Restoration, Acquisition, and Combination Project Proposal

Project Number	15-1198 RST
Project Name	Moga Back-Channel Construction
Sponsor	Snohomish Conservation District

List all related projects previously funded or reviewed by RCO:

Project # or Name	Status	Status of Prior Phase Deliverables and Relationship to Current Proposal?
14-1404	In progress	Design and permitting will be complete by Dec. 2015.

1. Project Location.

This project is located along a relic side-channel to the Snohomish River at 15106 Shorts School Rd at river mile 15.7. The side-channel is on the right bank of the river, 2.4 miles downstream of the confluence of the Skykomish and Snoqualmie Rivers. This site is within the Mainstem Primary subbasin strategy group in the *Snohomish River Basin Salmon Conservation Plan*.

2. Brief Project Summary.

This project will reconnect 6.3 acres and 0.71 miles (5.2 acres and 0.45 with partial funding~~for alternative option~~) of off-channel habitat to the Snohomish River at river mile 15.7. Project construction will include replacement of one barrier access road crossing with a 12' diameter culvert, installation of a second crossing with a 12'diameter culvert (with partial funding this second culvert will not be installed), removal of a foot path barrier crossing, excavation of 0.55 miles of relic channel (0.26 ~~for alternative option~~with partial funding), placement of wood structures, and planting of 5 acres of riparian forest.

3. Problems Statement.

A. Describe the problem including the source and scale.

The Snohomish River is the second largest producer of ESA listed Chinook salmon in the Puget Sound. The proposed project is located just below the confluence of the Skykomish and Snoqualmie Rivers in what is known as the *Confluence Reach* of the Snohomish River. As such, it is critical spawning and rearing habitat for both the Snohomish-Skykomish and Snoqualmie populations of Chinook salmon (SBSRF, 2005). As much of the lower Snohomish River is modified, developed, and diked, this reach represents the single best opportunity for restoration of salmon habitat needs (Snohomish County, 2003). In the early to mid 30's, much of this reach was diked (now 44% diked or armored) and the river has moved very little in the last seventy years. The Crabbs dike (now Moga) and Beck dike, in particular, have not been maintained and cut valuable side-channel habitat off from the river. Side-channel habitat provides critical ~~adult holding and~~ juvenile rearing habitat for several species of anadromous fish.

Snohomish County Surface Water Management completed the *Snohomish River Confluence Reach Analaysis* in 2003 with R2 Resource Consultants. This assessment included geomorphic analysis,

hydrologic analysis, and hydrodynamic/hydraulic modeling to assess the potential benefits and locations of restoration projects aiming to re-connect the river to the floodplain. In the two-dimensional hydrodynamic model, both current conditions and a potential dike breach scenario including breaches of the Beck Dike along Bob Heirman Wildlife Park (County-owned) and the Crabbs Dike (privately-owned property; now the Moga Dike) were modeled to determine flow velocities, directions, and eddy patterns. In the model, five sections of the Beck Dike and two sections of the Crabbs Dike were lowered along with a section of fill blocking the Moga side channel. The modeled scenerios predicted relatively small changes in flood depths and velocities which could be due to the fact that these dikes are over-topped in flood flows during present conditions already. The effects of breaching sections of the Crabbs dike only were not modeled. As a result of this assessment and salmon habitat needs identified in other documents, the County identified several potential restoration projects in the Confluence Reach that would improve Chinook habitat. Removing/breaching portions of the Crabbs and Beck dikes to re-connect side channels were among them.

Snohomish County just completed (2015) an assessment of the Snohomish River from the confluence of the Skykomish and Snoqualmie downstream to just above the estuary. This assessment included 2D hydrodynamic modeling similar to what was done in the first assessment although at a courser scale as well as channel migration analysis and sediment transport analysis. The report identifies the Crabbs/Moga side channel as well as side channels across the river behind the Beck dike as projects that are geomorphically feasible given current river conditions (Snohomish County, 2015).

While re-establishing flow-through of the Crabbs/Moga side channel through dike breaching is being considered by the County currently, the proposed project would open the side-channel up on the downstream end to re-establish connection of this habitat with the river and provide rearing habitat to juvenile Chinook and other salmonids. Potential dike breach scenarios are being modeled during the design of this back-channel reconnection project to ensure that the project will support a dike breach if one should occur, yet also provide long-term habitat if one does not occur. Snohomish County is a project partner and has provided technical assistance through the design process to ensure coordination between the two efforts.

