Tribes

NAME	FIRST NAME	LAST NAME	DATE
Confederated Tribes of the Chehalis Reservation	Mark	White	11/14/2016
Northwest Indian Fisheries Commission	Jim	Weber	11/14/2016
Quinault Indian Nation	Karen	Allston	11/14/2016

From: Mark White <mwhite@chehalistribe.org>
Sent: Monday, November 14, 2016 3:19 PM
To: info@chehalisbasinstrategy.com
Subject: PEIS Comments
Attachments: donot-reply@ctc.local_20161114_145805.pdf

Attached are the PEIS comments from the Chehalis Tribe.

Thank you

Mark White

Confederated Tribes of The Chehalis Indian Reservation

Natural Resources Department

Director Maia Bellon
Washington Department of Ecology
Chehalis Basin Strategy EIS
c/o Anchor QEA
720 Olive Way, Suite 1900
Seattle, WA 98101

Dear Director Bellon:

The Confederated Tribes of the Chehalis Indian Reservation Natural Resources Department (CDNR) has reviewed the Ecology's PEIS for the Reduced Flood Damage and Restoring Aquatic Species Habitat in the Chehalis Basin, dated Sept 29th, 2016.
Our comments assume that by identifying concerns early, impacts can be minimized to the resources of the Chehalis Basin and reduce financial costs.. Our primary goals is to protect all the resources of the Chehalis Tribe within the basin. Including, but not limited to all aquatic species, wildlife, cultural and historical.

General Comments

The Chehalis Tribe has been a part of this basin for over 10,000 years with documented cultural sites from Ocean Shores to the Willapa Hills above Pe Ell. Many are traditional fishing grounds along the Chehalis River and include several village sites occupied by the Chehalis People along its banks..

The Chehalis people have always managed the resources of this basin with great care ensuring protection of native species without negative impact.. In return, the basin has provided them with all they needed... While the threats over the years have changed, the Chehalis people's desire to have no negative impact on their traditional lands is still as strong in their minds and hearts as it has been for time immemorial.

The Chehalis Tribe has spent millions of dollars over the last twenty years on salmon and water restoration projects. The Tribe has converted agricultural and commercial lands and restored

them to flood plains and salmon habitat., By creating aquifer restorations, the Tribe has captured flood waters and recharged the groundwater of the Chehalis Basin.

Since 2000 years the Chehalis Tribe has seen the water table on the reservation drop over fifteen feet due to over-allocation of the groundwater resources and the impact of flood control measures to curb the floodplain. It is important that water resources be protected and restored to their natural function for all the citizens of the basin.

The Chehalis Tribe maintains a special relationship, not only with Washington State, but with all federal agencies responsible for protecting the trust resources of the Basin. Washington State, through legislation and the Centennial Accord, has promised to protect tribal resources in cooperation with the Tribes of Washington State to ensure protection for the future.

Specific Comments

1. The building of a dam would require water rights for storage of water. The PEIS does not appear to address the sources of obtaining these rights.. The Chehalis Basin is a closed basin and to obtain the rights would more than likely require the creation of them.. With the current over-allocation of the water rights in the basin, we feel that the PEIS does not adequately address the impact on groundwater resources of alternatives.

2. The dam site has had some minor geological testing completed. Based on the published test results, it appears that neither the site nor the resources around it are suitable for dam construction. This can have major safety concerns for the people downstream of the dam site. Based on the information provided, we feel that the dam alternative is not a safe or a viable alternative for this site. A large scale geological survey of the site would need to be conducted before any decision can made about Alternative 1.

3. In addition, the PEIS economics section does not take into consideration the cost of bringing in outside resources in for dam construction. The current geology reports indicate that the site is fractures with low grade basalt that crumbles easily. Based on current cost to benefit ratio that this will make the dam alternative cost prohibitive.

4. The PEIS does not specify who, and at what rate, will pay for the long-term maintenance and operation of alternative 1. This is a huge cost to the citizens of the basin and whatever entity is ultimately responsible for the operations and maintenance. None of the local entities has the capacity or the resources to take on this responsibility. This needs to be addressed before a decision is made about which alternative to pursue.

   The impact to groundwater is not significantly addressed in Alternative 1in the PEIS. By reducing flooding in the basin the aquafer recharge functions of the basin will also be reduced. . This needs to be clarified before a decision is made about alternatives. . The

Chehalis Tribe cannot support Alternative 1 due to unknown impacts to the groundwater resources of the Chehalis Basin.

5. Water Quality Standards are not adequately addressed in the PEIS. Washington State Standards for the Chehalis River were not adequately addressed in the PEIS, and impacts to Chehalis Tribal Water Standards were not addressed at all. The Chehalis Tribe has Treatment as a State for water quality standards authority, given by the Environmental Protection Agency. Impacts to the The Chehalis Tribe Water Quality Standards need to be addressed prior any alternative selection

6. Downstream impacts from Alternative 1 are not adequately addressed. The loss impacts of flooding and the benefits of flooding are not covered in the PEIS. The upper basin provides much of the gravels needed by aquatic species in the lower basin. The creation of a dam would eliminate these gravels from being transported downstream, causing negative impacts to channel morphology and aquatic species.

7. Alternative 1 clearly states that there will be negative impacts to tribal resources and fisheries. The Chehalis Tribe cannot accept this impact. This basin already has diminished resources and t Alternative 1 would increase the damage. Washington State made a commitment to protect tribal resources and cannot not support any project with negative impacts.

   Although there are assumptions made that Alternative 1 will improve fisheries, this is not based on fact. . During a meeting between the Chehalis Tribe and Ecology, the specific question was asked "If Alternative 1 moves forward, will the restoration move forward as part of that project?" The answer was not necessarily, because they are two different projects. One could be funded and not the other. The assumption is therefore made that if Alternative 1 is moved forward, then the improvement to fisheries will be from the restoration aspect, not the alternative itself.

   The PEIS only addresses impacts to a few select game species and not to all aquatic species. From a tribal standpoint this is unacceptable to move forward. The tribe views several cultural species that are important to the tribe from a historical and cultural perspective. All impacts to all aquatic species need to fully addressed before a decision can be made about which alternative to move forward.

   Because Alternative 1 will have significant impacts to tribal resources and fisheries, the Chehalis Tribe cannot support this alternative.

8. The purpose of the flood protection is to find a basin-wide solution that provides benefits for the citizens of the entire Basin. Upon review of the PEIS it is our conclusion that the only alternative providing some flood protection for the entire basin is Alternative 4. Alternative 1 only provides some small protection for the citizens in the upper watershed and no protection for lower watershed citizens.

   The PEIS states that I5 would go from a closure of four days to a 1-day closure. This statement has no supporting documentation. After consultation with WDOT, it appears

that there was never any study to conclude this fact and it appears that the statement was taken from a statement made early on. This needs to be addressed in the PEIS and supporting reference made to support this fact.

9. Under Washington State Administrative Code, the Chehalis Tribe has concerns that moving any alternative forward prior to the release of the final EIS could be a violation of state WAC.

   WAC 197-11-070(1)(b): "Until the responsible official issues a final determination of nonsignificance or final environmental impact statement, no action concerning the proposal shall be taken by a government agency that would: (b) Limit the choice of reasonable alternatives."

   After some legal review, it would appear that moving any alternative forward at this point by the Workgroup or any other government body, would be a violation of the WAC. It is the Chehalis Tribes opinion that no alternative be selected until a final EIS is complete.

Conclusion

It is the Chehalis Tribe's opinion that pushing this PEIS through without further refined study of the alternatives would not be in the best interest of resolving the Basin' flood issue. Further study is needed on all alternatives to verify their actual viability in providing basin-wide flood damage reduction without impacts to the people or the natural resources of the Basin.

Sincerely,

Donald Secena, Chairman

From: Green, Jennifer <jgreen@nwifc.org>
Sent: Monday, November 14, 2016 2:04 PM
To: info@chehalisbasinstrategy.com
Cc: Parker, Justin; Fran Wilshusen; James Weber; Clerical Admin; Fawn Sharp; Ed Johnstone; jgoodell@quinault.org
Subject: NWIFC Comments on the Chehalis Basin Strategy
Attachments: NWIFC Comments Chehalis PEIS 11.14.16.pdf

Attached is a letter from the Northwest Indian Fisheries Commission, Executive Director, Justin Parker.

If you have any questions on this letter please contact Jim Weber, Policy Analyst at 360-438-1180 or by email at jwweber@nwifc.org.

Thank you.

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November 14, 2016

Chehalis Basin Strategy EIS
C/O Anchor QEA
720 Olive Way, Suite 1900
Seattle, WA 98104
info@chehalisbasinstrategy.com

Dear Sir/Madam:

The Northwest Indian Fisheries Commission appreciates this opportunity to provide comments on the Chehalis Basin Strategy Draft Programmatic Environmental Impact Statement. The Commission is composed of designated representatives of the twenty western Washington Indian tribes that possess rights reserved by treaties with the federal government to take a fair share of the fish destined to pass their usual and accustomed fishing places. Among these fish are the anadromous species originating in the Chehalis River basin. As requested by the Quinault Indian Nation, the Commission has reviewed the Draft Programmatic Environmental Impact Statement (hereinafter "PEIS") and provides the following comments.

Fish Passage Standards

It is well established that one of the more significant sources of fish mortality caused by dams stems from impacts on downstream passage of juvenile salmon. The PEIS does not adequately address this issue. The PEIS fails to identify any standards or "yardsticks" for assessing the adequacy of fish passage survival for the dam projects (flood retention only or "FOR" and flood retention and flow augmentation "FRFA") it proposes. Since the dams under consideration would be brand new, it seems only reasonable that they should be constructed to provide the best fish survival possible under current technology. Over the last 30 years, there has been a tremendous amount of research in the Pacific Northwest and, particularly, the Columbia basin regarding how to retrofit dams and change operations to reduce the impacts they have on migrating juvenile and adult salmon. It is not clear to what extent the Chehalis FRO and, particularly, the FRFA proposals have been designed with these advancements in mind.

The PEIS notes that the "[f]ish passage facility designs in this EIS are conceptual in nature and would continue to be refined during project-level SEPA analysis."[1] Still, consistent with the assumption that new dams would not make the mistakes of the old dams, the PEIS states:

[1] *See* WDOE, Chehalis Basin Strategy, Draft Programmatic Environmental Impact Statement (September 2016) (hereinafter "PEIS") at 27.

> The dams proposed for the upper Chehalis River are uniquely designed for the purpose of flood retention and fish passage, with added measures intended to reduce the adverse impacts on fish. It is important to evaluate the impacts of the proposed dams in context with historical impacts of existing dams throughout the Pacific Northwest; however, because of the unique design of the FRO and FRFA dams and flood control operations being proposed, it is equally important to evaluate the impacts of each dam type on fish independent from the known effects of other dams.[2]

Given the problems with many existing dams, it is not surprising that the PEIS would ask reviewers to keep an open mind. Still, there needs to be context. The PEIS appears to acknowledge this when it states that:

> Final fish passage designs have not been determined, and passage success would vary considerably depending on the method of passage. Fish passage facilities would be designed according to state and federal fish passage engineering criteria to allow fish to safely pass the dam and access spawning and rearing area above the dam.[3]

Here the PEIS concedes that "passage success would vary considerably depending on the method of passage" and promises to design passage facilities according to state and federal passage criteria to allow fish to safely pass the dam. But what are these criteria? In conducting the cost, benefit, and impacts analysis, the authors of the PEIS had to make assumptions about which methods of passage might be used and their probable level of success. While it is not clear what was chosen, the results appear to be 64% juvenile downstream passage survival, 54% juvenile upstream survival, and 91% adult upstream survival.[4]

These survival estimates contrast significantly with recent requirements for re-licensing existing hydroelectric projects. For example, Round Butte Dam on the Deschutes River in Oregon was built in the 1960's and blocked fish passage. As part of the re-licensing settlement, the parties agreed that the dam should be retrofitted to provide fish passage according to the following criteria and goals for safe, timely and effective downstream and upstream passage: [5]

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[2] PEIS at 282.

