MEMORANDUM

Date: June 28, 2017
To: Chehalis Basin Board
From: Chrissy Bailey, Project Manager, Department of Ecology; and
Aquatic Species Restoration Plan (ASRP) Steering Committee
Re: Chehalis Basin Strategy: Potential Additions to the 2017-2019 ASRP Budget (July 7, 2017 Board meeting)

Introduction

This memorandum summarizes, for Board consideration, the Aquatic Species Restoration Plan (ASRP) Steering Committee's request for additional budget for development of the long-term restoration plan in the 2017-2019 biennium, and potential options for funding the Steering Committee's request.

In December 2016, the Governor's Chehalis Basin Work Group recommended a $60 million 2017-2019 budget appropriation for continued development and implementation of the Chehalis Basin Strategy (Attachment 1). The budget included $30.4 million in state funds to advance the long-term flood damage reduction and aquatic species restoration strategy, $9.6 million in state funds for design and construction of local flood damage reduction projects, and $20 million ($10 million state and $10 million federal funds) for construction of aquatic species habitat restoration projects. The Chehalis Basin Strategy Project Management (PM) Team, which includes state agency and consultant staff, developed and vetted the detailed elements that comprised the total budget.

Since December 2016, a number of potential budget additions have been identified. The PM Team discussed how realized cost savings from the 2015-2017 biennium might be reprioritized to address these potential needs; where tasks or efforts slated for 2017-2019 could begin immediately and be completed before the end of the 2015-2017 biennium, cost savings were shifted to carry out those efforts. This allowed addition of some of the potential budget additions/tasks to the work plan for the 2017-2019 biennium.

Additional Budget Items for Chehalis Basin Board Consideration

In the budget submitted by the Work Group in December 2016, it was assumed that the Aquatic Species Restoration Plan would be completed before the end of the current biennium (June 30, 2017). As discussed by the Work Group this past spring, the ASRP is not complete. Substantial technical and policy work is needed over most of the 2017-2019 biennium to develop the ASRP and to garner support from the tribes, state, and key stakeholders. The ASRP Steering Committee (Quinault Indian Nation, Confederated Tribes of the Chehalis Reservation, Washington Department of Fish and Wildlife, and ex-officio members) has identified additional staffing and technical needs for the development and review of the ASRP. In the first half of 2017, work on the ASRP has intensified with the development of a detailed work plan and schedule:

- Fall 2017 - preliminary draft ASRP
- Summer 2018 - full draft ASRP
- January 2019 - release public draft ASRP

During the development of this work plan, the Steering Committee identified the process, development, and staffing needs required to complete the ASRP, and clarified the work and associated budget needed in addition to those previously identified in the Work Group's 17-19 proposed budget. Two potential additional funding levels are shown in the table below. Both options contain funding for technical inputs, writing, review, and vetting. Currently, the Steering Committee has approved a pilot Ecological Corridor[1] effort (Option 1). If the Ecological Corridor delineation proves useful and cost-effective to the Steering Committee, they may elect to advance the Ecological Corridor effort to include additional sub-basins or the entire watershed (Option 2).

Option 1 - Completion of ASRP with only prototype ecological corridor delineation (mapped potential protection and restoration sites in the Skookumchuck sub-basin; prototype ecological corridor would provide template for future delineations in the rest of the watershed)	$1,106,674
Option 2 - Completion of ASRP with full ecological corridor delineation (mapped potential protection and restoration opportunities)	$2,237,674

Funding Considerations

Once final invoices are submitted by state agencies on 2015-2017 biennium contracts (likely by September 2017) there may be additional unexpended funds from the 15-17 biennium budget that could be used to fund some of the additional ASRP budget elements. However, because of the time-sensitive nature of the ASRP work, a funding decision must be considered in advance of September in order for on-the-ground work to progress this biennium.

A number of options appear possible for changes to the existing budget that could be made individually or in combination:

[1] Details on the Ecological Corridor Descriptions are available in Attachment 2, a memo developed by Natural Systems Design (NSD) titled *Addendum to Draft ASRP Ecological Prototype Description*.

- Reduce funds for advancement of certain elements of the long-term strategy. The current 2017-2019 budget includes approximately $30.4 million for these purposes.

- Reduce funds for construction of priority aquatic species habitat restoration projects. The current 2017-2019 budget includes approximately $8.2 million in state funds for habitat project implementation/construction (the remaining $1.8 million is for staff support and permitting).

- Reduce funds for construction of local flood damage reduction projects (Priority #1 on Attachment 3). The current 2017-2019 budget includes approximately $9.1 million for project implementation/ construction.

- Prioritize reappropriated funds from the 2015-2017 biennium to fill any gaps resulting from choosing one of the options above, once reappropriated funds are available.

ASRP Steering Committee Perspectives

The ASRP Steering Committee recognizes that in order to fund the additional costs, some existing 2017-2019 budget elements may need to be removed or reduced. The ASRP Steering Committee also fully understands that the use of remaining unexpended funds from the 2015-2017 is a Board decision.

While the Steering Committee is preparing for $20 million for 17-19 on-the-ground habitat restoration, until federal funding is secured the effective on-the-ground habitat project funding for 17-19 will be $10 million (less staff costs). The ASRP Steering Committee recognizes the goal of the Work Group has been a balance between long-term and on-the-ground projects, and without federal funding the 17-19 budget is weighted towards long-term products. Therefore, with recognition of the Board's full responsibility for this decision, the ASRP Steering Committee respectfully asks the Board to keep the state's 17-19 commitment to on-the-ground restoration at its current level or higher.