There are currently a series of wetland ponds along the relic side-channel that are connected to the river only at high flood flows. Water overtops the Crabbs/Moga dike at the upstream end and water backs up through depressions in the agricultural field at the downstream end. Water that enters these wetland ponds during flood flows is then backed up by the barrier crossing that is effectively acting as a dam, keeping water levels artificially high. While the wetland ponds are serving as excellent habitat for the beavers, otters, and birds that currently inhabit the site, these flow dynamics create conditions for invasive fish species to thrive and to strand juvenile salmonids that are not able to escape during normal flows. There is a small channel that flows from the barrier crossing to the river, but the majority of water that enters the ponds during high water floods through the agricultural field. Therefore, from the barrier downstream, the side-channel does not provide sufficient habitat for juvenile or adult salmonids in its current condition.

B. **List the fish resources present at the site and targeted by your project.**

Species	Life History Present (egg, juvenile, adult)	Current Population Trend (decline, stable, rising)	Endangered Species Act Coverage (Y/N)
Chinook	Juvenile/Adult	Decline	Y
Steelhead	Juvenile, Adult	Decline	Y

Coho	Juvenile	Decline	N
Pink	Adult	Unknown	N

C. Describe the limiting factors, and limiting life stages (by fish species) that your project expects to address.

The *Snohomish River Basin Salmon Conservation Plan* (2005) identifies rearing habitat in the mainstem as one of the highest priority limiting factors for recovery of Chinook. The proposed project will directly address this limitation by providing an additional 6.3 acres of off-channel rearing habitat and 0.55 miles of new channels to provide a total of 0.71 miles of off-channel habitat re-connected to the Snohomish River (5.2 acres off channel and 0.26 miles new channels for a total of 0.45 miles habitat with partial funding). These ponded areas calculations are for a design river elevation of 16.5 feet, which is expected during winter rearing and springtime snowmelt periods. Higher and lower river levels will, of course, result in higher or lower pond areas. The project will address the VSP parameters of abundance, productivity, diversity, and spatial distribution by providing rest and rearing habitat to both Snohomish-Skykomish and Snoqualmie populations of Chinook salmon thereby increasing the number of juvenile outmigrants per adult.

The following limiting life stages that this project will address are as follows:

- Chinook salmon (threatened) – juvenile rearing ~~and adult holding~~
- Steelhead (threatened) – juvenile rearing
- Coho (species of concern) – juvenile rearing ~~and adult holding~~

4. **Project Goals and Objectives.**

A. **What are your project's goals**?

Goal statement:

Increase the amount of off-channel habitat available to juvenile and adult salmonids from the Snohomish River.

The goal of this project is to open up back-channel habitat for juvenile rearing ~~and adult holding~~ of listed salmonid species by removing the barriers at the downstream end of the channel. At some point in the future, Snohomish County may decide to breach portions of the dike at the upstream end and fully re-connect the side channel which the landowner is willing to do. This option was proposed as geomorphically feasible in their recent assessment report that used 2D hydrodynamic modeling, sediment transport, and channel migration data to study potential project opportunities along the Snohomish River (Snohomish County, 2015). This feasibility could lead to the proposal and design of removal of portions of the Crabbs/Moga and Beck dikes in coming year. The County is concerned that removal of the Crabbs/Moga dike only could lead to a high avulsion risk and put both the County road and the French Slough dike downstream at risk. By coordinating both the Crabbs/Moga and Beck dike breaches at the same time and opening up the larger floodplain to the river, the avulsion risk at the Moga property will be much lower. For that reason, the feasibility of a Crabbs/Moga dike breach is not included in this first phase of the project.

The proposed project is, therefore, to open the Moga side-channel up from the downstream end to serve as a back-channel. This will provide valuable habitat for juvenile rearing. Flow in and out of the side channel will be sufficient to maintain this back-channel for the long-term but could be even more beneficial to salmon if the Crabbs/Moga dike is removed at the upstream end in the future.