[3] PEIS at 285.

[4] PEIS at 286, Table 4.2-5.

[5] *See* FERC, Order Approving Settlement and Issuing New License (June 21, 2005) Portland General Electric Co. and Confederated Tribes of the Warm Springs Reservation of Oregon (Project No. 2030-036, Pelton Round Butte Relicensing) proposed Article 18 at 146.

Criteria And Goals For Safe, Timely And Effective Downstream And Upstream Passage	
Item	**Criteria and Goals**
1. Screen Hydraulic Criteria	NOAA Fisheries smolt criteria (as provided in Article 22)
2. Downstream Passage Facility Survival (from Round Butte collection to lower Deschutes River release point)	93 percent smolt survival for temporary facility during first five years of operations. 96 percent smolt survival for permanent facility.
3. Upstream Passage Facility Survival (from lower Deschutes River collection point through Adult Release Facility)	95 percent during first five years of operations. 98 percent after five years.
4. Round Butte Reservoir Downstream Passage Associated with Temporary Passage Facilities	>50 percent of a statistically significant sample of tagged steelhead or spring Chinook outmigrants from any Project tributary averaged over four years of study.
5. Round Butte Reservoir Downstream Passage Associated with Permanent Collection Facilities	>75 percent survival of PIT-tagged smolts calculated as a rolling 4-year average during the first 12 years.

Examination of this table indicates that the fish passage criteria for retrofitting the 50 year old Round Butte dam call for downstream juvenile fish passage survival of 93% in the first five years of operation and 96% thereafter. Round Butte is 440 feet high. In contrast, the proposed Chehalis FRFA facility would be brand new, 285 feet high, and is currently predicted to provide 64% downstream passage survival. It would take a 50% increase for the FRFA project – as currently being considered – to achieve the juvenile downstream passage survival criteria specified for the Round Butte retrofit.[6]

Given the lack of discussion in the PEIS regarding fish passage effectiveness, appropriate standards for success, and the cost of achieving those standards, it is difficult to escape the impression that the PEIS is low-balling the fish passage survival and the associated costs that the FRFA needs to achieve. For example, the state perspective net benefits analysis in the appendices indicates that total project costs for various fish passage scenarios for the FRFA project range from $892 million to $1,243 million. All of the scenarios that are in the high restoration benefit category had a benefit/cost ratio less than one.[7] What scenario(s) delivered the 64% fish passage survival results displayed in the PEIS at Table 4.2-5? What is the cost of fish passage survival that meets, for example, the 93-96% standards?

[6] Some may assert that it is not appropriate to compare a hydroelectric dam with a flood retention dam. It seems entirely appropriate to require, at a minimum, that a not-yet-completely-designed project that is focused on two purposes – flood retention and fish protection and enhancement – ought to be able to meet at least the same fish protection criteria as a 50 year old hydroelectric and storage project that had previously failed to pass fish.

[7] PEIS Volume 2, Table ES-3 at ES-12.

It does not appear to us that the FRFA proposal developed by the Chehalis Basin Strategy has met the bars of providing state of the art fish passage survival at a cost with a benefit cost ratio greater than one.

Land Use Management Actions

The beneficiaries of the Chehalis Basin Strategy seek significant taxpayer-funded assistance to limit damage from flooding and to enhance degraded fish habitat. Based on the information contained in the PEIS, local Chehalis basin land use management actions are primarily responsible for these problems. Local governments have permitted extensive development in the floodplain. According to the PEIS, 11.5% of the Chehalis floodplain is developed and contains residential homes, shopping centers, and industrial facilities.[8] The PEIS anticipates that development of the floodplain will continue. Over the next 100 years, between 286 and 617 residential structures will be built in the floodplain in Lewis County.[9] Similarly, the PEIS contemplates that as a result of commercial/industrial development, between 96 and 207 new structures will be built in the Lewis County portion of the floodplain.[10] It specifies further that "[c]ommercial/Industrial development pressure in the modeled 100-year floodplain is relatively low and concentrated almost entirely in Chehalis and Centralia."[11] In contrast, new structures in the floodplain over the next 100 years in Grays Harbor and Thurston counties would be relatively few and primarily residential development.[12]

The PEIS notes that there is a significant contrast in the politics of development between Thurston County and, particularly, Lewis County. It states that Thurston County has not had growth in the floodplain, primarily due to development restrictions recently put in place.[13] The PEIS provides examples of some of the restrictions, which include prohibiting construction of single-family residences and on-site sewage systems in the floodplain, except via reasonable use exemptions. An additional example is that Thurston County has also required that new wells be constructed outside of the 100-year floodplain.[14] The PEIS states further that "[m]any of the Chehalis Basin communities considered in this report do not currently have regulations that prohibit development in the floodplain,"[15] and that the type of restrictions adopted by Thurston County "may not be feasible in every Chehalis Basin community."[16] In short, the PEIS

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[8] PEIS at 197.

[9] PEIS Volume 2, Appendix L at 18 (Build-Out Analysis).

[10] *Id.*

[11] *Id.* at 12

[12] *Id.* at 19.

[13] Although not mentioned in the PEIS, these development restrictions stem from Thurston County's compliance with the requirements of NMFS' Biological Opinion governing FEMA's implementation of its National Flood Insurance Program in Puget Sound. *See* NMFS, Endangered Species Act – Section 7 Consultation Final Biological Opinion on Implementation of the National Flood Insurance Program in the State of Washington Phase One Document – Puget Sound Region; NMFS Tracking No. 2006-00472 (September 22, 2008) (hereinafter "FEMA Biop").

[14] PEIS Volume 2, Appendix L at 22.

[15] *Id.* at 8 and 32.

[16] *Id.* at 22.

admits that an unstated number of Chehalis Basin communities have not adopted development restrictions to protect their residents from building in the floodplain and thereby incurring the damage from the inevitable flooding. Such failures to regulate floodplain development increase flood damage, increase costs to state and federal taxpayers, and increase the harm to fish habitat caused by floodplain development.[17]

Fish habitat degradation has been caused by numerous land uses, including urbanization, gravel mining, agriculture, logging, removal of large downed wood from streams, and dredging and filling.[18] As a result, fall Chinook habitat is 54% impaired, winter-run steelhead habitat is 56% impaired, coho habitat is 72% impaired, and spring Chinook habitat is 87% impaired.[19] Before asking for development of large, taxpayer-funded flood retention projects, local governments in the Chehalis Basin should take responsibility for doing what they can to reduce flood impacts to their citizens and harm to fish habitat. A good first step would be for local governments to fully implement the FEMA Biop Appendix 4 Minimum Criteria (as amended). The FEMA Biop calls for significant riparian buffers. Implementation of the buffers described in Appendix 4 would also contribute to meeting the TMDL for temperature in the Upper Chehalis basin.[20] Because current development regulations continue to allow floodplain development, implementing alternatives 1 or 2 would likely result in encouraging further floodplain development – to the harm of salmon habitat and the Quinault Nation's treaty rights.[21]

The proposed FRFA dam violates state water quality standards and is expected to eliminate a beneficial use

According to the analysis in the PEIS, violations of both dissolved oxygen and temperature water quality standards are expected in the FRFA reservoir.[22] Between these reservoir water quality problems and the fish passage problems, it appears that salmonid beneficial uses located at and above the proposed dam site will be very adversely affected by the proposed FRFA structure. We also note that lamprey, a current beneficial use at and above the dam site will be largely eliminated by the construction and operation of the FRFA dam.[23] The PEIS

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[17] *See generally* FEMA Biop. For a discussion focusing on how the minimum requirements of the National Flood Insurance Program encourage development in the floodplain, see pages 2-20. *See also* pages 83-99 (discussing how floodplain development leads to harmful changes in the floodplain and to salmon habitat productivity.

[18] PEIS at 8. *See also* FEMA Biop at 91-99.

[19] PEIS at 456.

[20] PEIS at 330. *See also id.* at 90 (This temperature TMDL was based on development of a functional riparian corridor that would limit heating and provide more favorable conditions for aquatic species. The lower mainstem Chehalis River is also in need of a temperature TMDL).

[21] PEIS Volume 2, Appendix L at 22-23 (additional floodplain development induced by alternative 1); *id.* at 27-28 (additional development induced by alternative 2).

[22] PEIS at 255.

[23] PEIS at 285 ("The fish passage facilities associated with the FRFA dam could nearly eliminate downstream passage for lamprey. Over the long term, the challenge of passing lamprey downstream around the FRFA dam could prevent lamprey from migrating to the ocean, leading to local reductions in the population, and possibly the elimination of lamprey upstream of the dam"). That lamprey would be eliminated upstream of the dam appears likely; the PEIS estimates less than 1% juvenile passage survival. PEIS at 286 Table 4.2-5.

assumes that a key benefit of the FRFA project is flow augmentation to reduce high water temperatures and enhance spring-run Chinook production in the Chehalis River below the proposed dam.[24] This portion of the Chehalis River has had a temperature TMDL since 2001 that calls for riparian revegetation to provide shade and other aquatic benefits.[25] Implementation of that TMDL would require action by state and local governments and landowners. Rather than take voluntary and/or regulatory actions to address these high stream temperatures in the mainstem Chehalis, the Chehalis Basin Strategy proposes construction of a taxpayer-funded dam to provide some of the benefits that local landowners have already been asked to provide via the temperature TMDL. "Solving" a portion of the Chehalis basin's temperature standard violations by ignoring an existing temperature TMDL and instead constructing a dam that will eliminate one or more beneficial uses (at least lamprey, if not spring chinook and coho) at and above the site of the dam is not consistent with the state's water quality standards.

Ironically, implementing the temperature TMDL by creating healthy riparian areas will also eventually provide flood water retention/slowing, bank stability, and late summer low flow benefits. The benefits of healthy riparian areas (and floodplains) are the key foundations on which alternative 4 (floodplain restoration) rests. Healthy riparian areas also contribute to the greater resilience alternative 4 provides to the impacts of climate change. The Commission supports adoption of the Quinault Nation's preferred alternative.

Conclusion

If the FRFA project is to be seriously considered, more transparent work needs to be done regarding fish passage measures that safely pass fish, are cost effective, result in robust, sustainable populations, don't eliminate beneficial uses, and assure compliance with state water quality standards. Similarly, analysis needs to be done regarding significantly improved floodplain land use management. What benefits would accrue by implementing Appendix 4 of the FEMA Biop on all floodplain lands, including agricultural lands? The PEIS does not appear to have examined this important component of flood and fish habitat management. It has already been shown that implementation of the FEMA Biop is reasonable in jurisdictions (Puget Sound, including Thurston County) where more cost effective flood risk reduction and protection of salmon habitat are sought.

Finally, we recommend that greater analysis of the benefits and impacts of various individual actions be performed to make it possible for governments and stakeholders with interests in the Chehalis basin to be able to negotiate, mix, and match various actions. This would allow the interested parties to examine individual actions and suites of actions other than the four alternatives that have been proffered to date. Once all of the above actions have occurred, the

[24] The PEIS assumes that spring-run Chinook will hold over summer and spawn in the mainstem Chehalis River between Elk Creek and the FRFA site prior to spawning in the fall in the same area. "Whether adult spring-run chinook salmon would respond behaviorally to modulating temperature and flow from the fRFA facility is unknown and represents a key uncertainty." PEIS at 290.

[25] PEIS at 90 and 330.

Department of Ecology should prepare and circulate a final EIS, as required by WAC 197-11-460(6). No actions should be taken to implement the dam and/or levee construction actions contemplated in the PEIS prior to issuance of the final EIS, as required by WAC 197-11-460(5).

