 in that it aligns with the goals of the WRIA 7 Watershed Restoration and Enhancement Committee (WREC) to offset consumptive uses of water from permit-exempt wells. This proposed floodplain restoration project can help increase floodplain water levels and provide benefits such as increased water storage and resilience to climate change impacts.

Given the current vegetation community on the site, dominated by reed canary grass, key measures include the transition from invasive species to a wetland and riparian area dominated by native vegetation. Beavers are active in the area and we expect to realize gains in beaver-associated off-channel habitat in the form of dam complexes and ponds throughout the site.

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

These restoration actions will benefit Chinook, Coho, Steelhead, Chum, Pink, and resident Cutthroat Trout that utilize this stream. Chinook and Steelhead are priority species, protected under the ESA. According to the King County stream report, Steelhead and Coho salmon use the mainstem and several key tributaries of Patterson Creek for both spawning and rearing.

Identification of anticipated support for and barriers to completion.

King County is committed to completing this project. The project is included on internal 10-Year Priority Project Lists and is well aligned with the goals and desired outcomes of the basin-wide Salmon Plan. As per King County's typical approach to floodplain restoration projects, public engagement is anticipated to occur throughout the project life-cycle. King County is already designing a project along the lower half of the project area footprint with no known barriers to implementation. Successful acquisition of upstream areas will be dependent on landowner willingness, but King County has been very successful in acquiring properties along Patterson Creek in the past.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels and perform restoration actions is approximately $1,625,000.

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. The project area is naturally very wet so that watering will likely be quite limited. 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. King County will explicitly

plan for the likely presence of beavers as they are present in much of the Patterson Creek basin. This may require higher levels of plan replacement over the first few years as well as protective devices such as beaver fencing and plant selection that discourages beaver browse. However, King County has completed other successful revegetation projects with similar conditions along Patterson Creek.

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

King County Department of Natural Resources and Parks. Sponsor contact: Andrea Mojzak amojzak@kingcounty.gov . The sponsor has initiated phase 1 design. Finding needed for implementation and phase 2 acquisition.

Documentation of sources, methods, uncertainties, and assumptions.

Not applicable at this stage of design.