B. What are your project's objectives?

Our objective is to construct a back-channel project that will allow water from the Snohomish River to flow in and out of the Moga side-channels during normal winter flows. The project will include the following:

- Removal of one complete barrier road crossing on the side channel with a 12ft wide culvert.
- Installation of a second 12ft wide culvert at a new crossing that is currently a dip in the access road to allow for fish access to the newly excavated channel (not in partial funding scenario).
- Removal of a partial barrier foot crossing near mouth of side channel.
- Excavation of a series of channels downstream of the main crossing to connect the existing wetland ponds with the river.
- Installation of large woody debris and gravel in this newly constructed series of channels to provide in-stream habitat conditions suitable for juvenile rearing.
- Provide shade to newly created channel along 100% of the length by planting a native riparian forest with a minimum width of 100ft.
- Improvements to existing riparian conditions along portions of the side channel by controlling invasive plant species and inter and under-planting with native conifers.

C. **What are the assumptions and constraints that could impact whether you achieve your objectives?**

Funding is not expected to be a constraint as this current proposal will fund the completion of the project and the landowner has committed to providing the required match.

This project will be entirely constructed on Greg Moga's property who is fully committed to the project, has signed the Landowner Acknowledgement Form, and has agreed to provide the match. The only other landowner this project will minimally affect is Paul Lund, whose property corner includes a section of the existing wetland/pond complex. We have met with both landowners and the project engineer on site to discuss the hydrologic impacts of this project. Mr. Lund is supportive of the project.

Our current SRFB grant funds both design and full permitting. As such, we have funding to begin the permitting process now. We have already made preliminary contact with permitting agencies and have developed a permitting strategy. We plan to allow plenty of time for agency review of permits before proposed construction summer 2016.

5. **Project Details.**

A. **Provide a narrative description of your proposed project.**

The proposed design project is to open up and improve the downstream end of the Moga side-channel to allow the Snohomish River to back water into a series of newly created channels and the existing wetland ponds above the barrier crossing during normal winter flows.

The side channel is currently acting as an oxbow that is inundated only at high flood flows when both the dike is overtopped and water enters from the downstream end. Because it is disconnected during normal flow, the oxbow is likely not benefiting Chinook salmon and may strand fish. Recent studies on disconnected oxbows such as this in King County revealed that they provide habitat primarily to invasive fish species (Higgins, Snohomish River Basin Technical Committee meeting, 2012). By removing the blockages at the downstream end, the channel will become re-connected with the mainstem river to serve as valuable off-channel refuge habitat. While our long-term goal for the site will be to open the channel up at both ends, opening it up to exchange from the river at the downstream end is predicted to provide significant Chinook habitat gains. Restoration of off-channel habitat in the upper estuary of other comparable rivers has been shown to successfully provide Chinook rearing habitat (Cordell et al., 2011; Gray et al, 2002; Hering et al., 2010).

Project elements include constructing a series of channels from the river to an existing pond (labelled Pond 1 in the attached drawing) and continuing the easternmost channel upstream to the existing farm access road ramp that currently blocks flow. Two culvert crossings (one in partial funding scenario) will be installed to connect the channels to Pond 2. Twelve foot diameter corrugated metal culverts will be installed within the roadway embankment. This will provide fish passable connection from the river to 6.3 acres of off-channel ponds and 0.55 miles of new channel for a total of 0.71 miles of off-channel habitat reconnected (5.2 acres off channel and 0.26 miles new channels for a total of 0.45 miles habitat with partial funding).

Remove barriers: A road crossing to the agricultural field (used for hay) was installed as a complete passage barrier at some time in the past. This crossing is completely filled with no culvert to allow for water flow (or potentially a plugged culvert). Some water does flow into the channel when it overtops the dike at the upstream end or when it backwaters from the downstream end through the low portions of the field. Design for this removal will be a 12ft wide corrugated metal culvert. In addition, a second 12ft wide culvert will be installed further down the access road at a low point in the field where water currently backs into the existing ponds (not in partial funding scenario). This culvert and newly excavated channels will improve access and reduce stranding. Near the mouth of the side channel, an existing partial barrier culvert under a walking path will be completely removed. These removals, along with channel improvements described below, will allow for water to more naturally flow in and out of the existing side channels and wetland ponds with the river level. As a result, the ponds will be lower during summer months, and at times, completely dry, reducing the presence of invasive fish species that prey on juvenile salmonids. Beaver ponds may eventually bring water levels back up and provide year-round rearing habitat.