ATTACHMENT 1

Governor's Chehalis Basin Work Group

Chehalis Basin Strategy 2017-2019 Biennium Budget Recommendations to the Governor

This document summarizes the Governor's Chehalis Basin Work Group's 2017-2019 biennium budget recommendations for continued development and implementation of the Chehalis Basin Strategy.

The Governor's Chehalis Basin Work Group was charged by Governor Inslee to develop budget recommendations for continuation of the Chehalis Basin Strategy to reduce flood damage and restore aquatic species habitat. The Work Group members are:

- Don Secena – Chairman, Confederated Tribes of the Chehalis Reservation
- Larry Goodell, Jr. – Chairman Off-Reservation River Committee and Treaty Habitat Policy Spokesperson, Quinault Indian Nation
- J. Vander Stoep - private attorney and Chehalis Flood Authority Pe Ell Alternate
- Jay Gordon - farmer in lower Chehalis Basin and Washington Dairy Federation Executive Director
- Karen Valenzuela – former Thurston County Commissioner and former Chehalis Flood Authority Vice Chair
- Rob Duff - Policy Advisor to Governor Inslee
- Steve Malloch – consultant and environmental community member
- Vickie Raines – Grays Harbor County Commissioner and Chehalis Flood Authority Chair

In developing their recommendations to the Governor for his proposed 2017-2019 budget, the Work Group considered the comments received on the draft Chehalis Basin Strategy Programmatic Environmental Impact Statement (PEIS) which was developed by the Washington State Department of Ecology. At this point in time, the Work Group is not ready to recommend their preferred long-term strategy but recommend continued work in the next biennium to evaluate Alternatives 1 and 4 (see attached Executive Summary for the draft PEIS) and implement priority projects to restore aquatic species habitat and reduce flood damage. The recommendations are categorized by major budget elements, which include all of the actions being evaluated in the draft PEIS, except for I-5 walls and levees. In the first half of 2017 – before the Work Group sunsets and the new Office of Chehalis Basin Board is established – the Work Group will develop additional recommendations for a long-term strategy to inform the final PEIS.

The Work Group recommends a $60 million budget appropriation, which includes $30.4 million in state funds to advance the long-term strategy for an integrated approach to reduce flood damage and restore aquatic species habitat, $9.6 million in state funds for design and construction of local flood damage reduction projects, and $20 million ($10 million state and $10 million federal funds) to be used for construction of aquatic species habitat restoration projects.

Budget Recommendation Elements

Dam

The Work Group, with the exception of Don Secena representing the Chehalis Tribe, recommends proceeding to a project-level environmental review for the dams being considered on the mainstem Chehalis River to address questions raised during public review of the draft PEIS and determine the feasibility to mitigate the impacts of the dam. The Quinault Indian Nation (QIN) opposes the dam(s) as proposed in the draft PEIS; however, the QIN will not oppose funding that shall serve to address the questions and concerns raised by QIN in the *Quinault Indian Nation Comments on Chehalis Basin Strategy Draft Programmatic Environmental Impact Statement* letter, dated November 14th, 2016. In order to analyze the range of issues raised in the PEIS process, additional studies and analyses will include, but are not limited to, continued refinement of hydraulic and hydrologic modeling; geotechnical analyses; impacts to salmon and other aquatic species, cultural resources, wetlands, and water quality/quantity modeling and monitoring; and, refinement of economic evaluation of costs and benefits, including external review.

This work includes applying for initial permits to start a formal State Environmental Policy Act (SEPA) and National Environmental Policy Act (NEPA) project-level environmental review. A draft project-level SEPA and NEPA EIS is anticipated to be completed during the 2017-2019 biennium, but not a final SEPA and NEPA EIS.

Restorative Flood Protection

The Work Group recommends proceeding with detailed modeling and pre-permit design for one priority sub-basin in order to conduct project level environmental review and to potentially implement in the 2019-2021 biennium. The goal in the 2017-2019 biennium is to determine if there are willing landowners and to establish proof of concept in a priority area, to understand if the approach is feasible to broader treatment areas.

This work includes studies and analyses such as two-dimensional hydraulic modeling of the entire RFP treatment area (upper Chehalis watershed above Newaukum, Mainstem, and South Fork Chehalis River); refined analysis of impacts to landowners and the need for floodproofing/relocation; refinement of economic evaluation of costs and benefits, including external review; and, policy analysis of the regulatory changes that may be required for project implementation.

Aquatic Species Habitat Restoration Projects

The Work Group recommends construction of priority aquatic species habitat restoration projects, including barrier removal, early action reach restoration projects (such as floodplain and channel restoration and side channel reconnections), and acquisition of critical habitats.

Through leadership and management of the Aquatic Species Restoration Plan Steering Committee (Quinault Indian Nation, Chehalis Tribe and the Washington Department of Fish and Wildlife), this work includes development of a scientific and transparent process for selecting projects. During the 2017-2019 biennium, the Work Group recommends restoration projects that provide as immediate a benefit to fish and other aquatic species should be prioritized. In addition, Chehalis Basin Strategy funds should be used for the highest priority fish passage barrier removal (culvert) projects that are not already being addressed through the Department of Natural Resources (DNR) Family Forest Fish Passage Program, Fish Barrier Removal Board, or the Washington State Department of Transportation "culvert case."