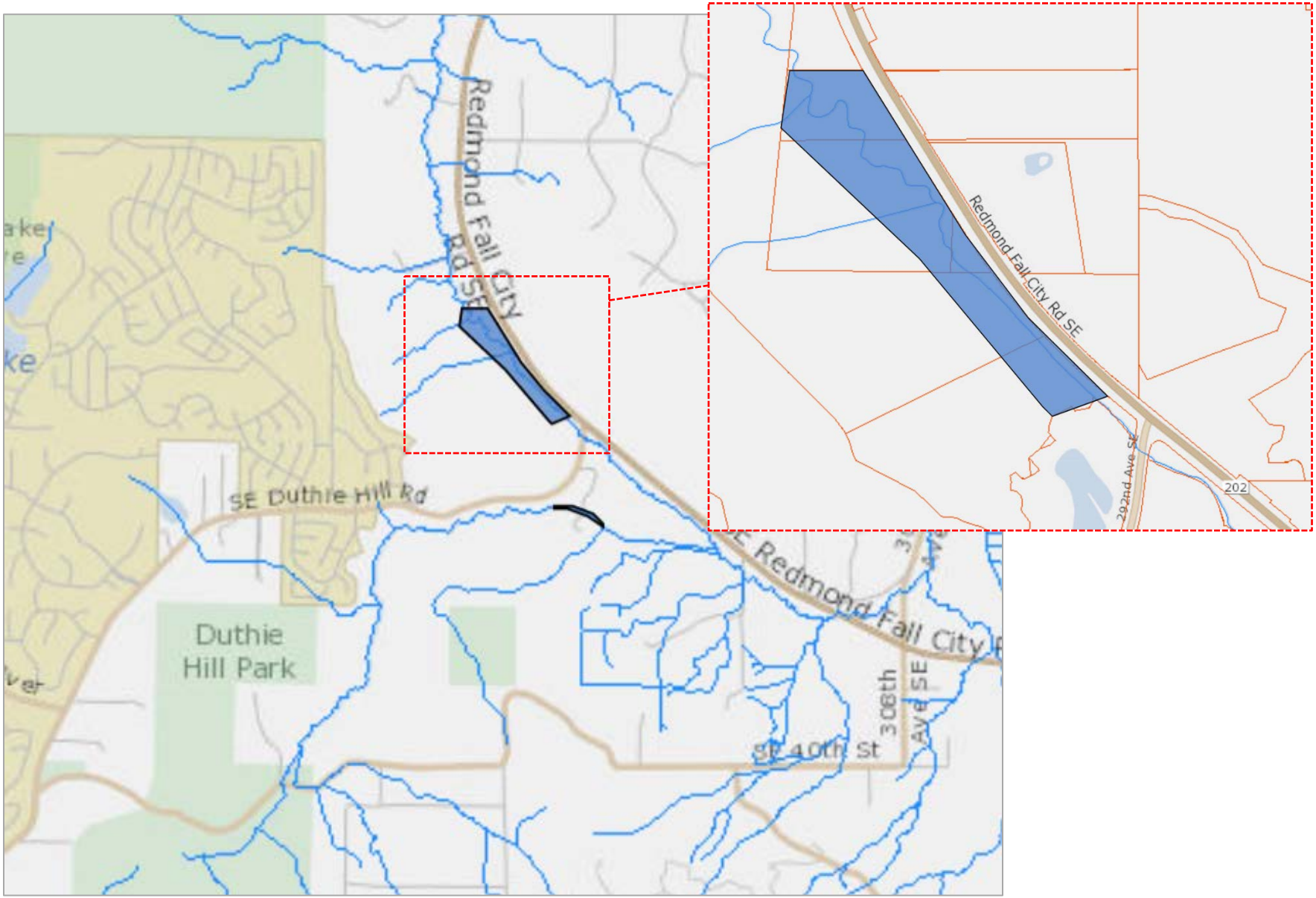


Figure 1. Map of Patterson Creek Floodplain Restoration

WRIA 7 – Project Description
Raging River Left Bank Mouth Levee Setback (Bernard Memorial Park)

December 22, 2020

Project Name and Number
Raging River Left Bank Mouth Levee Setback (Bernard Memorial Park) (7-RR-H25)

WRIA 7 WRE Subbasin
Raging River

Narrative Description
This project proposes setback of some or all of the existing levee along the left bank of the Raging River at Bernard Memorial Park (King County parcel #1424079050), located at the confluence with the Snoqualmie River, creating important riparian floodplain habitat. This project is located in Fall City, Washington within the WRIA 7 Raging River subbasin. Levee setback will improve floodplain connectivity and expand aquatic habitat as the river traverses an unconstrained floodplain.

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Bull Trout and resident Cutthroat Trout that utilize the Raging River as rearing habitat. Chinook, Steelhead, and Bull Trout are priority species, protected under the U.S. Endangered Species Act (ESA). The project will further help to prevent the extinction of ESA-listed species that depend on salmon, such as the Southern Resident Killer Whale population.

Quantitative or qualitative assessment of how the project will function.
Quantitatively, this project includes setback a portion or all of the levee to create floodplain habitat for salmon rearing and spawning.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1 below.