Improve channel conditions: From the crossing downstream, the channel has been highly modified. A portion runs through the agricultural field and as such, has been filled and graded. At the downstream end, the fill acts, in part, as a dike blocking the Snohomish River from back-filling into it during normal flows. We will excavate of a series of channels connecting the wetland ponds above the crossing with a wetland near the mouth of the side-channel, with the river. Channel enhancements will also include placement of large woody material, and installation of gravel and erosion control fabric. These channels will provide 0.71 miles and 6.3 acres of off-channel habitat for rearing (.45 miles and 5.2 acres in partial funding scenario).

Riparian planting: For much of the existing side-channel, the riparian buffer is an intact cottonwood gallery ranging between 200 and 500 feet wide. The District will enhance riparian forest conditions in this zone where necessary to include Japanese knotweed and blackberry removal as well as understory planting (estimated area two (2) acres). The construction portion of the project below the barrier replacement will

include planting of riparian forest all along newly constructed channels. The buffer width will be a minimum of 100ft from the edge of the channel. Total riparian planting area is estimated at five (5) acres.

B. Provide a scope of work.

Task	Responsible party	Deliverables	Timeline
Permitting	SCD	➢ Submit permit applications (currently funded under 14-1404 grant) ➢ Secure permits	May, 2016
Construction	Contractor	➢ Construction of crossing and channel enhancements	June – Sept., 2016
Construction inspection	Cardno	➢ Inspection of project construction ➢ As-builts	June – Sept., 2016
Planting	SCD	➢ Invasive plant control ➢ Complete riparian planting along newly constructed channel ➢ Forest enhancement in existing cottonwood gallery	➢ June – Sept. 2016 ➢ Oct. 2016 – April 2017 ➢ Oct. 2016 – April, 2017
Planting maintenance	SCD	➢ Invasive control and re-planting if necessary	May, 2017 – Dec. 2019

C. **Explain how you determined your cost estimates**.

Construction Costs were estimated as part of the ~~Conceptual~~ Preliminary Design process completed by Cardno and include a ~~25% contingency,~~ 7.7% sales tax, and approximately 5% Construction Observation by the design engineer.

Planting costs were estimated by the Snohomish Conservation District at $12,000/acre for installation and $2500/year for maintenance for two years following planting. The District is able to keep planting costs low by using bare-root plant material or material from our nursery and having plants installed by our WCC crew.

D. **Describe the design or acquisition alternatives that you considered to achieve your project's objectives.**

Several design alternatives were considered including the types of crossing, the new excavated channel configuration, and water level controls for existing wetland ponds. The proposed preferred alternative was selected based on feedback from the Snohomish River Technical Committee, a sub-committee of the Snohomish River Salmon Recovery forum:

- Crossing types – A hardened fjord crossing was considered as this would have been significantly less expensive to construct. This was decided against for two reasons: 1) the landowner prefers to maintain access to the site year-round with a bridge or culvert, and 2) the hardened crossing would be create a wide shallow section of the side-channel which would be too shallow for fish passage at the

lower flows. We decided to create a narrow, deeper channel to provide improved passage at a wider range of flows and allow for better sediment transport out of the channel during dropping flows, thus increasing the longevity of the project.

- Excavated channel configuration – We explored two channel configurations. In addition to the one presented, there as an option to install only one 12ft culvert and excavate .26 miles of channel instead of .55 miles (partial funding scenario). This would reduce channel length by 1540 feet (0.29 miles) and reduce the area of side channel restored from 6.3 acres to 5.2 acres. This configuration would ~~decrease the project cost by approximately $150,000~~cost a total of $334,285.
- Water level control – The water level in the existing wetland ponds are artificially high since the barrier crossing is acting as a dam, not allowing water to drain. The habitat condition of these ponds is high with beavers, otters, and great blue heron observed on site. We considered a design option of installing grade control structures just upstream of the barrier crossing to maintain higher water levels in the ponds so as not to lose this habitat. We decided, instead, to allow the side-channel to return to a natural flow regime based on river processes. Since beavers are present, they will likely build dams and raise the water level after construction. Design of the channel will include narrow portions to attract beavers to build in those locations that will not compromise the integrity of the newly installed culvert.

E. **How have lessons learned from completed projects or monitoring studies informed your project**?

Cardno has found from previously completed projects that barrier removal to off-channel habitat recreates the habitat forming process of hydraulic flow back and forth between the river and creates valuable juvenile salmon habitat. Previously completed projects of this type include the Spencer Island dike breaching on the lower Snohomish River (400 acres); Nookachamps Mitigation Bank (with Skagit River side channel/off-channel rearing habitat restoration elements); and the Orcas Island Dam removal project.