Thank you again for this opportunity to provide comments. If you have any question regarding these comments, please feel free to contact Jim Weber, Policy Analyst, at (360) 438-1180.

Sincerely,

Justin Parker
Executive Director

cc: Fawn Sharp, Quinault Indian Nation, President
Ed Johnstone, Quinault Indian Nation, Fisheries Policy Spokesperson
Junior Goodell, Quinault Indian Nation, Policy Spokesperson

From: info@chehalisbasinstrategy.com on behalf of Chehalis Basin Strategy <info@chehalisbasinstrategy.com>
Sent: Monday, November 14, 2016 4:55 PM
To: info@chehalisbasinstrategy.com
Subject: EIS Comment Form
Attachments: QIN-Comment-Letter-Attachment-1.pdf; QIN-Attachments-2-7-Attached-to-QIN-Comments.pdf; QIN-Exhibits-A-O-attached-to-QIN-PEIS-comments.pdf

Comment Form

First Name: Karen

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Comments: See three files uploaded on behalf of the Quinault Indian Nation:

--QIN Comment Letter + Attachment 1
--QIN Attachments 2-7 Attached to QIN Comments
--QIN Exhibits A-O Attached to QIN Comments

File Upload (1): http://chehalisbasinstrategy.com/wp-content/uploads/2016/11/QIN-Comment-Letter-Attachment-1.pdf

File Upload (2): http://chehalisbasinstrategy.com/wp-content/uploads/2016/11/QIN-Attachments-2-7-Attached-to-QIN-Comments.pdf

File Upload (3): http://chehalisbasinstrategy.com/wp-content/uploads/2016/11/QIN-Exhibits-A-O-attached-to-QIN-PEIS-comments.pdf

This email was built and sent using Visual Form Builder.

Quinault Indian Nation

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November 14, 2016

Chrissy Bailey, EIS Project Manager
Gordon White, Program Manager
Shorelands and Environmental Assistance Program
Washington Department of Ecology

RE: Quinault Indian Nation Comments on Chehalis Basin Strategy Draft Programmatic Environmental Impact Statement

Dear Ms. Bailey and Mr. White:

The Quinault Indian Nation (QIN) is pleased to submit the following comments regarding the Chehalis Basin Strategy Programmatic Environmental Impact Statement (PEIS). This letter and the "Chehalis Programmatic EIS Comment/Response Table," incorporated by reference as Attachment 1, include comments provided by QIN Treaty Habitat Policy Spokesperson, Larry Goodell, Jr.; QIN staff; staff from Natural Systems Design; staff from R2 Resource Consultants, Inc.; Larry Lestelle, Biostream Environmental (and additional comments are incorporated by reference as Attachment 2). In addition, the QIN incorporates by reference the following Attachments: Attachment 3, memo from Dave Carlton, PE, CFM, regarding the National Flood Insurance Program (NFIP); Attachment 4 by Rachael Paschal Osborn, Attorney at Law regarding the Public Trust Doctrine; Attachment 5 by Rachael Paschal Osborn, Attorney at Law regarding Flow Augmentation and Water Rights; Attachment 6 by Larry Goodell, Jr. critiquing the Build-Out Analysis in Appendix L to the PEIS; and Attachment 7, "Chehalis Basin Strategy Draft Programmatic EIS Independent Review," by Resource Dimensions, critiquing the Draft Economic Report in Appendix C to the PEIS.

As explained below and in the attachments, the QIN is deeply concerned with the impact some of the Alternatives considered may have on the QIN's treaty-reserved fishing rights, and believes that the current draft of the PEIS is not adequate to support any decisions that chart the course of flood damage reduction and aquatic species habitat restoration in the Chehalis Basin. In particular, we recommend refinement of the Restorative Flood Protection (RFP) Alternative and Aquatic Species Habitat Actions (ASHAs), as well as refinement of the social, economic and ecosystem costs and benefits analyses for more equitable comparisons of Alternatives. A Final

PEIS that addresses QIN's comments and concerns should precede any decision making about a specific Alternative.

I. QIN's TREATY RIGHTS AND SUBSTANTIAL INTERESTS IN THE CHEHALIS BASIN

The QIN is a signatory to the Treaty of Olympia (1856), by which it reserved, among other things, the right of "taking fish, at all usual and accustomed fishing grounds and stations" and the privilege of hunting and gathering, among other rights, in exchange for ceding lands it historically roamed freely. Treaty rights are not granted to tribes, but rather are "grants of rights from them—a reservation of those not granted." *United States v. Winans*, 198 U.S. 371, 380-81 (1905). Treaties take precedence over conflicting state laws by reason of the Supremacy Clause of the U.S. Constitution, Art. VI, Sect. 2. Accordingly, treaties are the supreme law of the land. *Worcester v. Georgia*, 31 U.S. 515, 531 (1832).

In a landmark court case known as the "Boldt decision," a federal court confirmed the QIN's fishing rights and established the plaintiff tribes, including QIN, as co-managers of off-Reservation fisheries resources entitled to half of the harvestable number of fish returning to Washington waters. *United States v. Washington*, 384 F. Supp. 312 (W.D. Wash. 1974). Based on evidence provided, the court determined the usual and accustomed areas of the QIN include "the waters adjacent to their territory" and "Grays Harbor and those streams which empty into Grays Harbor." *Id.* at 374-375; see also *United States v. Washington*, 459 F.Supp. 1020, 1097 (W.D. Wash. 1978), *aff'd* 645 F.2d 749 (9th Cir.1981). In a later compilation of key court findings, the court concluded: "The Quinault Tribe has usual and accustomed fishing places in Grays Harbor and its watershed, including the Humptulips River." *United States v. Washington,* 459 F.Supp. 1020, 1038 (W.D. Wash. 1978) *aff'd*, 645 F.2d 749 (9th Cir. 1981).

The QIN is the only federally-recognized Indian tribe with treaty rights in the Chehalis Basin. The Chehalis River and all of its tributaries empty into Grays Harbor and are, thus, within the QIN's usual and accustomed fishing areas. Moreover, the Ninth Circuit Court of Appeals has held that "The State of Washington is bound by the treaty. If the State acts for the primary purpose or object of affecting or regulating the fish supply or catch in noncompliance with the treaty as interpreted by past decisions, it will be subject to immediate correction and remedial action by the courts." *United States v. State of Washington,* 759 F.2d 1353, 1357 (9th Cir.1985) (en banc). As a result, the courts have recognized that "in building and maintaining barrier culverts Washington has violated, and continues to violate, its obligation to the Tribes under the fishing clause of the Treaties." *United States v. State of Washington,* Ninth Cir. No. 13-35474, Slip Op. at 59 (June 27, 2016). Needless to say, the State's actions with respect to the Chehalis Basin may parallel that of the so-called "culverts" case.

We take this opportunity to emphasize that the QIN's federally-protected treaty right guarantees every enrolled Quinault tribal member—now and into the future—the right to harvest any and all fish, shellfish and semi aquatic species anywhere within the QIN's usual and accustomed fishing area in perpetuity, and to hunt and gather within its ceded area on open and unclaimed lands. The Supremacy Clause of the U.S. Constitution binds the State of Washington and its agencies to honor the Treaties signed between Washington Indian tribes and the United States Government

in the 1850s. The State is obligated by the Treaties and recent federal court opinions to protect treaty resources and ensure agency actions do not harm them. The Centennial Accord further commits the Department of Ecology to maintain a government-to-government relationship that respects our values and culture.

QIN's treaty fishing right must be considered in regard to all of the Alternatives considered in the PEIS. QIN's property right in the fish must be considered in regard to any Alternative that would diminish habitat or otherwise negatively affect salmon or other aquatic species. Such diminishment or negative affect would be considered a compensable taking of the QIN's treaty right. Likewise, the right of access must be considered in regard to any Alternative that would impair the ability of QIN fishers to access their usual and accustomed fishing grounds in the Chehalis River Basin. Such impairment would be a violation of the treaty. Finally, the State must avoid taking any actions that would impair treaty protected resources. It is with this in mind, and given the fact that any action detrimental to fish populations may entitle QIN to injunctive relief, that QIN submits these comments.

Flooding in the Chehalis Basin in 2007 and 2009 caused widespread damage and loss—public safety was jeopardized, homes and businesses were harmed, livestock perished, and I-5 and other road closures resulted. Monetary costs from flood damage in the last decade are in the hundreds of millions while social tolls have been simultaneously enormous. What is not directly acknowledged in the PEIS is that QIN treaty interests are also directly harmed from flooding in the Chehalis Basin. Additionally, productivity for aquatic species has been reduced for decades, and as stated in the Governor's Chehalis Basin Strategy Recommendation Report:

> [I]f action is not taken, this degradation is expected to continue. Salmon habitat in the Basin already is degraded by 44%–78%, depending on the species. Failure to take action to restore physical and ecological Basin processes and habitat, coupled with potential impacts of climate change, are predicted to result in the complete loss (extirpation) of Spring-run Chinook from the Basin late this century, and a 70% loss of coho. It is very possible that the current trajectory would lead to Endangered Species Act listings and related restrictions, as well as great economic and cultural losses for tribal, commercial, and recreational fishers and others who depend on or enjoy these species.

Governor's Chehalis Basin Work Group 2014 Recommendation Report, November 25, 2014, p. 2. Over 830 studies have been conducted of potential actions to address flood damage, with no real change. *Id.* The Chehalis Basin is the second largest watershed in the State, yet has received far less funding for habitat restoration than any other salmon region. Attention to these problems is overdue.

The QIN shares the stated goals of the PEIS: to develop both a comprehensive approach to flood damage reduction and to aquatic species habitat restoration in the Chehalis Basin. **However, our federally-protected treaty rights are of paramount importance and provide the foundation of our interests in the Basin and these comments. Any Alternative chosen must protect and preserve QIN's treaty fishing, hunting, and gathering rights and interests consistent with the obligations imposed on the State by federal law.**

II. LEGAL RAMIFICATIONS NOT FULLY CONSIDERED BY THE PEIS

There are numerous legal implications under Federal and State law that are not fully analyzed or addressed in the PEIS.

A. Endangered Species Act and Magnuson Stevens Act

The federal permitting associated with the proposed Flood Retention Flow Augmentation (FRFA) and Flood Retention Only (FRO) dams have Endangered Species Act (ESA) consequences, which would trigger reviews by the National Marine Fisheries Service and U.S. Fish and Wildlife Service. Though acknowledged in the PEIS, ESA ramifications are not fully addressed. Similarly, the PEIS acknowledges the applicability of the Magnuson-Stevens Fishery Conservation and Management Act, including that Essential Fish Habitat occurs throughout WRIAs 22 and 23 (p. 163), but does not explore the possible ramifications.

B. National Flood Insurance Plan Considerations

The QIN incorporates by this reference as Attachment 3, a memorandum from Dave Carlton, PE, CFM, to Larry (Junior) Goodell dated October 21, 2016, as our comments on the application of the National Flood Insurance Program (NFIP). Additionally, under the NFIP, the Federal Emergency Management Agency (FEMA) must consider whether proposed actions in floodplains would meet minimum NFIP requirements and how the proposed changes would impact the NFIP maps. These considerations must occur prior to construction and trigger independent review for ESA compliance. FEMA has published Guidance for Compliance with the Endangered Species Act for Conditional Letters of Map Change, which should also be considered. See, Exhibit A, FEMA Procedure Memorandum 64 – Compliance with the Endangered Species Act for Letters of Map Change, August 18, 2010.