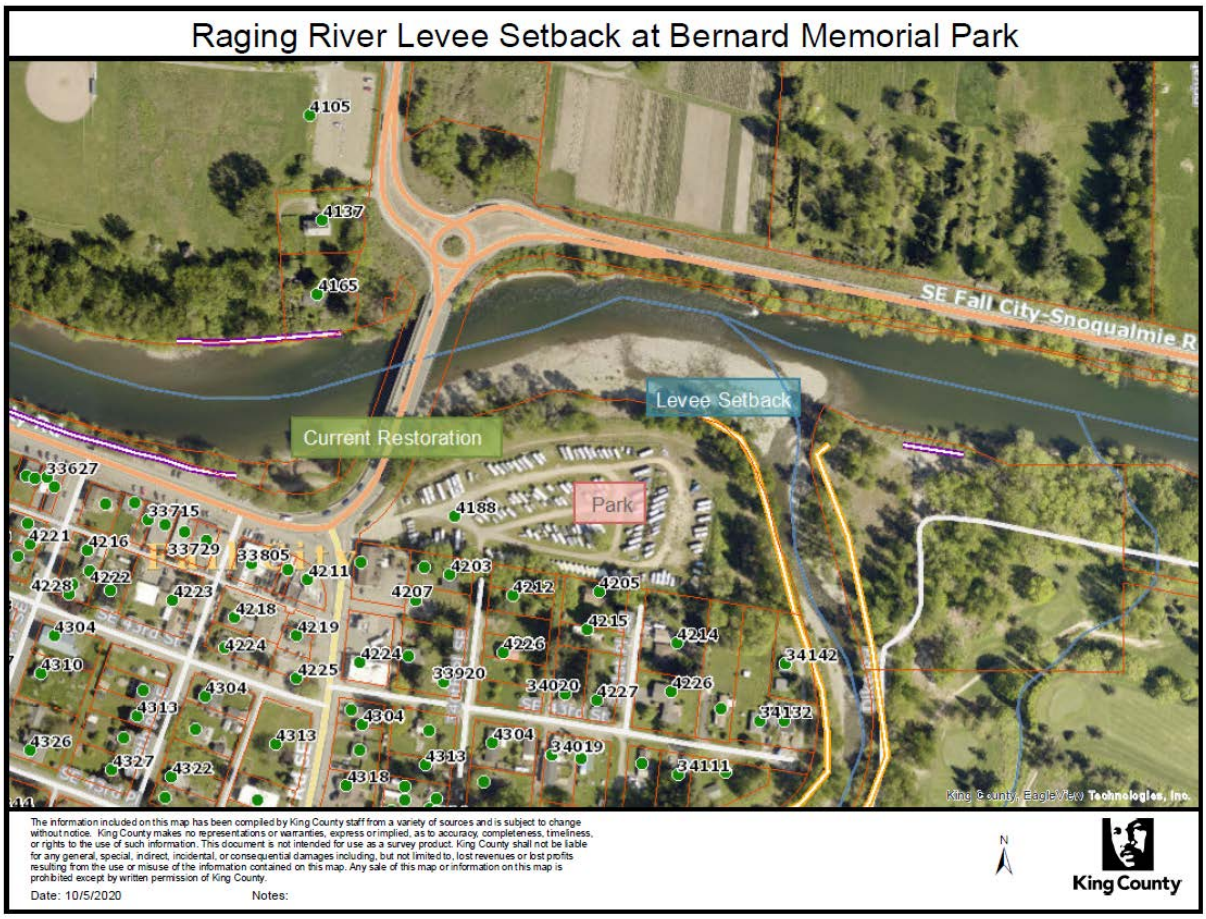


Figure 1. Raging River Left Bank Mouth Levee Setback (Bernard Memorial Park)

Description of the anticipated spatial distribution of likely benefits.

This project involves setting back a portion or all of the levee along the Raging River to create riparian floodplain habitat for salmon rearing and spawning within the Raging River subbasin in Fall City, Washington.

Performance goals and measures.

Specific goals and performance measures for this project have not been scoped at this stage. The overall objective is to support salmon recovery efforts by reconnecting floodplain, in conjunction with the local community. More detailed concepts will be explored in ongoing conversations.

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Bull Trout and resident Cutthroat Trout that utilize this section of the Raging River. Chinook, Steelhead, and Bull Trout are priority species, protected under the ESA. Levee removal will expand existing aquatic habitat for spawning and rearing.

Identification of anticipated support and barriers to completion.

At this stage in the partnership, the landowner is supportive of restoration efforts, and supports conversations around levee setback at Bernard Memorial Park. These conversations are still in the preliminary stage, and specific metrics and performance measures have not been established.

Friends of Fall City Parks/Bernard Memorial Park LLC have a vision for the Park that includes restored natural areas and a passive use park or open space with recreational and public access in the central area of the parcel (see attached map), along with the current active riparian buffer restoration along the left bank of the Snoqualmie River. The restoration and levee setback is supported by King County and other groups working in the region.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to design and permit, remove levee structure, replace levee will be approximately $3 M. Cost estimates are high-level and based on conceptual discussions.

Anticipated durability and resiliency.

Once the project is implemented, long-term ecological monitoring is desired to be performed for at least 10 years.

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

Mountains to Sound Greenway Trust. Sponsor contact: Mackenzie Dolstad mackenzie.dolstad@mtsgreenway.org. The sponsor is ready to proceed with scoping and reconnaissance, and is working with the landowner and community on the long-term plan and vision; the Greenway Trust will pursue future phases (design, implementation) in partnership with the Friends of Fall City Parks. The project is still in the conceptual phase, and is not yet ready to proceed toward implementation.

Documentation of sources, methods, uncertainties, and assumptions.