Refinement of Aquatic Species Restoration Plan

Historically, the Chehalis Basin has been one of the least studied basins in the state of Washington despite its important salmon runs and diversity of aquatic species. Comprehensive data collection on salmon and other species was initiated four years ago. The Work Group recommends continued data collection, research, and analyses for salmonids and other aquatic species in order to develop a more robust and empirically based understanding of the habitat and aquatic species in the Chehalis Basin, and to develop the next version of the basin-wide Aquatic Species Restoration Plan. This work includes various aquatic species research tasks (e.g., off-channel habitat surveys, native fish density, genetic diversity, abundance and distribution of chum salmon); flow and water quality modeling; refinement of the Ecosystem Diagnosis and Treatment, National Oceanic and Atmospheric Administration Watershed Analysis, and Washington Department of Fish and Wildlife amphibian models; hydraulic modeling to evaluate restoration scenarios; and, initiation of a monitoring and adaptive management program.

Land Use Management/Floodproofing

The Work Group recommends continued work with local governments to ensure that, through a series of land use management actions, new floodplain development does not impact floodplain function or cause additional harm for residents and structures that are already located in the floodplain. This work includes developing a transparent process with local planners to ensure that development in the floodplain will not be encouraged if a dam is pursued, and encouraging local jurisdictions to develop floodproofing strategies similar to recent planning efforts by the City of Centralia and Thurston County. Funding will be provided to initiate a basin-wide floodproofing program with an early focus likely in Centralia and Thurston County, for elevation, acquisition, and other structure retrofit projects. In anticipation of potential adverse impacts of climate change, the Work Group acknowledges that this work to protect local communities and develop standards to safeguard current investments is necessary.

The Work Group also recommends additional funding for DNR to conduct an independent study as part of the Forest Practices Board adaptive management program to assess the impact of forest practices on hydrology, including potential impacts on high and low flows and aquatic species habitat.

Local Flood Projects

The Work Group recommends funding the first tier of local flood damage reduction projects developed by the Chehalis River Basin Flood Authority. The prioritized project list includes the China Creek flood and habitat mitigation project, Wynoochee River wastewater treatment plant protection, and Thurston County Independence Road flood study. Local flood projects need to be designed in a manner that does not create harm to aquatic species. The QIN is concerned that projects like the Wynoochee River wastewater treatment plant are addressing an urgent problem but not in a comprehensive, systematic and ecologically friendly manner.

Aberdeen/Hoquiam Levee

At this time the QIN can neither agree or disagree with the Aberdeen/Hoquiam North Shore Levee Project. The Work Group, with the exception of the QIN, recommends supporting the next level of design and initial permit applications to evaluate the environmental impacts and determine the feasibility for the Aberdeen/Hoquiam North Shore Levee project.

Overall Participation and Public Outreach

The Work Group supports funding for agency and tribal staffing necessary for overall project management, facilitation of technical and policy meetings and workshops, and technical review of critical documents. This includes staffing for the new Office of Chehalis Basin.

This work also includes implementing a public involvement and outreach strategy for all the actions and activities within the Chehalis Basin Strategy. The involvement of the public, stakeholders, and governments is vital to developing and implementing the Chehalis Basin Strategy. The number of people and organizations involved in developing and implementing the Chehalis Basin Strategy was significantly increased in the last two years. The Work Group recommends continuing to expand the number of people and organizations involved in the next biennium including a specific focus to engage young people and landowners.

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Addendum to Draft ASRP Ecological Prototype Description

On May 31, 2017 the ASRP Steering Committee reviewed the Draft ASRP Ecological Corridor Prototype Description that included three options to define and delineate an Ecological Corridor (EC) in the Chehalis Basin. The Steering Committee agreed to proceed with the sub-basin option (2), but requested additional cost estimates to begin with other ASRP priority sub-basins - the South Fork Chehalis River, Skookumchuck River, Satsop River, and Wynoochee River.

The base cost for delineating the Ecological Corridor in the Newaukum River channel network was $190,000. These costs for the Newaukum River subbasin had assumed efficiencies in combining work with the area previously funded for the Restorative Flood Protection (RFP) strategy. Selecting a different sub-basin would add costs for GIS analysis and mapping tasks that have already been completed for the RFP in the Newaukum. Additional costs for other sub-basins include LiDAR availability, data compilation, base map development, field reconnaissance required in areas not assessed as part of the PEIS, and greater channel length in one sub-basin. We assume this analysis would include the study reaches currently part of the EDT model.

Further consideration needs to account for available base data in the form of LiDAR coverage. Given this need, the Satsop River subbasin is not suitable for selection of the EC prototype as only a very small fraction of the channel network has been mapped with LiDAR. All other subbasins have some gaps in LiDAR coverage and the EC prototype would not include segments with unconfined alluvial valleys that have not been mapped with LiDAR.

A comparison of sub-basin attributes and estimated cost to develop the EC prototype is shown in the table below. The Newaukum sub-basin would be the most cost efficient to analyze and would provide opportunity to compare and contrast the Ecological Corridor approach with the RFP strategy. The Skookumchuck River sub-basin would be the next lowest cost given the relative reduction in channel length needed to analyze for the EC.