C. Clean Water Act Considerations

The Chehalis River is a navigable waterway of the United States providing the federal and state regulatory nexus for protection of Chehalis River waters and floodplain wetlands under the Clean Water Act (CWA). Section 404 of the CWA regulates the discharge of dredged and fill material into waters of the United States, including wetlands. The Section 404 program is administered by the US Army Corps of Engineers and US Environmental Protection Agency. Section 401 of the CWA, state water quality certification, regulates discharge of pollutants into waters of the United States, including wetlands, and would regulate instream flow modifications by FRO and FRFA dam projects. Additionally, the Section 401 antidegradation policy provides provisions for protection of waters and water bodies relative to instream water uses; protection of waters in support of fish, shellfish and wildlife and recreation, in and on waters; and requires protection of all high-quality waters which constitute an outstanding national resource. The Washington State water quality certification program is administered by the Washington Department of Ecology (Ecology). Sections 404 and 401 of the CWA provide the regulatory context for assessing potential impacts to downstream waters and wetlands resulting from FRO and FRFA dam operations alterations of the Chehalis River natural flow regime.

Our primary contention relative to the PEIS Alternatives assessment and proposed mitigation concerning potential downstream impacts to Chehalis River waters of the United States, including wetlands, due to the operation of the FRO and FRFA Alternatives, is that there is inconsistency in the PEIS conclusions. The PEIS recognizes that downstream adverse impacts to these waters and wetlands may be significant, permanent and require compensatory mitigation under the CWA, yet the PEIS minimizes the impacts of the FRO and FRFA Alternatives.

Flood control dams such as the FRO and FRFA affect the primary physical factors that control the shape, size and overall morphology of a river and its floodplain, the natural flow regime (magnitude, frequency, duration and timing of flows; Poff, et al. 1997), sediment supply (volume and size), and the frequency of sediment transport (Schumm 1977; Poff, et al. 1997; R2 Resource Consultants, Inc. and TetraTech, Inc. 2014). Flood control dams, because of their alteration of a river's natural flow regime, have been demonstrated to adversely impact downstream riparian and floodplain vegetation composition, structure and ecosystem functions and floodplain wetlands (Rood, et al. 2005; Johnson, et al. 2012; Scott, et al. 1996; Shafroth, et al. 2010; Jansson, et al. 2000a; Naiman, et al. 2005). Furthermore, documented downstream adverse impacts of dams include loss of aquatic and riparian biodiversity and impairment of aquatic, floodplain and riparian ecosystem functions (Nilsson and Berggren 2000; Naiman, et al., 2005; Burke, et al., 2009; Benjankar, et al., 2011). The mechanisms by which flood control dams impact natural flow and sediment regimes, and subsequently the dependent downstream aquatic, riparian and floodplain ecological communities, can be most effectively modeled and analyzed by taking an ecosystem approach to evaluating biotic community (fish, wildlife and vegetation) dependencies upon natural surface water and groundwater flow, sediment and disturbance regimes.

The systematic downstream impacts of dam hydro-regulation of a river have been demonstrated to result in a *cascade of effects* through the downstream aquatic, riparian and floodplain wetland ecosystems. The riparian vegetation mosaic pattern is affected first, followed by the riparian and floodplain dependent riparian and aquatic fish and wildlife populations (Naiman et al. 2000; Nilsson and Berggren 2000). The cascade of effects of flood control dams–throughout the aquatic and riparian ecosystem, and the complex alteration of downstream aquatic and riparian communities–has been noted by numerous authors (Ward and Stanford 1983; Ligon, et al. 1995; Richter et al. 1996; Poff et al. 1997; Naiman, et al. 2000; Nilsson and Berggren 2000; Rood, et al. 2005; Tockner and Stanford 2002; Naiman, et al. 2005; Jorde, et al. 2008).

The adverse downstream impacts to waters and wetlands may be significant and permanent, and are likely to not be minimal in their spatial extent. The PEIS statements to the contrary about the potential changes in floodplain wetland hydrology cannot be substantiated.

The QIN believes that, at minimum, the following changes must be made to the PEIS to ensure compliance with the CWA:

1. A spatially explicit surface water, groundwater and sediment transport model of downstream effects of the Alternative 1 dam operations is necessary to quantitatively assess potential downstream impacts to waters and wetlands.

2. Identification of existing Chehalis River wetlands extent at the project-scale is necessary to provide a quantitative impact analysis and identify any required compensatory mitigation. Additionally, a wetland functional analysis of potentially impacted waters and wetlands should be required (Washington DOE Riverine Wetland Functional Assessment).

D. Fish and Wildlife Coordination Act Considerations

The Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. § 661 *et seq.* (as amended), assures that fish and wildlife resources receive equal consideration with other values during the planning of water resource development projects. Despite the Alternatives for flood retention facilities and levees, the PEIS has no substantive analysis consistent with the requirements of the FWCA.

The FWCA was passed by Congress because the goals of water-related projects (e.g., flood control, irrigation, navigation, hydroelectric power) may conflict with the goals of conserving fish and wildlife resources. *E.g., Udall v. Federal Power Commission*, 387 U.S. 428, 443-44 (1967) (invoking the FWCA to support the conclusion that the Federal Power Commission had failed to explore and evaluate adequately the likely effects of a proposed dam on the Snake River and noting that "[c]ertainly the wildlife conservation aspect of the project must be explored and evaluated"). Conversely, developers can design water development projects to enhance fish and wildlife resources if such goals are incorporated into project plans.

The FWCA's central objective is that wildlife conservation receive "equal consideration" with other features of water resource development programs. To do so, the FWCA requires consultation with the U.S. Fish and Wildlife Service when there are plans to conduct, license, or permit an activity involving the impoundment, diversion, deepening, control, or modification of a stream or body of water. The FWCA also requires consultation with the head of the state agency that administers wildlife resources in the affected state. The purpose of this process is to promote conservation of wildlife resources by preventing loss of and damage to such resources and to provide for the development and improvement of wildlife resources in connection with the action. This is not consultation for consultation's sake. Rather, the PEIS should (but does not) contain an explicit record of compliance with FWCA. This is because the FWCA explicitly requires action agencies to prepare mitigation plans and to give consideration to fish and wildlife in manner that is equal to that accorded to projects' projected benefits. *E.g.*, 16 U.S.C. § 663(a); *id.* § 661. Moreover, the FWCA expressly authorizes the implementation of mitigation plans. In addition to the requirement that agencies prepare plans for the use of water and lands affected by a project for wildlife conservation purposes, the FWCA empowers action agencies to modify construction or operation of water projects in order to conserve wildlife resources. *Id.* § 662(c).

The FWCA is closely intertwined with the Public Trust Doctrine (see next subsection E.). By enacting the 1958 amendments to FWCA, Congress effectively wrote aspects of the Public Trust Doctrine into the statute. The protection of fish and wildlife resources sought to be achieved through these amendments is an interest that the public trust doctrine was developed, in part, to vindicate. The FWCA's mandate that "wildlife conservation shall be given equal consideration…with other features of water resource development programs," 16 U.S.C. §

661(a), reflects the fundamental principle of the Public Trust Doctrine that the sovereign has a duty to manage wildlife resources for the common good. The Senate report on the 1958 amendments states that "equal consideration" requires action agencies to put wildlife interests "on the basis of equality with flood control, irrigation, navigation, and hydroelectric power." 218. S. Rep. No. 1981, 85th Cong., 2d Sess. 5 (1958). The FWCA should thus be understood to require more than just compliance with consultation procedures; its thrust is that projects may not always proceed at the expense of valuable wildlife resources.

The PEIS must consider the FWCA and ensure that adequate weight be given to fish and wildlife values. To that end, the only reasonable alternative that meets the FWCA's stated goals, the Restorative Alternative, must be given greater weight.

E. Public Trust Doctrine Considerations

The Chehalis River Basin ecosystem provides extraordinary ecological benefits and services to Washington's citizens, including members of the Nation. The State must rely on the Public Trust Doctrine to protect these ecological benefits and services now, and for future generations.

The Public Trust Doctrine protects public interests in navigation, commerce and fisheries relating to shorelines and navigable water bodies. The Public Trust Doctrine has existed in Washington since statehood in 1889. It is "partially encapsulated" in the Washington State Constitution, Article XVII, Section 1, which asserts public ownership over all navigable waters of the state, including harbors, rivers and lakes. This public ownership is the source of the public right to utilize navigable waters, including bedlands, tidelands, shorelands, and navigable inland waterways. The Washington Department of Natural Resources (DNR) apparently has made an informal determination that the Chehalis River is not navigable upstream of Pe Ell, but that decision has been neither publicly vetted nor reviewed by courts. QIN urges a formal determination of navigability of the upper Chehalis River, particularly in light of current recreational boater use in this area.

Please see detailed Public Trust Doctrine analysis by Rachael Paschal Osborn in Attachment 4.

Without question, the state must consider its legal obligations under the Public Trust Doctrine within the PEIS and apply the Public Trust Doctrine to inform its decision in implementing any of the Alternatives. For that reason, it is inconceivable that the Public Trust Doctrine is not mentioned anywhere in the PEIS. This failing is significant, especially in the context of the Restorative Alternative which would advance the many public interests supported by Public Trust Doctrine.

F. SEPA Requirements

The basic purpose of SEPA's command for environmental review is to require governments to fully consider environmental and ecological factors when taking actions that significantly affect the quality of the environment. *King County v. Wash. State Boundary Review Bd.*, 122 Wash.2d 648, 659, 860 P.2d 1024 (1993). The QIN is concerned that this basic mandate – full consideration of all factors – has not been met.

The QIN urges the state to respect the limitations under SEPA that limit further actions "[u]ntil the responsible official issues a final determination of nonsignificance or final environmental impact statement, no action concerning the proposal shall be taken by a governmental agency that would: (a) Have an adverse environmental impact; or (b) Limit the choice of reasonable alternatives." WAC 197-11-070. This regulation limits the actions of a governmental entity during the SEPA process. Here, until a final decision is made on the PEIS, the actions of the Legislature and the Governor concerning funding a particular alternative may violate WAC 197-11-070 by limiting the choice of reasonable alternatives. Such a result is particularly likely here given the numerous studies and documents that have been released after the initial publication of the PEIS, suggesting that additional environmental and other analysis still needs to be completed as to the Alternatives.

Similarly, SEPA requires that "[w]hen there are gaps in relevant information or scientific uncertainty concerning significant impacts, agencies shall make clear that such information is lacking or that substantial uncertainty exists." WAC 197-11-080(2). QIN believes there should have been more identification of data gaps and more clarity about uncertainty, particularly with regard to ASHAs. Based on the significant data gaps and level of uncertainty, we caution the state to heed the requirements in WAC 197-11-080(3):

> Agencies may proceed in the absence of vital information as follows:
> (a) If information relevant to adverse impacts is essential to a reasoned choice among alternatives, but is not known, and the costs of obtaining it are exorbitant; or
> (b) If information relevant to adverse impacts is important to the decision and the means to obtain it are speculative or not known;
>
> Then the agency shall weigh the need for the action with the severity of possible adverse impacts which would occur if the agency were to decide to proceed in the face of uncertainty. If the agency proceeds, it shall generally indicate in the appropriate environmental documents its worst case analysis and the likelihood of occurrence, to the extent this information can reasonably be developed.

The QIN understands SEPA generally requires less detailed information in a nonproject (or programmatic) EIS. Nevertheless, we highlight the stated purposes of EISs in WAC 197-11-400:

> (1) The primary purpose of an environmental impact statement is to ensure that SEPA's policies are an integral part of the ongoing programs and actions of state and local government.
> (2) An EIS shall provide impartial discussion of significant environmental impacts and shall inform decision makers and the public of reasonable alternatives including mitigation measures, that would avoid or minimize adverse impacts or enhance environmental quality.
> (3) Environmental impact statements shall be concise, clear, and to the point, and shall be supported by the necessary environmental analysis. The purpose of an EIS is best served by short documents containing summaries of, or reference

to, technical data and by avoiding excessively detailed and overly technical information. The volume of an EIS does not bear on its adequacy. Larger documents may even hinder the decision making process.