The Mountains to Sound Greenway Trust has recently initiated a small riparian restoration project on the north border of Bernard Memorial Park (along the left bank Snoqualmie River), and is partnering with the landowner, the Bernard Memorial Park LLC and the Friends of Fall City Parks to complete these efforts. This effort is being funded by a small grant from the Snoqualmie Watershed Forum/King County Flood Control District Cooperative Watershed Management grant program.

In early 2017, the Friends of Fall City acquired nearly 7 acres of land located at the confluence of the Raging and Snoqualmie Rivers. The Friends' vision for this site, until recently used as an RV storage facility, includes active restoration of the riparian buffer along the Snoqualmie River, complemented by the removal of the RV storage area to create a community park and open space. The Friends contacted the Greenway Trust and other partners in the area (including the Snoqualmie Tribe and the Wild Fish Conservancy) to investigate and initiate restoration actions while planning for the future park is underway.

The Greenway Trust sees the initial riparian buffer restoration as an important first step in developing a solid foundation of trust with the Friends of Fall City Parks. Conversations about possible levee setbacks and other larger-scale restoration efforts were mentioned earlier in the process, and the Friends are supportive of the concept overall. However, much work remains in order to scope out a possible future project that would meet both the landowner and community needs and desires for public and

recreation access, and salmon recovery goals. These conversations will continue in partnership with the Friends of Fall City and other interested parties.

WRIA 7 – Project Description
Raging River Bridge to Bridge Acquisitions and Raging River Bridge to Bridge Floodplain Restoration

December 22, 2020

Project Name and Number
Raging River Bridge to Bridge Acquisitions and Raging River Bridge to Bridge Floodplain Restoration (7-RR-H26[14])

WRIA 7 WRE Subbasin
Raging River

Narrative Description
This project proposes property acquisition of riverfront properties from willing landowners between river mile 0.5 and 328th Way SE at river mile 2 along the Raging River in Fall City, Washington in the WRIA 7 Raging River subbasin. The intent of these acquisitions would be for future floodplain restoration projects. Proposed future floodplain restoration actions include removal and setback of 4,000 feet of levee along the right bank of the Raging River at river mile 1.0 restoring 35 acres of floodplain.

Ultimately, these restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Bull Trout and resident Cutthroat Trout that utilize the Raging 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.
Quantitatively, this project includes acquisition of properties along the left bank of the Raging River to allow for future restoration to create salmon rearing habitat as the river reestablishes the floodplain within this area. The specific future floodplain restoration actions proposed include removal and setback of 4,000 feet of levee along the right bank of the Raging River at river mile 1.0 which will restore approximately 35 acres of floodplain.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features on the attached Site Plan in Figure 1.

Description of the anticipated spatial distribution of likely benefits.
This project involves purchasing properties along the left bank of the Raging River within the Raging River subbasin in Fall City, Washington. The total number of properties proposed is still in development.

Performance goals and measures.
Potential performance goals and measures will be based on length of levee removed and area of floodplain reconnected to the river.

[14] Other project numbers associated with this project: 07-MPR-204

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

These restoration actions will benefit documented Chinook, Coho, Steelhead, Chum, Pink, Bull Trout and resident Cutthroat Trout that utilize this section of the Raging 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. Future floodplain restoration actions will expand existing aquatic habitat and provide additional spawning and rearing habitat.

Identification of anticipated support and barriers to completion.

King County is committed to completing this project. The project is included on priority project lists and is well aligned with the goals and desired outcomes of the basin-wide Salmon Plan.

Estimate of capital costs and reoccurring O&M costs.

Estimated total cost to acquire target parcels and conduct floodplain restoration work is approximately $15.5 million.

Anticipated durability and resiliency.

Not applicable

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

King County Department of Natural Resources and Parks. Sponsor contact: Andrea Mojzak.

Properties have not yet been acquired and feasibility and design have not yet been completed. The sponsor is ready to proceed with scoping and reconnaissance immediately.

Documentation of sources, methods, uncertainties, and assumptions.

Uncertainties pertain to funding and landowner willingness to sell property.