F. **Describe the long-term stewardship and maintenance obligations for the project or acquired land**.

The landowner purchased the land, in part, to protect and restore fish and wildlife habitat. They plan to build a house where the previous house was located, far from the project site and outside of the floodplain. No additional development activities are planned.

The Snohomish Conservation District will use the requested grant funding to steward and maintain the riparian planting for 2-3 years following construction. If additional maintenance is needed after that time, the District will use funds from its Assessment to complete the work.

The landowner will assume long-term stewardship and maintenance of the installed crossing.

6. **Context within the Local Recovery Plan.**

A. **Discuss how this project fits within your regional recovery plan and/or local lead entity's strategy to restore or protect salmonid habitat**

This project targets ESA listed Chinook salmon and is in the Mainstem Rivers Subbasin Strategy Group in the *Snohomish River Basin Salmon Conservation Plan* (2005). Reconnection of off-channel habitat and

riparian enhancement are Tier One priorities in this strategy group. Ecosystem diagnosis and treatment modeling indicate that restoring the Upper Snohomish/Cathcart Sub-basin (where this project is located), would provide a particularly high benefit to Chinook. The 10-year target for restored off-channel habitat in the Mainstem Rivers Subbasin Strategy Group is 167 acres and as of our latest update to the progress of targets in 2012, we had only completed 25 acres. This project will complete an additional 6.3 acres toward the target (5.2 with partial funding).

B. **Explain why it is important to do this project now instead of later.**

Snohomish County just completed a geomorphic assessment of the Snohomish that identified side channels behind the Crabbs/Moga and Beck dikes as geomorphically feasible projects given current river processes (Snohomish County, 2015). These breaches, however, will likely be several years off if they do happen. There is an opportunity to take action immediately to open this channel up as a back-channel and create juvenile rearing habitat. Snohomish County Surface Water Management is advising the District and Cardno on the design of this project to ensure it will be constructed in such a way as could handle flows if the channel was opened up from the upstream end in the future. Regardless, the back-channel project has been designed to allow enough flushing from the downstream end to ensure the long-term connection with the river if the dike is never breached.

We received SRFB funding (project 14-1404) in the last round for final design and permitting and are in process of completing the Preliminary Design (to be completed and included in this proposal to RCO in August). Final designs will be completed no later than December, 2015. The landowner is extremely motivated to see this project go to construction the summer of 2016 and should we receive this funding, we are on track to do that.

C. **If your project is a part of a larger overall project or strategy, describe the goal of the overall strategy, explain individual sequencing steps, and which of these steps is included in this application for funding.**

See question B above for explanation as to how this project fits in with potential breach of the Crabbs/Moga dike.

This is one of many side-channels identified in the County's newly released geomorphic assessment (Snohomish County, 2015). The County currently has funding from the Coordinated Investment/Floodplains by Design grant allocated in the state budget to complete preliminary design of three of these proposed projects. We expect, therefore, the proposed Moga project to be part of a larger reach-scale approach to restoration in this section of the Snohomish River.

7. **Project Proponents and Partners.**

A. **Describe your experience managing this type of project**.

The Snohomish Conservation District successfully completed two barrier replacement projects the summer of 2014 (50ft bridge on Dubuque Creek and two squashed culverts on tributary to S. Fork Stillaguamish) and has an additional culvert replacement project scheduled for construction summer 2015. In addition,

staff (Habitat Restoration Specialists and an Engineer) at the District have experience permitting and constructing in-stream projects (wood placement and barrier removal) on salmon-bearing streams. Because the District does not have specific experience managing a river construction project of this magnitude, they will rely on the partnership with Snohomish County and other agencies/organizations on the Technical Review and SRFB Review Committees to assist with permitting advice and design development and review. Snohomish County Surface Water Management will assist in interpretation of their modeling and assessment work in this reach and advise development of the design to fit with potential future dike breaches that they will be modeling. In addition, the District will hire Cardno, the design engineer, to conduct project construction inspections and create an as-built after completion.