(4) The EIS process enables government agencies and interested citizens to review and comment on proposed government actions, including government approval of private projects and their environmental effects. This process is intended to assist the agencies and applicants to improve their plans and decisions, and to encourage the resolution of potential concerns or problems prior to issuing a final statement. An environmental impact statement is more than a disclosure document. It shall be used by agency officials in conjunction with other relevant materials and considerations to plan actions and make decisions.

Emphasis added. These underlined statements underscore the importance of full and transparent analyses being used to guide state decision making. For the myriad reasons elaborated herein, the QIN does not believe the PEIS meets these criteria.

The requirements for nonproject EISs such as this PEIS are outlined in WAC 197-11-442, and include that "impacts and alternatives in the level of detail appropriate to the scope of the nonproject proposal and to the level of planning for the proposal." WAC 197-11-442(2). The incomplete, inequitable, and generalized nature of the analyses of Alternatives and impacts in this PEIS, as discussed in these comments, is not at a "level of detail appropriate" for use of the PEIS as a planning document to guide the Governor's budget recommendation that locks in an Alternative or Alternatives for potential funding by the 2017 Legislature.

The QIN also takes issue with the disparate analysis of the Alternatives as described in subsection III.B. below. Such inequity does not meet the requirements of a nonproject EIS in WAC 197-11-442(2): "Alternatives including the proposed action should be analyzed at a roughly comparable level of detail, sufficient to evaluate their comparative merits (this does not require devoting the same number of pages in an EIS to each alternative)."

Finally, the cumulative impacts analysis in Section 5.8 does not comply with SEPA requirements. "A proposal's effects include direct and indirect impacts caused by the proposal. Impacts include those effects resulting from growth caused by a proposal, as well as the likelihood that the present proposal will serve as precedent for future actions." WAC 197-11-060(4)(d). The scope of impacts includes direct, indirect, and cumulative impacts. WAC 197-11-792. "The range of impacts to be analyzed in an EIS (direct, indirect, and cumulative impacts, WAC 197-11-792) may be wider than the impacts for which mitigation measures are required of applicants." WAC 197-11-060(4)(e).

The PEIS only considered two generalized future actions as part of its cumulative impacts analysis— new residential and commercial development, and expansion of agricultural uses — outside of those local flood protection actions included in the PEIS, and only did so with a broad brush that fails to comply with the SEPA requirements. The PEIS's consideration of impacts from future potential growth caused by the various Alternatives is wholly inadequate to meet the SEPA requirement in WAC 197-11-060(4)(d). See QIN's significant comments criticizing Appendix L. Build-Out Analysis in Attachment 6. The PEIS compares the projected outcomes of

the Alternatives to a baseline that is described as current condition. As noted, however, outcomes associated with managed forests are combined in the Alternatives as part of the ASHA, making it appear as if managed forests are mitigating for adverse effects of the FRO and FRFA Alternatives. The economist who prepared materials for the PEIS recognized that the managed forests effects were actually part of a future baseline against which the alternatives needed to be compared. Hence the baseline used by the economist (in an appendix) was a different baseline than used within the body of PEIS for making comparisons.

The PEIS should have considered the cumulative impacts of those proposed and future foreseeable actions to address flood impacts not included in the PEIS. One such example of a currently proposed project that has been omitted from the cumulative impact analysis is the U.S. Army Corps of Engineers current consideration of an "Application for a Department of the Army Permit and a Washington Department of Ecology Water Quality Certification and/or Coastal Zone Management Consistency Concurrence" from the Port of Chehalis to fill up to 40 acres of wetlands adjacent to Berwick and Dillenbaugh Creeks in Chehalis, Washington. The associated wetland mitigation site is located adjacent to Stearns Creek near Adna, Lewis County, Washington. This project is not speculative. Given the impact to wetlands within the Chehalis Basin, this project should be quantitatively assessed. The cumulative impact analysis under SEPA is inadequate.

III. QIN SPECIFIC CONCERNS ABOUT CHEHALIS BASIN PEIS

We preface our comments about the PEIS with the following historical context. The QIN did not participate as a member of the Chehalis River Basin Flood Authority, or the process that resulted in the "Governor's Chehalis Basin Work Group 2014 Recommendation Report," the basis for the Chehalis Basin Strategy that is now the subject of this PEIS. Moreover, despite being the only federally-recognized Indian tribe with treaty rights and interests in the Chehalis Basin, we had no input into the recommendations to address long-standing aquatic species habitat degradation and declines in salmon and other fish populations. Our involvement with the Governor's Work Group began on April 8, 2016, with initial attendance by QIN-appointed representative Larry Goodell Jr. in his capacity as our Treaty Habitat Policy Spokesperson, because of the need to protect our federally-protected rights and interests.

A. QIN Concerns with Process

From day one, the PEIS development schedule has been unreasonably compressed. Developing even a programmatic review of the technically, socially and politically complex Alternatives in under a year invites substantive problems and undermines meaningful public involvement. And, not surprisingly, substantive problems are abundant within the PEIS and public involvement has been circumscribed. These problems were most recently made obvious by the short 30-day comment period for the 565-page PEIS, plus its numerous appendices and supporting technical documents. QIN understands the driving factor for this expedited process and abbreviated public comment period is Governor Inslee's interest to develop a budget recommendation for the 2017-2019 biennium for consideration by the Washington State Legislature in 2017. While the QIN supports swift action to address flooding risks and aquatic habitat degradation, the QIN believes

the State of Washington should apply sound science and seize this opportunity to develop a thoughtful and realistic, comprehensive and holistic integrated floodplain management approach that honors treaty rights and serves the entire Chehalis Basin, State of Washington, and the future generations affected by these decisions. Rushing into a decision of this magnitude and import is shortsighted, and calls into question the value and credibility of the PEIS.

QIN has repeatedly called on the state team to take a more cautious and thoughtful approach to the development of the various PEIS Alternatives. See letter dated April 18, 2016 from QIN to Robert Duff; and email communications dated April 29, 2016, RE: Meeting Follow Up. Exhibit B. Moreover, during the many meetings of consultants generating analyses and drafting the PEIS, the QIN and our consultants have repeatedly been in the position of pointing out potential flaws in modeling exercises and other analysis due to the expedited approach. See Exhibit C, email communications dated May 13, 2016, RE: Fresh PEIS Concerns; L. Lestelle Memorandum dated May 11, 2016, RE: EDT Modeling Plan for DPEIS and FPEIS, Exhibit D.

This rushed approach has resulted in confusion and subsequent publications of information after the release of the PEIS. This trickle of substantive documents after public release of the PEIS reduces transparency and effective public participation, which is contrary to one of the stated purposes of SEPA, to "[e]ncourage public involvement in decisions that significantly affect environmental quality." WAC 197-11-030(f).

For example, one addendum was published after the formal publishing of the PEIS on September 29, 2016—the October 17, 2016 Addendum, "RE: Addendum to Chehalis Basin Strategy SEPA Draft EIS." This document was submitted by Ecology 19 days into the public comment period. To add further confusion, not only was the addendum posted on the chehalisbasinstrategy.com website, the text of the PEIS (and associated figures) was changed and replaced with the updated information. However, there was no public disclosure that these changes were made in the actual document. The result is that the new PEIS has different pagination, eliminating easy comparisons of the two drafts. These actions are inexcusable from an open government perspective. In fact, QIN staff spent significant effort reviewing the original PEIS and referencing original page numbers. As a result, the attached Comment Response Table may include both original page numbers and revised page numbers in relation to specific comments. Given the short timeline for PEIS review, and the volume of QIN comments, QIN was unable to verify page number citations.

Another concern was the establishment of a separate "technical blog" at http://cbs-drafteis-blog.com/ offering "Technical Q&A on Draft EIS." This blog answers ongoing questions about the PEIS and provides additional new information to blog readers, but it is not referenced on the PEIS website for PEIS reviewers to have access to the same information. It is unclear to QIN whether this information will be considered part of the official SEPA record. For that reason, the QIN did not review information provided on this blog and, accordingly, is concerned as to how this information may be used by Ecology.

Additionally, after the PEIS was published, a memorandum dated October 12, 2016, was circulated to explain differences between two drafts of the Economic Report. This document was not posted publicly to the PEIS website, yet it admits an error in the assumption of

agricultural crop values. Further, a WebEx discussion occurred on October 25, 2016, including only three representatives of the Governor's Work Group, because "several questions have come up regarding the Economic analysis and assumptions that needs to be clarified and possibly updated. The meeting is intended for us to discuss each of these areas, provide additional information and provide opportunity for input into the assumptions for the final Economics report." See Exhibit E, email communication from Anne Falcon, October 23, 2016. New information was provided and discussed, which prompted additional analysis to update the Economic Report. See Exhibits F and G. All of this information, while relevant to an effective cost benefit analysis, is excluded from the PEIS public review process.

Lastly, a climate change report published July 8, 2016, by the University of Washington Climate Impacts Group provoked a PEIS team discussion of the "causes of flooding" on October 5 – again, after the PEIS was published. Exhibit H, notes from October 5th discussion. It belies common sense that PEIS development would not have begun with an unassailable statement of the underlying cause of flooding, one of the two problems it seeks to address.

Procedural errors occurring during the SEPA process are reviewed under the rule of reason. All of the foregoing represent consequential errors that call into the question the credibility and veracity of the PEIS. All subsequent information released should be clearly incorporated into the PEIS, and the PEIS recirculated for new public comment after all the analyses are completed.

B. QIN Substantive Concerns with Alternatives

1. The Alternatives Lack Specificity

The PEIS provides broad brush characterizations of the Alternatives. It relies on assumptions and generalizations, yet draws specific conclusions and purports to offer a valid comparison of approaches from which the Governor and Legislature should make funding commitments and implementation recommendations. While this analysis of the Alternatives is troubling, the problems with the Alternatives are not limited to a general lack of specificity. The PEIS minimizes the fact that development within naturally flood-prone areas is the root of flood damages within the Chehalis Basin and that a fundamental change in land development and ownership is a cost-effective and prudent action. This "action" should be part of every Alternative and clearly explained. The PEIS lacks a plan for what needs to be done to focus development to areas not currently subject to flooding and that any land use within flood prone areas should be compatible with periodic flooding and have no adverse impact to the ecosystem. In fact, the PEIS seems to facilitate the opposite by reducing reliance on the NFIP, thereby resulting in a likely increase in development in areas that formally would have been considered part of the floodplain.

2. Action Elements are Inconsistently Bundled

The manner in which the Alternatives bundle flood damage reduction and aquatic species restoration Action Elements mutes or dilutes the effects of individual elements and makes it difficult to equitably compare them. Because of this bundling, it is impossible to draw bottom-line comparisons of potentially viable Action Elements that inform reasonable conclusions about

the most appropriate Alternative. For example, it appears to QIN that the dam elements of Alternative 1 are bundled with the ASHAs in an attempt to limit the severe habitat impacts the dams will have. Similarly, the dam elements of Alternative 1 are bundled with two large-scale levee projects to maximize flood damage reductions. However, the same approach is not applied with regard to Alternative 4. There is no explanation as to why Alternative 4 was not bundled with Alternatives 2 and/or 3 to provide substantially more flood damage reduction to the most densely populated areas and critical infrastructure. Similarly, it is mystifying that the FRO/FRFA was not analyzed by itself, without any interaction with the other Large-Scale Flood Damage Reduction Actions. The RFP has been hydraulically modeled as a stand-alone action so the benefits of combining the RFP with other actions are unknown. In contrast, the effects of the reduction in areal extent and flood elevations based on the Alternative 1 (FRO/FRFA) actions include benefits provided by the Airport Levee Improvements, I-5 Projects, and Aberdeen/Hoquiam North Shore Levee. These reductions in flooding (especially in the Chehalis-Centralia area) are not attributable exclusively to the Flood Retention Facility. (PEIS, pg. 261). Thus, comparison between Alternatives 1 and 4 is misleading because Alternative 1 includes results from a combination of actions, rather than the FRO/FRFA alone.