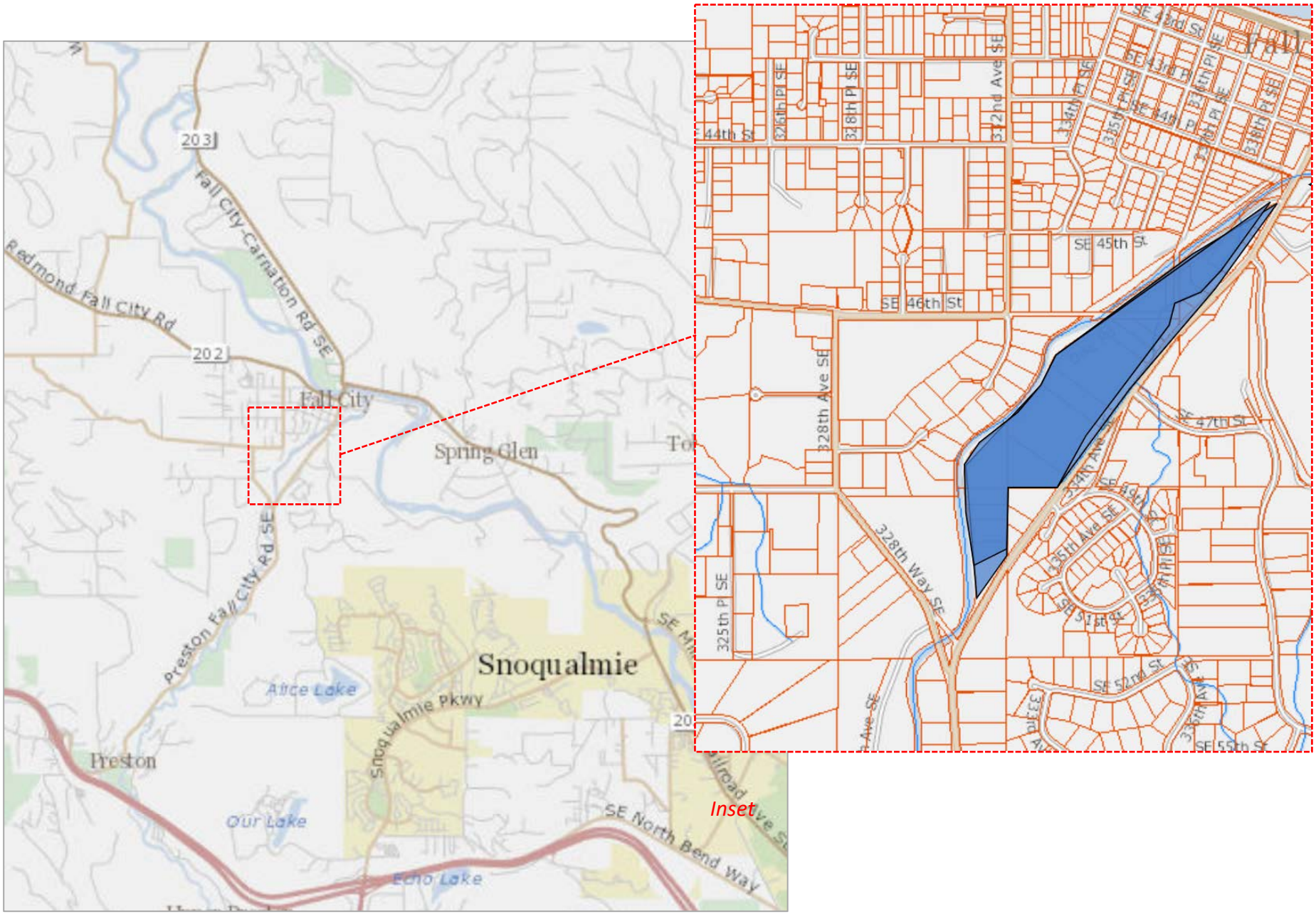


Figure 1. Map of Raging River Bridge to Bridge Floodplain Restoration

WRIA 7 –Project Description
South Fork Snoqualmie River Levee Setback Project

December 22, 2020

Project Name and Number
South Fork Snoqualmie River Levee Setback Project (Nintendo Project) (7-USN-H27[15])

WRIA 7 WRE Subbasin
Upper Snoqualmie

Narrative Description
The South Fork Snoqualmie River Levee Setback project (SFLS) is a multi-stakeholder approved effort to setback up to 2,500 feet of levee, resulting in:

- 25 acres of reconnected floodplain and increased floodwater storage;
- 12 acres of restored riparian habitat, ecosystem function, and processes;
- mitigation of climate change impacts on ESA-listed salmonid species downstream;
- reduced flood risk and long-term flood hazard management costs; and
- increased recreational opportunities for local communities.