Cardno is the consultant on contract to complete the design of the project. Cardno's Restoration, Engineering and Geomorphology group in the Pacific Northwest routinely evaluates, designs, permits and assists in construction of large river and wetland restoration projects. Similar completed projects include Conservation Island dike removal and side channel excavation on the Okanogan River, Spencer Island dike breaching project on the lower Snohomish, Nookachamps Mitigation Bank with side channel connections to off-channel rearing habitat on 300 acres on the Skagit River, and Orcas Island dam removal and culvert replacement on West Beach Creek, San Juan County.

B. **List all landowner names**.

- Greg Moga, Landowner Acknowledgement Form attached

C. **List project partners and their role and contribution to the project**.

- Snohomish County Surface Water Management will contribute technical assistance. They will assist with integration of their modeling and assessment data as well as coordination with modeled scenarios for future dike breaches in the confluence reach.
- Cardno is under contract with the District to complete the final design of this project and provide technical specifications for the bid documents. We have included funding in this grant proposal to contract with them to provide the construction inspection and as-builts.

D. **Stakeholder Outreach**.

This project will potentially impact only one landowner in addition to the property owner. We met with the landowner on-site with Cardno and Snohomish County Surface Water Management to discuss the project alternatives and any impacts to water levels on the property. We expect the only impact to this adjacent property to be lower water levels in the summer as the wetland ponds currently backed up by the barrier crossing will be allowed to drain. This landowner has expressed support for the project.

We don't anticipate any safety concerns associated with this project as nothing will be constructed in the main channel of the Snohomish River and the project is over a quarter mile from any boat launches.

References:

Cordell et al. 2011. *Functions of restored wetlands for juvenile salmon in an industrialized estuary.* Ecological Engineering 37: 343–353.

Gray et al. 2002. *Contrasting functional performance of juvenile salmon habitat in recovering wetlands of the Salmon River Estuary, Oregon, USA.* Restoration Ecology Vol. 10 No. 3, pp. 514–526.

Hering et al. 2010. *Tidal movements and residency of subyearling Chinook salmon in an Oregon salt march channel.* Can. J. Fish. Aquat. Sci. 67: 524–533.

Snohomish County Public Works, 2003. *Snohomish River Confluence Reach Analysis, Phase 1 Feasibility Study Final Report.*

Snohomish County Public Works, 2015. *Reach Scale Geomorphic Analysis of Hydraulic, Hydrologic, and Sediment Conditions in the Snohomish River Between SR 522 and Ebey Slough*. Technical Memorandum, R2 Resource Consultants for Snohomish County Surface Water Management.

Snohomish Basin Salmon Recovery Form (SBSRF), 2005. *Snohomish River Basin Salmon Conservation Plan.*

Snohomish Basin Salmon Recovery Form (SBSRF), 2013. *Three Year Work Plan*.

Supplemental Questions

Restoration Project Supplemental Questions

A. **Will you complete, or have you already completed, a preliminary design, final design, and design report (per Appendix D) before construction?**
Yes

B. **Will your project be designed by a licensed professional engineer?**
Yes

C. **If this project includes measures to stabilize an eroding stream bank, explain why bank stabilization there is necessary to accomplish habitat recovery.**

NA

D. **Describe the steps you will take to minimize the introduction and spread of invasive species during construction and restoration.**

Our construction specifications will require all equipment to be steam cleaned prior to mobilization and also require clearing and grubbing material containing invasive seed as identified by engineer to be off hauled or buried under at least 6' of compacted fill.

Comments

Use this section to respond to the comments you will receive after your initial site visits, and then again after you submit your final application.

Response to Site Visit Comments

Please describe how you've responded to the review panel's initial site visit comments. *We recommend that you list each of the review panel's comments and questions and identify how you have responded. You also may use this space to respond directly to their comments.*

RCO Review Panel Comments

Date: May 24, 2015 **Project Site Visit?** ☒ **Yes** ☐ **No**
Review Panel Member(s): Tom Slocum and Kelley Jorgensen

Review panel comment:

The overall project concept, as described in the Project 14-1404 Conceptual Design Report, appears to be technically sound and will likely provide substantial benefit to the targeted salmon species/life histories. As of the date of the site visit, the project design is not developed enough yet to provide certainty on some of the key design issues that are mentioned in the Conceptual Design Report. Two issues in particular need to be resolved: 1) how much the wetland will be allowed to drain during low river stage in order to balance preserving ecological functions for other native aquatic fauna (amphibians, turtles and mammals), preventing fish stranding, and discouraging infestation with warm water resident fish like bass; and 2) how to design the new channels to minimize the long term aggradation of fine sediment, so that the connection will be sustainable over a relatively long time frame. Until the design and permitting implications of these two issues are worked out, the construction cost estimate/grant budget cannot be determined accurately. The "25% contingency" place holder in the conceptual cost estimate is not an allowable substitute for an accurate construction budget and is not an eligible budget line item.