3. The PEIS Does Not Analyze All Alternatives Equally

The PEIS has not provided equal and fair analysis to each Alternative. There are discrepancies in the level of detail in alternative and action descriptions in different parts of the PEIS.

For example, in the Executive Summary, the ASHA description is much longer (over one page) than other alternatives (one paragraph each). Conversely, in the Alternative Descriptions, the RFP description is much longer than the ASHA, at five pages of narrative with seven figures versus a half page of narrative with two figures. (pg. 57). Compounding matters, the level of analysis of the ASHAs is much less than the FRO/FRFA and RFP and yet Alternative 1 clearly relies on the habitat benefit of the ASHA to reduce habitat impacts from the FRO/FRFA dam options. Given the lack of detail regarding ASHA actions, the fisheries benefits, impacts and costs of the ASHA lack credibility.

Further skewing the Alternatives analysis, the dam options have been studied for a considerably longer period of time and in more depth than the RFP Alternative, which only received funding for study in November 2015. It is unreasonable to compare a theoretical holistic restoration approach (the RFP) that has not been fully fleshed out or modeled in detail to a project-level dam proposal that has progressed to the level of developing water temperature predictions and a study of rock sources for concrete aggregate. At minimum, the RFP Alternative needs further refinement and consideration. Refinement of the ASHAs, which are only vaguely and generally described, is ongoing. Because ASHAs are associated with each Alternative, and indeed, purport to moderate the severe impacts reported from the FRFA and FRO, they should be fully described and their impacts fully analyzed. Without comparable study, it is impossible to know whether each Alternative is truly capable of implementation in a manner that would meet the dual purposes of the Strategy.

4. The ASHAs Are Merely Aspirational

The ASHAs, which are included in every Alternative except No Action, are so generally described and leave so many implementation variables to be addressed later that it is impossible to draw reasonable and reliable conclusions about their effectiveness or assurance of implementation. Accordingly, the QIN is concerned that ASHAs represent little more than aspirational concepts. While they are presented as a series of fish-benefit projects, there are not enough details provided and, thus, no assurance or enforceable requirement that restoration at the requisite magnitude will actually be undertaken. Certainty is required given the impacts the proposed projects will have on the QIN's treaty-reserved rights. The only certainty if Alternative 1 is implemented is the certainty of further habitat loss.

Since either the FRO or FRFA will have immediate adverse impacts to fisheries, a substantial implementation of the ASHAs sufficient to offset these impacts would have to be implemented prior to Alternative 1 in order to address treaty interests. In addition, the "high" level of restoration ASHAs are the only way to mitigate the FRFA or FRO in Alternative 1 to achieve habitat goals given existing conditions. ASHAs at the high level appear similar to those employed in the RFP Alternative, although their similarities (or differences) are not discussed or explained. This is highlighted in the figure attached as Exhibit I. Also troubling is that to the extent the ASHAs are similar to the RFP Alternative, they will have significant adverse impacts to the landowners related to flooding and channel erosion – yet this is not addressed or analyzed in the PEIS.

Furthermore, the manner in which stream reaches were selected for modeling ASHA benefits to fish populations was based on their potential benefits from complete restoration (if such restoration could in fact be done) based on earlier EDT modeling; these reaches would have high restoration potential only if they had been previously degraded in a substantial manner. However, reaches that are most degraded would also be the most difficult and costly to restore. If ASHA elements are only implemented where adverse impacts to landowners are avoided, the ASHA high scenario is entirely unrealistic and over-predicts the actual amount of habitat benefit possible. Regardless, given that landowner willingness is a requirement for ASHAs to be implemented, and given the amount of degradation in the system, and given the scale at which the ASHA was modeled, the restoration benefits are overly optimistic. Moreover, planning that is underway to develop ASHAs have found that many landowners may only be interested in providing some amount of access for restoration work if they can also have streambank instability issues addressed. The modeling of ASHAs presented in the PEIS made no allowance for such actions, which would act to reduce restoration effectiveness.

5. The Alternatives Need to Be Analyzed Under the Same Time Horizon

The PEIS presents results of the Alternatives combined with projected benefits of ASHAs, as well as some projections for benefits to occur within managed forests (implementation of the Forest Practices Act). The effects of these various actions have different time horizons associated with them as to when either adverse effects or beneficial effects would actually occur. These different time horizons were not modeled in EDT, making the comparisons between the alternatives combined with ASHAs and managed forests not fully transparent, nor realistic. The

adverse effects of the dam alternatives would be essentially immediate, or at least could be expected to occur fully over a short period (e.g., within 10 years). Similarly, the RFP Alternative would also be expected to have significant (beneficial) effects within a relatively short time period, though it would have even greater benefits realized as some aspects of the alternative matured over time. Benefits of ASHAs would also differ across short- and long-term time horizons, depending on the type of restoration actions assumed (but these types have not been specified in the PEIS). In contrast, benefits from managed forests outcomes would only be realized after the 100 year time frame of the PEIS and only with strict enforcement of current policies. Significant areas such as Green Diamond land within the Satsop are not subject to current state forest practice guidelines since they are managed under a separate habitat conservation plan. How many such areas are there within the Chehalis and what are the differences? Further, the ASHAs in the PEIS are presented as if the outcomes of managed forests are part of the ASHAs, which is not the case. In effect, this makes it look in the PEIS as if the ASHAs would produce much greater benefits to fish than could actually be expected from the ASHAs alone.

Also of concern, the PEIS compares the projected outcomes of the Alternatives to a baseline that is described as current condition. As noted above, however, outcomes associated with managed forests are combined in the alternatives as part of the ASHA, making it appear as if managed forests are mitigating for adverse effects of a dam.

6. Fish Passage Concerns Are Minimized

To be sure, fish passage is a critical aspect of ensuring that some level of salmon production can be maintained upstream of the dam site. While it is unlikely that either spring or fall Chinook could be maintained under either dam option due to inundation of spawning areas (see Attachment 2), some level of Coho and Steelhead production should be achievable with high enough passage effectiveness. Though the PEIS acknowledges that final fish passage designs are not complete, the PEIS minimizes the uncertainty associated with this critical function. As explained in detail in Attachment 2 by Larry Lestelle, fish passage is difficult to design for, and the effectiveness levels that can be achieved remain uncertain until actual construction and evaluation. Fish passage under the FRFA option has even greater uncertainty than under the FRO option; it may be difficult to realize high enough passage effectiveness to sustain any runs in the upper Chehalis. Adequate passage facilities under the FRFA would also be extremely costly. The uncertainties associated with tunnel passage (FRO) also need to be more clearly described and evaluated in the Final PEIS.

7. Spring Chinook Population Data Is Overstated

Finally, the QIN has serious concerns about information related to the abundance and stability of the spring Chinook population being mistaken. As related by Larry Lestelle in Attachment 2, it is likely that the run size is less than commonly believed and may be on a downward trajectory similar to the Queets and Hoh runs. At the least, there is now greater uncertainty about the status of the run and its viability. The PEIS fails to recognize this uncertainty and fails to consider what is needed to maintain the population's viability. EDT modeling does not suffice as a viability risk analysis. A dam would only add to that uncertainty and likely increase the risk of extinction,

potentially triggering an ESA listing. The modest losses in fish production attributed to the area upstream of the dam site presented in the PEIS are directly related to the severely degraded state of that area as a result of past and on-going logging practices. Despite that, the area still provides important contributions to the spatial structure of the populations, particularly for spring chinook but for the other species as well. Furthermore, once these areas are inundated by a dam, future restoration opportunities will be foreclosed; an issue that is especially important to spring chinook.

While aspects of the foregoing substantive shortcomings may be attributed to the short timeframe providing for developing a PEIS for such complicated and multi-faceted options to address flooding, or simply due to the programmatic nature of the PEIS, neither can excuse the PEIS's inadequate Alternatives analysis. However, the QIN believes the unequal level of effort of analysis results in unbalanced comparisons between Alternatives. This, coupled with the flaws underpinning the analysis and as described in Attachment 2 by Larry Lestelle, leads the QIN to the conclusion that the PEIS fails in its ultimate mission of informing decision makers as to the best method to develop both a comprehensive approach to flood damage reduction and to aquatic species habitat restoration in the Chehalis Basin.

In addition to the foregoing general comments, the QIN provides additional specific comments in the "Chehalis Programmatic EIS Comment/Response Table," attached as Attachment 1.

C. Forest Management Assumptions

The PEIS states that: "There is uncertainty as to the long-term effectiveness of riparian maturation in managed forestland. As a result, the effectiveness of riparian maturation in managed forestland was reduced from 100% to a range from 20% to 60% effective in the model to account for this uncertainty." PEIS at 432.

The QIN questions the appropriateness of considering forest practices as a substantial benefit to salmon stocks over the relatively short analysis period of 100 years. While there is ample evidence linking poor forest management with harm to salmon habitat, the QIN is unaware of any studies that demonstrate a causal link between forest management under Washington rules or similar prescriptions and increases in salmon populations. Given there is no evidence presented regarding the magnitude and timing of a fisheries benefit under current rules, and that no changes in forest management are proposed as part of the PEIS, it is inappropriate to consider the effects from this element in any Alternative.

While the forest practice regulations are intended to improve fish habitat over time, it is acknowledged that additional harm to salmonids will continue to occur due to forest practices. The incidental take permit for covered ESA- listed species issued to Washington State under a Habitat Conservation Plan covering the Forest Practices Act and regulations acknowledges this potential harm. In general terms, that means that forestry practiced under Forest Practices Rules continues to harm aquatic species. Even with a net overall benefit compared to historic land use practices, there is likely both short-term and ongoing harm to salmon habitat resulting from forest practices and much of the recovery will be decades into the future. The degree of ongoing harm is site-specific.

The forest practices regulations were written around a passive restoration strategy for riparian function. In 100 years the riparian trees presumably remaining in the riparian areas because of implementation of current forest practice rules will still be relatively young and the natural processes related to large woody debris (LWD) recruitment and subsequent habitat improvements will likely only be just starting. Furthermore, LWD recruitment will only be available in conifer-dominated riparian forests. The spatial extent of riparian forests with a high coniferous component would need to be characterized if this were to truly represent a future source pool for LWD recruitment. A significant percentage of existing riparian forest in western Washington is dominated by red alder, with minimal if any coniferous element, which does not provide LWD recruitment potential.

Under the passive restoration strategy, the trees existing on the landscape when the rules were implemented were roughly 20-40 years of age. In many areas, the channels were nearly devoid of wood due to earlier misguided wood removal actions. To recover the habitat functions provided by large woody material, the existing coniferous trees must age to a point that their size is sufficient to provide stable wood in the channel. Once adequate size is achieved-- at some point beyond a 100 year old forest, depending on stream size--some form of natural mortality is required to recruit those trees to the river channel. The most common processes for recruiting riparian trees to the channel are streambank erosion, mass wasting and windthrow. These processes are episodic and spatially variable across the landscape and will not result in a uniform recovery of habitat function across the landscape. When these processes occur prior to the trees maturing, wood recruitment has little beneficial effect and the timeline is reset. Overall, the recovery from the near complete loss of large wood within the channels will take much longer than the 100-year evaluation period, resulting in ongoing impacts, not benefits to fisheries. Accordingly, and without a quantitative mapping and characterization of riparian forest composition, age and size, the assumption that current management practices will benefit fisheries within the presumed 100-year timeframe is flawed. This underscores the need for the ASHAs to be expanded to include wood placement within managed forests.