	Drainage Area (sq mi)	Channel Length (mi) *	Estimated Cost	Comment
Newaukum River	157	152	$190,000	Base cost from 5/19/17 document
South Fork Chehalis	125	142	$275,000	Similar channel length, but lose efficiency of concurrent work with RFP
Skookumchuck River	123	94	$225,000	Reduced channel length offset by additional data needs (not evaluated with RFP reaches in PEIS).
Wynoochee River	196	139	$310,000	Similar channel length to Newaukum but lost efficiencies by not combining work with RFP tasks and additional data needs (not evaluated with RFP reaches in PEIS).
Satsop River	300	221	N/A	Not suitable for prototype given lack of base data (LiDAR)

* Channel length in EDT study reaches. Total channel length of drainage network to be determined based on technical recommendations and approval of ASRP Steering Committee.

DRAFT ASRP Ecological Corridor Description

Tim Abbe, Larry Lestelle, Gary Morishima, Jen O'Neal, Scott Katz
5/19/17

Purpose – Facilitate Deliberation by the ASRP Steering Committee:

(1) Describe the concept of delineating an Ecological Corridor (EC) for the Chehalis ASRP, along with background information regarding the principles, foundations, and methods underlying ECs.

(2) Describe methodology for delineating the EC

(3) Explain the importance of delineating the EC to provide a structural framework for identifying, prioritizing, and evaluating potential benefits of restoration measures within the Chehalis Basin and describe how the EC concept would be integrated with the habitat modeling efforts of EDT and the NOAA Models

(4) Opportunities for integrating the RFP and EC concepts

(5) Provide preliminary cost estimates for EC delineation

What is an Ecological Corridor (EC) for the Chehalis Basin?

An EC is the geographic area within the Chehalis Basin that provides the minimum space necessary to sustain hydrologic and geomorphic processes to meet the goals of the ASRP given the range of natural processes such as channel migration, flow regime (e.g., high flows capable for sediment transport, bank erosion and floodplain inundation, in-stream wood structure)

The concept of ECs and restoration of degraded habitats has been explored for decades worldwide[1] and in the State of Washington.[2] Basic information on ECs is readily available via the internet, for example:

Q&A about corridors http://conservationcorridor.org/the-science-of-corridors/

Special Issue of Ecological Restoration http://er.uwpress.org/content/30/4.toc

http://www.sicirec.org/definitions/corridors

https://www.rivercare.org/what-are-wild-link-corridors

http://conservationcorridor.org/2016/04/designing-ecological-corridors-prior-to-infrastructure-development-in-romania/

The EC is based on the fact that a sufficient amount of space in specific geographic locations is needed to accommodate normative (aka natural) processes to ensure critical habitats form and are sustained over time, including future climate scenarios. The "normative" concept is particularly important in flow-

[1] A recent synthesis of methods to evaluate the effectiveness of ECs and the Pros and Cons of their use can be found at: http://www.set-revue.fr/sites/default/files/articles/pdf/article_07.pdf.

[2] Bolton, S. & J. Shellberg. 2001. Ecological Issues in Floodplains and Riparian Corridors. Report to Washington Department of Fish and Wildlife Washington Department of Ecology Washington Department of Transportation. University of Washington. Center for Streamside Studies, July 11, 2001. Beechie, T., Sear, D., Olden, J., Pess, G., Buffington J., Moir, H., Roni, P., and M. Pollock. 2010. Process-based Principles for Restoring River Ecosystems. Bioscience 60(3):209-222

altered rivers such as those with large dams (e.g., Poff et al. 1997[3], Fuerstenberg et al. 2003[4]) and has been used for salmon recovery planning in the Columbia River system (Williams 2006[5]; Liss et al. 2006[6]) and many other regions (e.g., King County, Trinity River). Numerous studies have shown that despite historic impacts, it is possible to restore geomorphic and ecological processes to some level of a normative state. The EC concept can also be employed to promote environmental resilience of environmental restoration efforts to impacts of climate change[7]. Thus, it is possible to develop restoration strategies balanced with prudent land use, that can result in an ecosystem in which both natural and human-developed elements exist in a balance, allowing aquatic species to thrive and many of society's present uses of the watershed to continue, although not without modification (Liss et al. 2006).

Examples of important EC processes in the Pacific Northwest include maintenance of the range of natural flows and sediment supply that sustain aquatic habitat, input of functional "key" wood material and formation of logjams, bar & island formation, channel migration, bed & floodplain aggradation, creation of off channel features such as side channels, oxbow lakes, and floodplain wetlands, and the development of mature riparian forests.

> *Delineation of the EC will provide the structural framework for short and long-term restoration of ecologically functional habitat areas needed to sustain aquatic species and prioritize land acquisition and easements. It will define the area of the valley bottom where restoration actions such as wood placement, grading, barrier removal and reforestation, would be needed to restore ecological function at the level to achieve and sustain the goals of the ASRP within a reasonable time frame. These actions will help avoid deterioration and accelerate the recovery of natural processes within the Chehalis Basin*

The movement of water, sediment and organic matter within a drainage network occurs from the headwaters to the ocean. The continuous spatial context also applies to native

[3] Poff, N., Allan, J., Bain M., Karr J., Pretegaard, K., Richter, B., Sparks, R, and J. Stromberg. 1997. The Natural Flow Regime: A Paradigm for River Conservation and Restoration. Bioscience 47(11):768-784.