Snohomish Conservation District reply:

Question 1: Lowering Wetland surface

The wetland will be drained approximately four feet when the river is at average annual flow. However, the wetland will experience a much wider range of flows after the reconnection is made, fluctuating with the river. At some points in time, the wetland will be higher than existing due to river levels after reconnection. We intentionally designed the placement of large woody debris in orientation and location to attract future beaver dam building activity to more naturally control flows in and out of the off channel rearing ponds. We expect the reconnected areas to remain jurisdictional wetlands but with a different flow regime. Instead of a blocked, dead-end pond with no outlet or connection to the river, this will be a fluctuating wetland and riparian area directly connected to the river.

Question 2: Likelihood of long-term aggradation

The likelihood of long-term aggradation in the proposed new channels is low, owing to the geomorphic setting and local flow hydraulics in the vicinity of the project site. Two issues are of potential concern:

- What is the probability of outlet blockage by deposition from the main river, particularly given that the geomorphic report (Snohomish County, 2015) predicts that the downstream segment ("16+17" by their terminology) is shown as "Moderate Aggradation" on their *Plate 3 - Snohomish River Bed Stability Rating*?

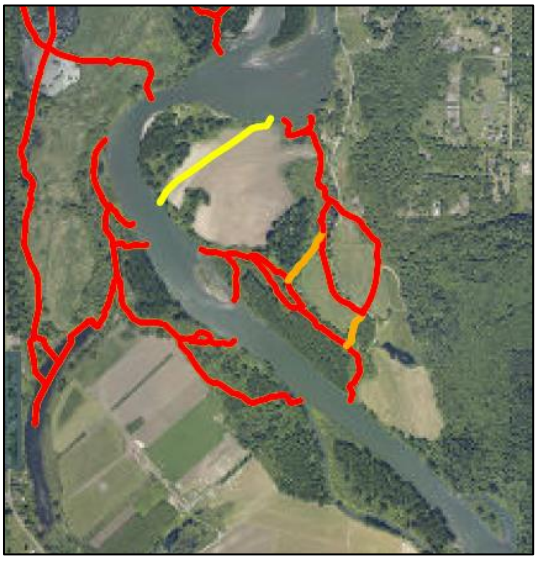
  Airphoto inspection and our field visit both show that the outlet location is at a zone of persistent scour at moderate and high flows, lying at the outside of a prominent bend. Although at a whole-river scale this does appear to be a zone where some deposition occurs (Snohomish County, 2015), the local hydraulics are not well-represented by the coarse granularity of the R2 sediment-transport modeling. The outlet should remain well-scoured of potential sediment accumulations indefinitely into the future.

1. 

Aerial view of the project site, showing its location relative to the outside bend of the Snohomish River where scour is ubiquitous (flow from left to upper right).

- What is the likelihood that overbank flows will deposit fine sediment into the excavated channels and pond complex, resulting in the long-term loss of these habitat features?

  The hydraulic modeling suggests that the relict channels are inundated by 2- to 5-year discharges, and so the most obvious conclusion is that the ponds in their current configuration (which includes relatively poor outlet passage for floodwaters) have managed to persist for at least the last several decades with no systematic changes in size/appearance resulting from sedimentation. This is likely a consequence of the shortened flow path that floodwaters can take across the bar, relative to the longer path around the bar at lower flows, resulting in locally steeper hydraulic gradients and thus a potentially enhanced ability to transport suspended sediment.



Project site, showing flow paths activated at 2-year (red), 5-year (orange), and 10-year (yellow) discharges. The flow path that is connected fully across the bar at 5-year and higher discharges which includes the path of the proposed channels at its downstream end. The side channel is roughly ½ the length of the main channel, suggesting that the gradients are likely twice as steep as in the main channel and are likely to have significant sediment-transport capacity under moderate and larger floods.

Sequential views of the primary pond at the project site in 1990 (left) and 2015 (right), showing no obvious effects of sedimentation in the intervening 25 years.