Recovery of riparian function has not occurred to date and there is no guarantee it will under the current forest practices regulatory scheme. For one, it is not clear that the current forest practice regulations are properly protecting stream temperatures in fish bearing and non-fish bearing waters. Similarly, the Peery, et al. analysis supports the assertion that high density road networks continue to deliver sediment to streams, even under current rules, and further degrade fish habitat. In areas with particularly high road density, it also appears likely that those impacts may offset or exceed filtering and shading benefits of maturing riparian buffers. With this level of uncertainty, the QIN requests that the model and PEIS authors explain in further detail how continued private forest management can be considered a benefit to salmon stocks. If it is harmful in some ways and beneficial in others, it would be most appropriate to transparently take both of those impacts into account rather than assuming a net benefit.

It is also unclear from the PEIS what uncertainties that are likely to reduce restoration are included in the 20%-60% range of habitat benefit. First, for example, the QIN suggests that the habitat improvement modeling should take into account the lack of protection for many streams in the Chehalis basin. The forest practices rules only meaningfully protect fish-bearing streams.

Absent other protections (such as for unstable slopes or listed species habitat), non-fish perennial streams receive 50' buffers for half of their length or 500 feet, and non-fish seasonal streams lack riparian buffers. WAC 222-30-021(2). In many watersheds, non-fish bearing streams make up more than half of the length of total stream miles.[1] The impacts of lack of restoration on headwater streams are felt downstream (Gomi et al 2012). According to a large body of recent literature, "fishless headwater streams are inseparable from fish-bearing rivers downstream" (Naiman & Latterell 2005).[2]

Second, the model should take into account rates of compliance with forest practices regulations over time. The Washington Department of Natural Resources has long documented troublingly low compliance rates, particularly on riparian prescriptions and stream typing. For example, reproduced below is a page from the 2012-2013 report (the most recent, finalized report):[3]

Table 5:2012 -2013 Compliance with Forest Practices Rules for Riparian and Wetland Harvest Prescriptions

	Status of Compliance	Western Washington					Eastern Washington				Statewide			
		No Inner Zone Harvest	For $ No Outer Zone Harvest	DFC Option 1	DFC Option 2	Np Activities	No Inner Zone Harvest	For $ No Outer Zone Harvest	For $ Inner Zone Harvest	Np Activities	Ns Activities	Type A Wetland	Type B Wetland	Forested Wetland
Small Forest Landowners	# Compliant	4	9	0	1	1	7	2	0	0	3	6	3	3
	# with Deviation	7	2	0	0	0	1	1	0	0	1	3	1	0
	% of Sample Compliant	36%	82%	n/a	100%	100%	88%	67%	n/a	n/a	75%	67%	75%	100%
	Confidence Interval	(12, 68)	(55, 96)	n/a	n/a	n/a	(53, 99)	(23, 96)	n/a	n/a	(20, 99)	(32, 91)	(21, 99)	(30, 100)
	Assessed	11	11	0	1	1	8	3	0	0	4	9	4	3
Industrial Landowners	# Compliant	35	20	17	27	18	21	9	0	6	21	10	13	13
	# with Deviation	12	1	16	20	6	5	2	0	1	0	1	0	1
	% of Sample Compliant	74%	95%	52%	57%	75%	81%	82%	n/a	86%	100%	91%	100%	93%
	Confidence Interval	(60, 86)	(80, 100)	(38, 65)	(43, 71)	(54, 90)	(64, 92)	(55, 95)	n/a	(43, 100)	(84, 100)	(60, 100)	(76, 100)	(67, 100)
	Assessed	47	21	33	47	24	26	11	0	7	21	11	13	14
All Landowners	# Compliant	39	29	17	28	19	28	11	0	6	24	16	16	16
	# with Deviation	19	3	16	20	6	6	3	0	1	1	4	1	1
	% of Sample Compliant	67%	91%	52%	58%	76%	82%	79%	n/a	86%	96%	80%	94%	94%
	Confidence Interval	(54, 79)	(78, 97)	(38, 65)	(45, 71)	(55, 90)	(68, 92)	(58, 92)	n/a	(43, 100)	(80, 100)	(58, 94)	(72, 100)	(72, 100)
	Assessed	58	32	33	48	25	34	14	0	7	25	20	17	17
Population Size Estimate		753	210	140	369	1454	186	75	0	454	1932	215	296	593

1

As the table shows, compliance for riparian prescriptions in Western Washington varies widely and often barely exceeds 50 percent. If it has not happened already, the QIN suggests discounting expected benefits to reflect historic compliance rates. The model should measure actual performance of the regulatory regime instead of ideal performance.

Third, the model should take into account incursions into riparian buffers, such as construction or maintenance of river crossings, stream parallel roads, and likely blowdown or mass wasting events.

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[1] *See* discussion at https://www.epa.gov/water-research/headwater-streams-studies

[2] *See* p. 67 (Supplement B), 166–185, and references cited therein.

[3] The report is available in full here: http://www.dnr.wa.gov/publications/fp_cm_final_report_2012_2013.pdf

Fourth, there are regulatory inconsistencies that should have been factored into the model. For instance, some of the property is under small forest landownership and these forests are managed differently than large landowners under the Forest Practices Act and its rules. There are significant small landowner holdings in Lewis County per the proposed (but not approved) Family Forest Foundation Habitat Conservation Plan (HCP) (2004), which covered 2,350 family forest landowners that represent approximately 134,000 acres of low elevation productive forests, many adjacent to salmon bearing streams, the Chehalis and Cowlitz Rivers. How much of the land outside of Lewis County is classified as small landowner holding, as defined by the Washington Administrative Code 222-21-010(6), within the Chehalis Basin? This is relevant because small forest landowners are allowed more liberal provisions under Forest Practices (including smaller RMZs than for non- small forest landowners anywhere between 20' and 101' under Ch. 222-12 WAC). Accordingly, the maturation of riparian zones as a benefit to salmon will need to take the proportion of timber production in this area that is owned by small landowners into consideration. Similarly, any approved HCP, currently in effect or to be negotiated in the future, would take those covered lands out of the regulatory framework of the Forest Practices Act. QIN is aware of one HCP approved for Green Diamond, which has significant land holdings in Satsop area. QIN is unclear if these considerations were included or factored into the EDT modeling, but they should have been and could significantly affect the outputs.

In sum, the QIN requests a more robust explanation of how the 20% to 60% range was selected and modeled, as well as an explanation of whether those figures account for the impacts of logging and deviations from idealized to actual riparian performance. The QIN is concerned that if the modeling overestimates the benefits of private forest management, it will forecast an overly optimistic future for salmon stocks. That would in turn minimize the perceived risk of harm to those stocks, which would be a crucial mistake that undermines the decision making process and potentially harms the QIN's treaty rights.

There are more practical uncertainties to consider as well. The PEIS examines the impacts of four Alternatives over a 100-year timeframe and applies a static assumption about the regulatory framework during that period. The Forest Practices Habitat Conservation Plan (HCP) and associated Incidental Take Permits covering logging under the state Forest Practices Act and regulations cover a 50-year period and expire in 2056. There is no certainty that the Forest Practices Act and its regulations will remain as they are beyond that, or for that matter, will not be modified prior to 2056. In fact, they are highly likely to change because of new science, to address climate change realities, or in response to other externalities. There may be additional ESA listings that trigger re-opening the HCP. Similarly, it is noteworthy that the current US Fish and Wildlife Services Incidental Take Permit (TE 121202-0) covering forest practices does not cover take of ESA-listed bird, insect or terrestrial mammal species having Critical Habitat in the Basin; therefore, there are no limitations on forest practices for those species.

D. Landslide Hazards

QIN notes that some adjustments were made in the PEIS in response to QIN's prior comments relating to forestry on unstable slopes. It continues to be the case, however, that there is no

evidence supporting the conclusion that Washington's forest practices rules eliminate forestry-related impacts of landslides to water quality. Repeated incidents of landslides occurring following forestry provide at least anecdotal evidence that the opposite is the case. As climate change likely produces more and heavier rains, it is increasingly likely that forestry will cause mass wasting events, debris flows, and landslides, which will adversely impact water quality and salmon habitat.

Additionally, the QIN compared its GIS database from Washington Department of Natural Resources (WDNR) regarding landslide hazards in the Chehalis Basin and discovered significant differences from those reported in the PEIS. The maps at Exhibits J, K, and L combine and depict data from WDNR's landslide inventory, deep-seated landslide inventory, 100K geologic landslide mapping, as well as the results using WDNR's SLPSTAB Predictive Model to map "High Expected Probability of Slope Instability to Shallow-Rapid Failure." The extent of landslide hazards greatly exceeds those included in the PEIS (pp. 115-117) or in the supporting document "Landslide Reconnaissance Evaluation of the Chehalis Dam Reservoir," prepared by Shannon & Wilson, Inc., dated September 22, 2015. The QIN can only assume that the assumptions about landslide failures and contribution of potential sediment input are incorrect. Furthermore, we note that stabilization of unstable slopes is not included in the costs of Alternative 1. Nor is the impact of landslides on sedimentation and habitat within the proposed reservoir considered. Nelson and Dubé (2016) reported that sediment inputs by slides and debris flows into the Upper Chehalis and Stillman Creek have a significant residence time and impact on valley morphology. This work does not appear to be evaluated with respect to the reservoir area. These shortcomings need to be addressed in the Final PEIS.

We also note that one could infer WDNR also has concerns about these potential impacts because of its planned LiDAR collection in 2017, funded in part to "[i]mprove understanding of geologic hazards across the state." See map at Exhibit M, which compares areas of current to planned LiDAR data collection, and Exhibit N explaining WDNR's upcoming data collection plans.

E. Water Law Implications

There are many statements in the PEIS that raise concerns under Washington water laws. These are analyzed in detail in Attachment 5, Flow Augmentation and Water Rights, incorporated herein.

F. Build-Out Analysis

The Build-Out Analysis at Appendix L, and associated references in the PEIS, has significant shortcomings which are fully addressed in Attachment 6 by Larry Goodell, Jr. In short, continued development within the floodplain exacerbates the risk of flood damage. Flood damage, however, is not only confined to dollars and cents and real property. Adverse impacts to aquatic ecosystems are sustained by flood events to varying levels of severity. The PEIS fails to adequately acknowledge development and urbanization as a contributing factor to high flows, including the increase of land clearing, impervious surfaces and pollution, among other impacts, that are associated with development and urbanization. These impacts directly result in adverse

impact to aquatic ecosystems and the species that depend on them. As for development potential, the PEIS must consider more than real estate and dollars and cents. All adverse impacts to the aquatic ecosystems of the Chehalis Basin associated with Build Out must be assessed. Additionally, rather than focus solely on the modeled 100-year floodplain, the development potential of the entire Chehalis Basin, beyond the bounds of the floodplain, must be analyzed and considered.

As previously mentioned, the PEIS does not fully address the root cause of historic flood damages that are related to development within Basin or to account for or protect the QIN's property rights created by the Treaty.

With respect to floodproofing, the PEIS states that "The EIS anticipates a substantially increased level of action with a stable funding source, oriented to making the maximum number of structures resilient to future flooding." PEIS at p. 52. While this anticipated effort is laudable, it badly misses the mark. Not only is such "stable funding" completely unknown and unknowable, the appropriate approach in light of the Endangered Species Act (ESA) and the Puget Sound Biological Opinion is to ensure that there is no more development in the floodplain. Such an action should be considered as an element of each Alternative. Indeed, the ESA's purposes to ensure no action jeopardizes species or adversely modifies their habitat is triggered by the application of the National Flood Insurance Program (NFIP) in Chehalis Basin communities.

On September 22, 2008, the National Marine Fisheries Service (NMFS) issued a Biological Opinion (BiOp) that concluded that continued implementation of the NFIP in the Puget Sound jeopardized the existence of Puget Sound Chinook salmon, Puget Sound steelhead, and Southern Resident killer whales, and adversely modified Puget Sound Chinook salmon critical habitat. The conclusions were based in part on a reduction of floodplain connectivity and access for juvenile Chinook salmon which reduces abundance and productivity of the species. This is because, among other things, the sale of flood insurance enables development in the floodplain that negatively impacts salmon. BiOp at 8 ("[M]ost of the literature related to the NFIP's environmental and developmental impacts suggests that the program encourages, in some manner, the development and environmental transformation of wetlands and coastal areas, or that it does little to impede these impacts.")