[4] Fuerstenberg, R., 2003. Normative Flow Studies Project Conceptual Framework – Provisional Final Draft. King County Department of Natural Resources and Parks, Feb 2003. See also Parametix. 2003. Literature Review: Effects of Flow Alteration on Aquatic Ecosystems: Normative Flow Project. King County Department of Natural Resources and Parks. Jul 2003.

[5] Williams, R. 2006. Restoring Salmon to the Columbia River. Return to the River. Elsevier Academic Press, Burlington, MA. See also: Williams, R., Stanford, J., Lichatowich, J., Liss, W, Coutant, C., McConnaha, W., Whitney, R., Mundy, P. Bisson, P. and M. Powell. 2006. Strategies for Restoration in the Columbia River Basin. Return to the River Ch 13. Return to the River. Elsevier Academic Press, Burlington, MA. Rieman, B., Smith, C., Naiman, R., Ruggerone, G., Wood, C., Huntly, N,, Merrill, E., Alldredge, J., Bisson, P., Congleton, J., Fausch,, K., Levings, C., Pearcy, W., Scarnecchia, D., and P. Smouse. 2015. A Comprehensive Approach for Habitat Restoration in the Columbia Basin. Fisheries 40(3): 124-135.

[6] Liss, W., Stanford, J, Lichatowich, J., Williams, R., Coutant, C., Mundy, P., and R. Whitney. 2006. Developing a New Conceptual Foundation for Salmon Conservation. Return to the River Ch 3. Elsevier Academic Press, Burlington, MA.

[7] Timpane-Padgham BL, Beechie, T., and T. Klinger. 2017. A Systematic Review of Ecological Attributes that Confer Resilience to Climate Change in Environmental restoration. PLoS ONE 12(3): eo172812. https://doi.org/10.1371/journal.pone.0173812; Justice, C., White, S., McCullough, D., Graves, D., and M. Blanchard. 2017. Can Stream and Riparian Restoration Offset Climate change Impacts to Salmon Populaion, Journal of Environmental Management 188:212-227; Beechie, T., Imaki, H., Greene, J., Wade, A., Wu, H., Pess, G., Roni, P., Kimball, J., Stanford, J., Kiffney, P. and N. Mantua. 2012. Restoring Salmon Habitat for a Changing Climate. Published online in Wiley Online Library. DOI: 10/10092/rra.2590.

anadromous fish species and the movement of other aquatic and terrestrial wildlife within the watershed. The Governor's Workgroup has stated that the productivity of the Chehalis Basin has been reduced by over 80% for some species. The abundance and productivity of aquatic species depends upon ecological processes and functions within fluvial corridors (channels & floodplains) and riparian areas. As a baseline, it is essential to define the longitudinal and lateral extent of distinct habitat vital to life histories of aquatic species that historically existed throughout the Chehalis basin river system. Since ecological modeling being conducted for the ASRP focuses on salmon, the methodology to delineate the EC will focus on identifying the locations where habitats critical to salmonid life history currently are or once existed prior to human disturbance.

> *The delineation will provide a description of how different portions of the aquatic network have been altered over time and how they could be restored or reconnected. Importantly, the EC will describe the unique geomorphic habitats that once occurred in each portion of the network as well as what types currently exist and which have either been disconnected or eliminated. The EC delineation will also describe the temporal and spatial scale of geomorphic processes throughout the network and estimate the space needed to ensure the natural range of habitat types will be sustained into the future. This delineation is needed to identify critical restoration opportunities that would be needed to maintain this minimum functional corridor.*

Naturally occurring habitat types differ spatially and temporally within the EC as the river moves and changes – what is important is that within the EC there will be the *opportunity* for each habitat type to naturally form by allowing the dynamic river system to maintain itself. Polygons within the EC will be used in both the EDT and NOAA models to see if the area under different restoration scenarios and climate change scenarios will be sufficient to attain ASRP goals, and where it could be reduced or expanded. By explicitly delineating specific geographic areas and describing specific restorative actions needed, the EC will also provide a quantitative means of prioritizing geographic areas and ***on-the-ground*** restorative actions, as well as guidelines for evaluating potential benefits and impacts of those actions and addressing existing human constraints. For example, the EC may provide downstream flood reduction benefits but have local flood impacts.

The importance of the EC to the ASRP

The EC will establish the geographic foundation for development and implementation of the ASRP, both in providing a scientifically credible delineation of areas needed to sustain the range of historic habitats and accommodate the processes necessary to form and sustain these habitats. In summary, the EC will:

1. Delineate the geographic area needed to achieve ASRP goals
2. Identify constraints and barriers effecting ASRP implementation
3. Provide a spatial template for prioritizing the implementation of ASRP projects (i.e., land easements, acquisitions, and restoration actions.
4. Provide a geographic template identifying historic habitat impacts, the types of restoration actions that may be needed, how restoration actions may benefit or impact local communities, and what types of actions could be considered to mitigate impacts.