Persistence of the pond feature on the project site, observed over at least the last 25 years, is likely to be enhanced following project implementation, insofar as the excavation of the planned outlet channel should enhance downstream flow (and thus sediment transport) back out to the

Snohomish River. No quantitative modeling of this condition appears to be necessary on the basis of both the empirical history and the nature of the proposed actions.

Review panel comment:

Manual 18 requires that proposals for construction projects with budgets exceeding $250,000 must provide all Appendix D-2 preliminary design deliverables by the final application date. If the schedule for completing the preliminary design delivables under project No. 14-1404 cannot meet this deadline, then we recommend that this proposal for construction funding should be postponed until the next SRFB funding round. The construction proposal will be much stronger if the design grant deliverables are completed.

Snohomish Conservation District reply:

We will include all the Appendix D-2 design deliverables by the deadline.

Review panel comment:

The review panel recommends that the final application include (typically pulled from the Preliminary design report) a comparative table of the design alternatives considered, and the relative fish habitat benefits of each for ease of comparison. The final application (and preliminary design report) should include the reach scale map that was used at the site visit that describes the relationships between the nearby dikes and levees that were referenced in the application. Please confirm that the current design won't preclude any future larger-scale floodplain restoration if those levees are no longer functional. Please provide the R2 technical memo prepared for the County regarding the reach-scale geomorphic analysis that addresses the project reach.

Snohomish Conservation District reply:

The preliminary design report (attached in PRISM) includes a comparison of the design alternatives and the relative fish habitat benefits of each for comparison (pages 9-10). Alternatives 2 and 3 were determined to provide the most benefit to salmonid species. Alternative 2 in the report represents that partial funding option provided in this application and Alternative 3 represents the full-cost option that provides the most habitat benefit to salmonids.

The Reach Scale map is attached in PRISM.

The current design won't preclude future large scale floodplain restoration, in fact we have designed this project as a potential first phase of a larger project. We will include the R2 technical memo as an attachment is PRISM.

Review panel comment:

Please clarify how the project will provide for adult holding habitat for Chinook and coho as stated in the application. Is overwintering and winter flow refuge a more limiting habitat type than spring outmigrant or summer off-channel rearing habitat? It did not appear that temperature or water surface elevation dataloggers were deployed as part of the conceptual design – why not? What data is available for spring and summer temperatures in this reach of the Snohomish River?

Snohomish Conservation District reply:

Adult holding areas are in the main channel. This project will not affect or improve adult holding. Overwintering off channel habitat and winter flow refuge is a key limiting habitat type in this reach and increases in this habitat are very beneficial to juvenile salmonids. Temperature data loggers were installed summer 2014 but were confiscated by beavers so additional loggers have been installed summer 2015. Data will be collected in September and will be used to inform final design.

Review panel comment:

The review panel appreciates that the project proposal is being designed to consider other native fauna. This can result in a better balanced project if the needs of all species are taken into account and habitat for non-fish species can be incorporated if primary habitat objectives for the multiple species don't conflict. Balancing the interests of preserving the existing high value ecological function in the wetland versus providing access for salmonid rearing and refuge habitat is the key issue that will drive the project design and permitting. Depending on the permitting strategy (i.e. whether a nationwide or an individual Section 404 permit), the sponsor will need to consult with the Army Corps of Engineers and potentially also the Washington Department of Ecology for guidance on how to minimize and/or mitigate impacts to the wetland. Section 106 cultural resources review and critical areas review under Snohomish County Shorelines Management Act and Critical Areas Ordinance will also be necessary. These conversations with regulators need to happen at the preliminary design stage. While the Manual 18 rules do not require permit applications to be submitted by the final application date, we strongly recommend that the final proposal include documentation of at least preliminary discussions with the County, Corps and potentially Ecology on the wetland impact issues.

Snohomish Conservation District reply:

The Conservation District has had discussions with several tribes, Snohomish County Planning and Development Services, the U.S. Army Corps of Engineers, and DNR to discuss permitting requirements and design. We are consulting with them on how to minimize potential impacts to wetlands and/or regulated critical areas.

Response to Post-Application Comments

Please describe how you've responded to the review panel's post-application comments. *We recommend that you list each of the review panel's comments and questions and identify how you have responded. You also may use this space to respond directly to their comments.*