As part of the SFLS project, a new setback levee, approximately 3,000 feet long, 1 to 9 feet high, and meeting current engineering standards, will be constructed. The levee setback alignment would position the new levee within the dedicated right-of-way so no property acquisition is needed for levee construction. This project moves the levee further away from the river, between 400 and 800 feet, therefore reducing impediments to river flow, providing approximately 25 acres of improved habitat and additional connected floodplain for increased floodwater conveyance and storage. At least 12 acres of the newly connected floodplain will undergo riparian and floodplain restoration as part of this project, including areas along the South Fork Snoqualmie River and Ribary Creek.

Quantitative or qualitative assessment of how the project will function.
Overall, we estimate that there will be about 2 acre-feet per year (AFY) of additional storage between the levees. The project may consider excavation to mitigate (avoid) downstream impacts if deemed necessary. Lowering the floodplain by a foot would add about 20 acre-feet of compensatory storage – likely at an elevation similar to the downtown areas of North Bend. This project will improve overall watershed hydrology, which will in turn improve downstream water quality, summer low flows, reduce water temperature, and reduce red scour for Chinook salmon.

A map and drawings of the project location.
The project site is shown in relation to surrounding physical features in Figure 1 and Figure 2.

[15] Other project numbers associated with this project: 07-HRA-004

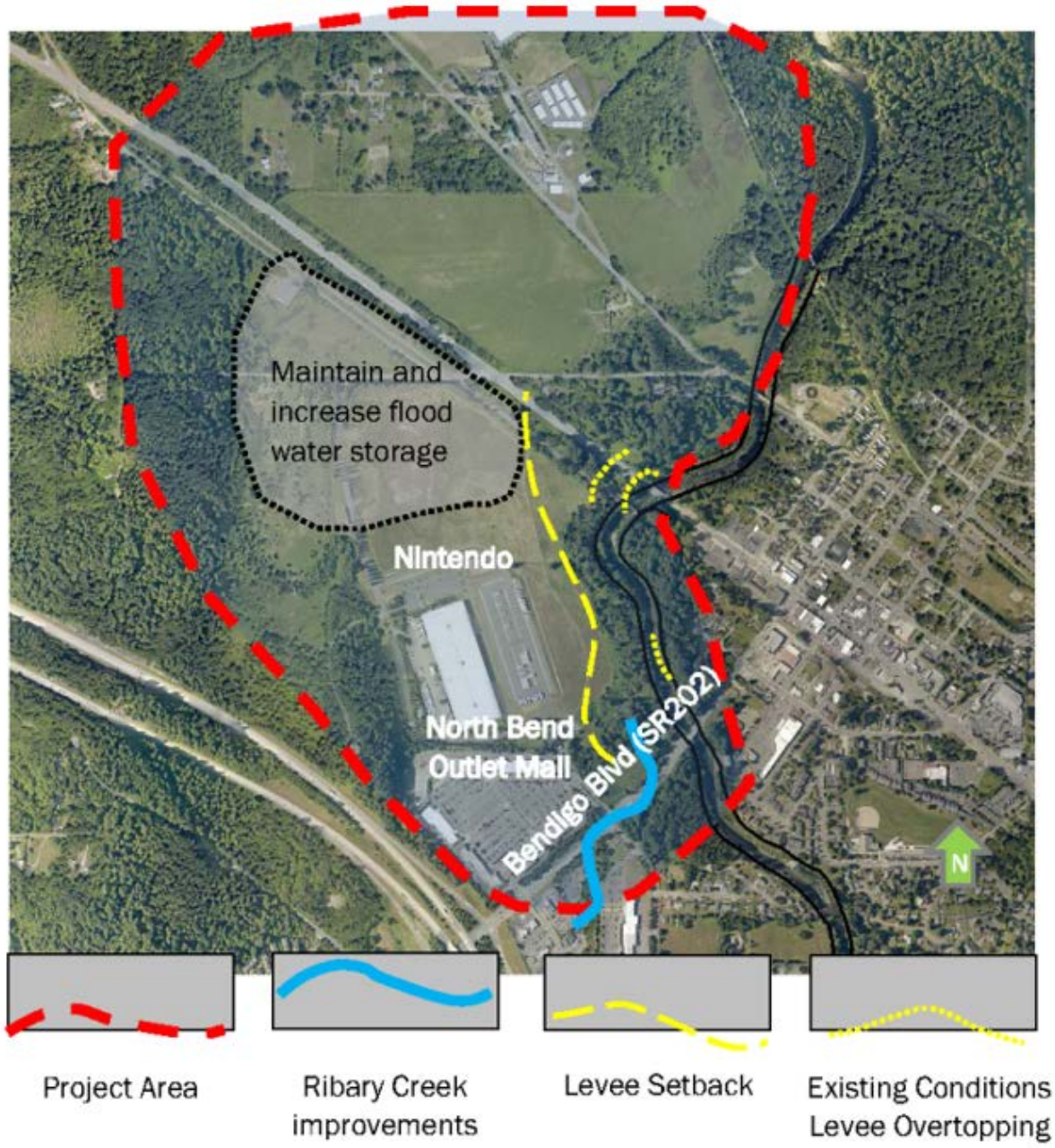


Figure 1. South Fork Snoqualmie River Levee Setback Project Site Plan - Overview

Figure 2. South Fork Snoqualmie River Levee Setback Project Site Plan – Detailed Restoration Actions

Description of the anticipated spatial distribution of likely benefits.

12 acres of floodplain restored. 25 acres of area connected to floodplain. Floodplain inundation is reduced by about 50 acres for the 100-year event.

Performance goals and measures.

The goal of this proposed floodplain restoration project is to help increase floodplain water levels and provide benefits such as increased water storage and resilience to climate change impacts.

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

The project will provide for the conservation, protection and restoration of natural systems within this area for fish and wildlife habitat. This reach of the Snoqualmie River serves as a significant habitat area for resident trout species and large wildlife corridor for elk, deer, beaver, wintering bald eagles, pileated woodpecker, songbirds and other native species. The watershed also supports wild runs of Coho, Chinook, Pink, and Chum salmon and Steelhead downstream of the project site and Snoqualmie Falls. Chinook and Steelhead are priority species, protected under the ESA. Instream structure enhancement and riparian restoration in the City of North Bend are priorities in the Snohomish River Basin (WRIA 7) Salmon Conservation Plan. This proposal addresses several priority ecological actions identified in the Snohomish Plan such as: restoring hydrologic and sediment processes, restoring of wetland functions, enhancing riparian areas, protecting water quality and restoring shoreline conditions (Snohomish