<u>Relationship to Habitat Modeling</u>. Delineation is an iterative process that begins by describing the unique geomorphic and ecologic habitats (those critical to salmon life histories and other key aquatic species the ASRP will focus on) found within any given area of the channel network. Mapping of habitat types within the EC will provide complete spatial reconstruction of historic conditions (such as

anabranching channels) that is not being done by NOAA. After being reviewed and vetted by an expert panel, the reconstruction will provide the most complete estimate of historic conditions that can serve as a foundation of both the EDT and NOAA ecological models.

Once a historic corridor is delineated, the geomorphic processes that form and sustain habitat types are defined. Based on the spatial scale of habitat types, the key factors influencing habitat formation (e.g., type of riparian vegetation), and the time periods over which habitats are formed, a minimum area is delineated that is necessary to accommodate the range of habitats once found within each portion of the channel network. The resulting EC polygon can then be directly entered into the EDT and NOAA models as a way of scaling a potential restoration effort to help identify the magnitude of work needed to achieve the goals of the ASRP. The actions needed to restore habitat in any polygon will need to be identified as related to return to historic conditions. The level of effort for restoration needed will be dependent upon the existing level of habitat and what level is considered adequate to meet the goals (30%, 50%, etc. of historic). Model output would then guide refinement of the EC, both the total area needed and how restoration areas are prioritized. Results may lead to either reductions or expansions of the final EC, as well as the level of action needed in different areas.

The EC thus provides a road map for helping to assess the scale and extent of restoration needed to achieve the goals of the ASRP before incurring the expense of implementing projects on the ground. Of course, the ASRP should include a clear plan to monitor actions and habitat outcomes as part of adaptive management and to calibrate the model output to actual physical and biological responses. These data could then be used to improve the accuracy of the models to continue the iterative process mentioned above.

Delineation of the EC for the Chehalis Basin

The basic methodology and products associated with delineation of EC are described below. Existing databases and mapping will be used to the full extent possible. LiDAR will be the foundation of EC mapping. In portions of the watershed lacking LiDAR, EC mapping will be done using existing topographic data, focused field mapping and extrapolating mapping of analogous areas where LiDAR is available.

1. Spatial reconstruction of historic habitat conditions building on NOAA database, topography/LiDAR and relative elevation mapping (REM), surficial geology, historic aerial photos, state channel type mapping, and hydraulic models (where available). *This builds upon and does not replicate NOAA work which is not doing a reconstruction of historic channel patterns, only compiling available historic data*.
    a. There is overlap between this task and those included in the RFP conceptual design. Efficiencies can be gained by utilizing data and results analyzed in this task for both the RFP and ASRP in the RFP sub-basins.
2. Description of the type and locations of existing habitat using available information (NOAA, DFW), REM, and recent aerial photographs.
    a. Example habitats could include:
        i. Off-channel rearing ponds and channels (subdivided by formative processes)
        ii. Pools (subdivided by those with % without cover, formative processes)
        iii. Spawning gravels
        iv. Side channels (subdivided by perennial, ephemeral)

v. Riparian vegetation (subdivided by types, age class)

vi. In-stream wood (subdivided by relative size and function)

b. There is overlap between this task and those included in the RFP conceptual design. Efficiencies can be gained by utilizing data and results analyzed in this task for both the RFP and ASRP in the RFP sub-basins.

3. Description of channel changes contributing to habitat loss (e.g., channel incision disconnecting floodplains, channel straightening, confinement of meander zones, loss of anabranching) effecting any given area of the network. This has been partially done for RFP sub-basins but not larger watershed. Existing data from PEIS, NOAA, and other sources will be used to extent possible.

4. Description of type and location of direct and indirect human impacts to degradation of habitat and ecologic processes (e.g., levees, bridge constrictions, bank protection, floodplain development, riparian clearing). Existing data from PEIS, NOAA, and other sources will be used to extent possible.

   a. There is overlap between this task and those included in the RFP conceptual design. Efficiencies can be gained by utilizing data and results analyzed in this task for both the RFP and ASRP in the RFP sub-basins.

5. Description of geomorphic processes unique to each portion of channel network and the respective spatial and temporal scales necessary to create and sustain aquatic habitat.

   a. There is overlap between this task and those included in the RFP conceptual design. Efficiencies can be gained by utilizing data and results analyzed in this task for both the RFP and ASRP in the RFP sub-basins.

6. Delineation of the minimum ecological corridor necessary to achieve restoration goals will have an across-valley and down-valley (i.e., longitudinal) component. The across-valley width required varies with the desired habitat type and restoration goals, so spatial reconstruction from the previous steps will be used in order to identify historical habitat boundaries. The starting assumption is that the EC will have sufficient space to accommodate all of the unique aquatic habitats (life history habitats) that once existed. In particular, the following preliminary methodology is envisioned:

   - Based on spatial reconstruction of historical habitat conditions (step 1) delineate historical zones as the outer boundaries of: (1) active channel migration, (2) active and ephemeral channel network, (3) hydrologically connected perennial and ephemeral wetlands, and (4) riparian forest. These zones would be expected to form outwardly-expanding boundaries from the current channel.
   - From historical zones and current conditions, delineate longitudinal bounds for reaches with similar characteristics. Along each reach, estimate the historical aquatic habitat abundance of: main channels, side channels, backwater channels (disconnected on one side), floodplain water bodies (e.g., oxbow lakes), and wetlands.
   - Convene a workshop of interdisciplinary experts to assess overlap of historic aquatic habitat and geomorphic features and adjust estimates as indicated.
   - Based on dominant historic habitat type, delineated historical zones, and the restoration potential, estimate the cross-valley corridor width required to restore the habitat type. For example, a reach dominated by main channel habitat requires a corridor for active channel

migration, whereas a reach dominated by wetlands requires a wider corridor. Similarly, if a restoration potential of 60% is assumed for EDT modeling, then 60% of the ideal corridor would be delineated.

- Identify the minimum riparian corridor based on desired habitat type and function of the riparian zone. For example, a reach dominated by main channel habitat requires a smaller riparian corridor to provide shade, whereas a reach dominated by side channels requires active wood recruitment processes.
- Overlay delineation of existing habitat (from step 2) and identify the difference between existing habitat and historical zones.
- Overlay constraints (identified in steps 3 and 4) that drive the differences, and delineate polygons for the spatial extent of impairments, including channel incision, channel modification, floodplain development, etc.
- Identify reaches where constraints could feasibly be removed in order to restore historic habitat. Based on the historic assessment, desired habitat types and opportunity to remove constraints, delineate an ecological corridor. This corridor would then be used as input into the EDT model for assessment of feasible population recovery. Defining a "minimum" corridor is expected to be an iterative process that combines physical possibility (from topographic and historical analysis), current practicality and constraints, and population recovery targets.

Merely plugging polygons into the habitat models will not automatically produce an actionable plan. The question that needs to be answered is the level of restoration within the polygons contained in the EC, i.e., full or partial and to what level. Modeling results will be used to evaluate the quantity of quality habitat needed, and thus allow refinement of the EC extent. For example, if abandoned channel meanders form rearing habitat, there must be enough space for channel migration so that meanders can form and be abandoned. Likewise, if bank erosion is needed for wood recruitment and side channel formation, there must be sufficient space for some channel migration. Since riparian conditions directly influence the rates of channel migration, existing conditions will influence how much space or direct actions are needed to achieve goals for restoring mature riparian vegetation. In areas that have experienced channel incision, the EC delineation will identify actions to reverse incision and floodplain areas that could be reconnected – this will be particularly important for hundreds of miles of tributary, headwater channels.

a. There is overlap between this task and those included in the RFP conceptual design. Efficiencies can be gained by utilizing data and results analyzed in this task for both the RFP and ASRP in the RFP sub-basins.

7. Description of actions needed to restore and sustain geomorphic processes that are critical to creating habitat necessary for aquatic species targeted by ASRP Steering Committee.

8. Ecological modeling iterations to refine EC. The implications to formative processes must be considered in any refinements.

9. Prioritization for EC land acquisitions, easements, and projects (e.g., removal of lateral and longitudinal barriers and constraints, channel and floodplain restoration, groundwater reconnection).

10. Description of potential impacts of restorative actions on areas outside (perimeter) of EC, such as increases in water levels and expansion of active channel migration zone that may be needed

to supplement the EC such that the goals of the ASRP can be met through an iterative process (via predictions of models as compared to plan objectives and targets).

11. Development of guidelines for evaluating individual ASRP projects.

Opportunities for Integrating RFP and EC concepts.

Both the Restorative Flood Protection (RFP) and ASRP concepts involve delineation of corridors, but for different purposes. For the RFP, a corridor refers to the idea that flood damage can be minimized by moving people, infrastructure, and property out of harm's way of natural riverine processes. Poff et al. (1997) stated: "…it is clear that, whenever possible, the natural river system should be allowed to repair and maintain itself. This approach is likely to be the most successful and the least expensive way to restore and maintain the ecological integrity of (altered) rivers (Stanford et al. 1996[8])." The most effective mix of human-aided and natural recovery methods will vary with the river.

In contrast, an EC delineates the area needed to deliver significant, sustainable ecological processes. Although both the RFP and EC tasks work to effectively delineate "work areas" within valley bottoms and are founded on geomorphic and ecological principles, the two concepts seek to achieve inherently different goals (Table 1). For both the RFP and ASRP corridors, actionable restoration measures must be undertaken through a process in which the degree to which ecological restoration can occur and be sustained within a certain time period must be "balanced" against the social feasibility of implementing restorative measures on the landscape.

Table 1: Comparison between the Restorative Flood Protection (RFP) and Ecological Corridor (EC) concepts for the Chehalis River Basin, WA.

	Restorative Flood Protection	vs	Ecological Corridor
Focus	Flood focused		Aquatic species focused
Where	Middle upper watershed (~140 miles of river) Broad floodplains Channel slope <1%		Entire Chehalis Basin (~3300 miles of river) Diverse floodplains Diverse channels
Area	<u>Maximum</u> area to slow and store floodwaters		<u>Minimum</u> area needed to support self-sustaining aquatic ecological processes.
What	Rough channel and floodplain conditions (lots of in-channel wood and shrubs on floodplain)		Diverse channel conditions/locations
Model	Hydraulic model		EDT model & NOAA model

Although the RFP and EC concepts differ, the geographic areas would be expected to overlap to some degree. Efficiency can be gained by integrating efforts to delineate corridors for the RFP and ASRP processes. Hydrologic modeling for the RFP process will delineate channels for focusing efforts to reduce damage from flooding and efforts to quantify costs will help establish budgetary needs. Needs for EC and habitat modeling efforts could then be overlaid onto this RFP-based information to identify

[8] Stanford, J., Ward, J., Liss, W., Frissell, C., Williams, R., Lichatowich, J., and C. Coutant. 1996. A General Protocol for Restoration of Regulated Rivers. Regulated Rivers. Research and Management 12:391-413.

needs for connectivity and other types of habitats for restoration of aquatic species. Taken together, the RFP and EC information would establish a scientific and social basis for identifying and prioritizing opportunities for both reducing flood-related damage and restoring habits for restoration of aquatic species.