Salmon Plan page 11-84 & 11-86, 2005). These restoration actions in the headwaters (where listed resident bull trout are presumed) are critical to a watershed approach to restore habitat forming hydrologic processes for salmon downstream. The project is identified in the Snohomish Basin Salmon Recovery Forum's 4-year Work Plan as project # 07-HRA-004.

Identification of anticipated support for and barriers to completion.

The City of North Bend is committed to this project. The City has placed this project on the Six-Year Transportation Improvement Program After completion of the setback levee the City may choose to construct and build a road on the landward side of the levee. The project has a letter of support and funding commitment from the King County Flood Control District.

North Bend currently holds a dedicated right-of-way for the levee setback project. The City has been in discussions with the King County Flood Control District regarding ownership of levees, extent of levee removal, new levee design/construction standards and project funding. The City has engaged in stakeholder discussions with Nintendo, BNFS Railroad, and individual property owners.

The City is partnering with King County's River and Floodplain Management Section to design and construct this project. The City also plans to partner with the Mountains to Sound Greenway Trust and/or the Snoqualmie Tribe to manage the restoration elements of the stream and floodplain restoration. North Bend and Mountains to Sound Greenway have been working together on riparian restoration in the city for over 10 years and have implemented 9 projects to date totaling over $300,000.

Estimate of capital costs and reoccurring O&M costs (order of magnitude costs).

The total project cost is estimated to be approximately $8.6 M. The new setback levee will be constructed in a more stable configuration than the existing flood protection facility which should reduce, and may eliminate, flood damages and future post-flood maintenance needs.

Project durability and resiliency.

The benefits of the projects are anticipated to occur both locally and downstream of the project site. The importance of and potential for these benefits are supported by multiple leading publications, including: (1) the Snohomish River Basin (WRIA 7) Salmon Conservation Plan (Salmon Plan), (2) the Snohomish Basin Protection Plan (Protection Plan), and (3) Climate Change Impacts to Salmon Issue Paper (Climate Paper).

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

This project is already programmed for construction under the King County Flood Control District's 2017 Capital Improvement Strategy for the South Fork Snoqualmie River. The City of North Bend has staff and consultant resources to manage this project.

Documentation of sources, methods, uncertainties, and assumptions.

No specifics provided.