Estimated Costs for Delineating the EC

Delineation of the EC for the Chehalis Basin could be pursued in a variety of ways, depending on Steering Committee priorities and budgetary considerations. Three alternatives are provided for discussion.

Preferred - Delineation for the entire Chehalis Basin: Preliminary estimated $1.2 million. A detailed cost estimate is under development.

Mid-Range - Prototype for Newaukum System, including integration of RFP and ASRP corridors: Preliminary estimate $190 thousand. Details TBD,

Minimal - Prototype South Fork Newaukum Basin: Preliminary estimate $95 thousand. Rough draft description follows.

A "proof of concept" scope of work for the current biennium ending in June 2017 would be undertaken to delineate an EC for the South Fork of the Newaukum River and to develop and document methodology for EC delineation. This work would be conducted over the summer of 2017 and completed in the Fall of 2017.

Develop detailed EC delineation methodology	$ 5,000
Geomorphic delineations	
Ecologic outcomes? delineations (with Tribes and modelers)	
Description and methodology of integration of EC into ecologic models	$ 15,000*
Meetings (3) with ecological modelers	
Description of goals and products	
Methodology refinement**	
Refinement of EC description	$ 5,000
Preliminary EC delineation for South Fork Newaukum	$ 60,000
Reporting to the ASRP Steering Committee	$ 10,000
TOTAL	**$ 95,000**

*budget will need to be increased if funding is needed for ICF, NOAA, state or other participants
**this scope doesn't not include EDT or NOAA simulations of example EC

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Sponsor	Proposal	Cost	Description	Note
Priority #1 **Proposals that identify solutions, continue/complete previously funded efforts, and/or address emergencies.**				
Aberdeen	North Shore Levee	$ 1,500,000	Cost for final design, permitting, right-of-way acquisition plan and appraisals (follows currently funded 60% design CLOMR phase).	* **Continues/completes** project previously funded.
Centralia	China Creek Flood and Habitat Mitigation Project.pdf	$ 2,500,000	Estimated cost for Phase 2 construction (follows currently funded hydraulic modeling, design, permitting and baseline fish monitoring phase).	* **Continues/completes** project previously funded.
Montesano	Wynoochee River WWTP Protection Project.pdf	$ 5,000,000	2017-19 project is to protect WWTP from Wynoochee river by installing a hardened structure (such as an excavated riprap revetment or sheet pile wall) in the overbank to deflect oncoming river.	* **Continues/completes** project previously funded. * Addresses substantial flood damage threat to critical public infrastructure. * Have funded (2015-17) evaluation of relic channel reopening as important element of longer-term solution.
Thurston County	Flood Study.pdf	$ 100,000	Cost to evaluate hydrologic flows, identify alternatives to alleviate chronic flooding on Independence Road, select solution and identify costs and funding need.	* **Study** to identify preferred solution(s) to chronic flooding issue/area.
WA Coast Sustainable Salmon Foundation	HWS Pilot.pdf	$ 45,914	Cost to extend Habitat Work Schedule beyond salmon recovery to a common, visible, single-source tool for coordinated capital investment planning/funding in the Basin (e.g., landowner, CDs, WDFW, Flood Authority, Office of Chehalis Basin).	* **Continues/completes** project previously funded. * Part I ($85,000) funded 2015-17. Part II ($45,914) is completion funding.
		$ 9,145,914		

Priority #2 **Proposals that are placeholders, contingent on favorable identification and evaluation in a final 2015-17 study.**				
Chehalis	Rice Road Culvert Replacement.pdf	$ 2,862,061	Estimated cost to replace undersized culvert and elevate portion of Rice Road to address Dillenbaugh flooding issue and ensure emergency access.	* **Placeholder** project assuming forthcoming draft and final 2015-17 Dillenbaugh Creek Culvert Assessment study identifies project as a relevant and preferred solution without adverse impacts.

Chehalis	WWTP Demo, Floodplain Storage.pdf	$	2,810,880	Four-phase project to: 1. demo/remove wastewater facility. 2. create 10-acres wetland habitat. 3. monitor wetland/flood storage. 4. install recreational amenities.	* **Placeholder** project assuming flood storage benefits being modelled 2015-17 are positive. * Demo costs may decrease through reuse/repurpose of waste concrete.
Napavine	Kirkland Road Drainage Improvements Construction.pdf	$	595,000	Estimated cost to upgrade drainage infrastructure to better convey Newaukum flood waters from east of I-5 to west of I-5.	* **Placeholder** project assuming forthcoming draft and final 2015-17 Kirkland Road study identifies project as a relevant and preferred solution without adverse impacts.
Oakville	Oakville 17-19.pdf	$	1,480,900	Estimated cost to implement Oakville culvert drainage improvements.	* **Placeholder** project assuming forthcoming draft and final 2015-17 Oakville Flood Relief study identifies project as a relevant and preferred solution without adverse impacts.
		$	**7,748,841**		