Rather than acknowledge this problem, the PEIS turns a blind eye to it. Not only is the BiOp never mentioned by the PEIS, the PEIS suggests that the "building levees or floodwalls around" existing structures or the development of farm pads "constructed of fill [to] provide an area elevated above flood levels to hold livestock and critical farm equipment during a flood" are acceptable approaches. PEIS at p. 52. However, both of these concepts are specifically mentioned in the BiOp as contributing to salmon habitat loss. BiOp at 85 ("Placing fill to elevate properties and building levees to trigger floodplain map revisions are detrimental to floodplain and channel function. Lands that are periodically flooded provide safe off-channel refugia, with abundant food items, for rearing juvenile salmonids during periods of high flow when mainstem channels cannot be occupied, functions essential to decrease mortality in juvenile salmonids. Filling in floodplains to remove them from the mapped floodplain decreases the extent of off channel habitat and impairs the natural processes that create and maintain these habitats, removing these functions. Fill in floodplains also reduces flood water storage. This causes higher

water levels downstream, greater water velocity during high flow events, and increased erosion, which have adverse effects on salmon."). The BiOp further concludes that placing fill in the floodplain diminishes the functional condition of floodplain processes that create and maintain salmonid habitat. *Id.* at 92.

The PEIS's suggested flood control efforts, including use of levees, often exacerbate flood hazards by encouraging human occupation of flood-prone areas. Levees also confine rivers, limiting the potential for creating or re-establishing complex and diverse habitats that are important for juvenile salmon rearing and refuge, such as side channels, oxbows, and floodplain wetlands. BiOp at 12-13.

The BiOp required changes to the implementation of the NFIP in order to meet ESA requirements in the Puget Sound watershed. FEMA offers two ways to meet this ESA requirement:

1. Prohibit all development in the floodway and other areas as specified by the RPA.
2. Enact regulations that allow development that meet the criteria specified in the Biological Opinion by either:
    a. Adopting the NFIP ESA Model Ordinance, or
    b. Enforcing the same requirements in other ordinances, such as the growth management, zoning, or critical areas regulations.

FEMA, Region 10, "Floodplain Management and the Endangered Species Act Checklist for Programmatic Compliance," (November 2013), p. 8.

Given the existence of ESA listed species in the Chehalis Basin, it is prudent to consider adoption of the NFIP ESA Model Ordinance or similar requirements in local land use regulations that restrict development in floodplains as an Action Element in every Alternative considered to address flooding and aquatic species habitat restoration. Any proposed Alternative that does not explicitly restrict future floodplain development and a plan for how to do so fails to achieve the stated purpose and need of the PEIS to provide: (1) a safer future for people and (2) reduced social and economic costs associated with flooding. Any additional development within flood prone areas greatly expands the risk to human life, property, and natural and treaty resources. The only certain way to ensure people are protected is to move them out of harm's way. Examples across the United States have demonstrated that acquisitions and relocations provide a substantial economic and environmental benefit (e.g., Conrad, McNitt and Stout 1998; ASFM 2002).

G. Economic Report

We find the Economics Report to be based on too many unexplained and undocumented assumptions as to make it fundamentally flawed, explained in detail by Resource Dimensions at Attachment 7.

IV. QIN CONCLUSIONS AND RECOMMENDATIONS

The QIN provides the following recommendations concerning the Alternatives. Given that only a select few of the Alternatives will be advanced as part of the Governor's budget recommendation to the Legislature, the QIN focuses on the Alternatives mostly likely to be considered for funding and implementation.

A. No Action Alternative

The predicted impacts to salmon, particularly spring Chinook, from taking no action in the face of climate changes are grim: "Depending on projected changes in climate, spring-run Chinook salmon could be nearly extirpated from the Chehalis Basin, or have substantially reduced populations, primarily as a result of assumed increases in summer water temperature." PEIS at p. 459. The unsustainable legacy of forest practices and land-uses in the Chehalis Basin exacerbate high flows during flood events that negatively impact aquatic species habitat by triggering and compounding channel incision, among other factors. The QIN is, therefore, directly harmed by all flooding in the Chehalis Basin - due to damages to treaty right resources and their habitat. This outcome is not acceptable to the QIN in light of opportunities to address and reverse these inevitable consequences. The QIN agrees that taking no action is not a viable Alternative.

B. Alternative 1: 2014 Governor's Work Group Study Elements[4]

The key difference between this Alternative and the others is that it includes two possible flood retention structures, the FRFA and the FRO. Based on the admitted impacts to treaty right resources (PEIS at pp. 304-36), fish and wildlife, and based on the QIN's analysis of the effectiveness of each of these flood retention elements in relation to the uncertainty and lack of scientific support for the presumed anticipated benefits of ASHA, the QIN cannot support Alternative 1 or any Alternative that includes either the FRFA or FRO.

There is overwhelmingly strong agreement in scientific literature regarding downstream spatial and temporal cumulative impacts of dam alterations of natural flow regimes on downstream geomorphology, riparian ecosystems and communities, and floodplain wetlands (R2 Resource Consultants and TetraTech 2014). Channel narrowing, and decoupling of channel and floodplain surface water hydrology due to the flood control dam capture of peak discharges, are reported to cumulatively result in vegetation channel encroachment and subsequent channel incision, has been a widely reported (Ligon, et al. 1995; Johnson et al. 2012; Marren, et al. 2014). The new, deeper channel requires higher discharges to overtop adjacent floodplains (Ligon, et al. 1995). This type of hydrologic and geomorphic impact has been reported to result in a number of cumulative ecological impacts such as decreased riparian and aquatic species diversity and decreased standing biomass of fish (Ligon, et al. 1995) as well as simplification of floodplain vegetation mosaic and associated riparian and aquatic habitat diversity (Amoros and Bornette 2002; Nilsson and Berggren 2000; Naiman, et al. 2008). Conversely, dynamic, natural flow regimes, like those present in the Chehalis River Basin, have been shown to increase the

[4] The QIN did not participate or contribute to this study.

biodiversity of ecosystems (Power et al., 1996, Magilligan and Nislow 2005, Poff et al 2007, Marchetti and Moyle 2001). Therefore, the QIN believes the impacts of the anticipated loss of habitat and ecosystem function have been greatly underrepresented and inadequately described in the PEIS.

The FRFA will permanently cut off sediment supply from the Upper Chehalis. The PEIS does not provide sufficient evidence that the FRO will be capable of sustaining the natural sediment flux downstream of the dam. Impoundments will occur during times when most of the sediment is moving so large quantities will accumulate within the reservoir reach and immediately upstream. The PEIS fails to demonstrate that periods between impoundments will be capable of removing the accumulated sediment and thus adversely impacting a key natural process essential to fisheries and river ecology. This is particularly critical given that reducing coarse sediment supply will further aggravate channel incision the river has experienced due to historic land use management.

The PEIS leaves mitigation for unavoidable adverse impacts to an adaptive management approach that will be developed during project-level design. However, the PEIS admits "a Flood Retention Facility may cause adverse impacts that cannot be fully mitigated by the compensatory actions described here." PEIS at p. 303. If the impacts cannot be fully mitigated, the promise of future mitigation measures to address the adverse impacts is illusory at best.

This Alternative relies on bundling with the stated habitat benefits of ASHA (though these are only generally described and not fully analyzed) to cancel out or mitigate for the impacts. However, we disagree that the ASHAs proposed can replace those holistic ecosystem functions that would be altered and impacted from the FRFA or FRO. The QIN believes the overall impacts to aquatic habitat and the uncertainties and risks associated with these flood retention structures, and the lack of specificity and analysis regarding the effectiveness of ASHAs, eliminate the viability of Alternative 1.

The flood reduction benefits of this Alternative heavily rely on hydraulic modeling to estimate flood elevations of different flood protection alternatives based on a single set of synthetic hydrographs that have been scaled to represent floods with different recurrence intervals. These synthetic hydrographs are based on empirical approximations of selected peak flow events rather than hydrologic modeling that represents a larger range of possible peak flows. The relative contribution of each sub-basin is static in this framework. In contrast, the historic record demonstrates that the relative contribution of streamflow from each sub-basin to flow in the main stem Chehalis at Ground Mound is variable. For example, in the 2007 flood the Chehalis River above Doty, the South Fork Chehalis River, and the Newaukum River each contributed 66%, 26%, and 16%, respectively, relative to the total streamflow observed at Grand Mound. During the 2009 storm their relative contributions were 40%, 23%, and 26%, respectively (e.g., Table 1 of [Karpack, 2014]). Another issue related to the stated benefits of the FRO/FRFA actions is that there is no analysis or evaluation of the potential effects of multiple and closely spaced atmospheric river events within the basin.

Finally, the 100-year lifetime of the project unduly favors Alternative 1 and undervalues the benefits of restorative flood protection and floodplain buy-outs. Under a timeframe of greater

than 100 years, another dam or major dam retrofits may be required, while no additional costs are incurred with the RFP. The risks involved with aging flood retention infrastructure are not accounted for or analyzed. There is no accounting for the costs and impacts of potential dam failure or eventual dam removal and/or replacement.

Dams not only upend ecosystems, they can erase our shared history and culture, not to mention directly and adversely impact the QIN's treaty-reserved fishing rights. At a time when our State has seen the success of dam removal on the Lower Elwha, the PEIS's preference for a dam project is simply anachronistic.

C. Alternative 4: Restorative Flood Protection

The QIN formally proposed natural, restorative flood protection in October 6, 2015. Letter to Brenden McFarland from Dave Bingaman, Exhibit O. The State of Washington provided funding to retain NSD to develop the requested ecological approach to address flooding and habitat degradation, which began November 2015. The goal of this work was to "provide a screening-level technical assessment of the Restorative Flood Protection approach so that local residents and the people of Washington State can determine if the RFP deserves further consideration and can be part of a long-term solution to improve the quality of life within the watershed." "Preliminary Scientific Assessment of a Restorative Flood Protection Approach for the Upper Chehalis River Watershed," Report by Natural Systems Design, September 2016 (Draft).

Natural Systems Design (NSD) developed the RFP to answer these questions: "Can large scale watershed restoration reduce flooding and flood impacts to residents and communities in the Chehalis Watershed? Is this a viable flood damage reduction strategy?" *Id.* The answers, according to the Technical Report, and as evidenced in the RFP, are yes and yes. Studies from around the United States underscore the economic and environmental benefits of the RFP (e.g., Conrad, McNitt and Stout 1998; ASFM 2002).

The QIN supports the RFP as the Alternative that is best able to meet the goals of the PEIS and protect the federally-reserved treaty fishing rights of the Quinault people. Indeed, the innovative approach of the RFP stands in stark contrast to the backwards looking focus of Alternative 1.

The foregoing critical analyses and PEIS shortcomings under SEPA support QIN's ultimate conclusion that the PEIS is not adequate to support any decisions that chart the course of flood damage reduction and aquatic species habitat restoration in the Chehalis Basin. We recommend refinement of the RFP Alternative and ASHAs, as well as refinement of the social, economic and ecosystem costs and benefits analyses for more equitable comparisons of Alternatives. A Final PEIS that addresses our comments and concerns should precede any decision making about a specific Alternative.

Thank you for consideration of these comments. The QIN will continue to engage in the PEIS process as it progresses to a Final EIS, and will continue to participate through our appointed

policy representative Larry Goodell, Jr. on the Governor's Work Group. The QIN reserves the right to submit additional and further comments. Additionally, we reserve the right to government-to-government consultation with Governor Inslee as needed.

Sincerely,

Fawn R. Sharp, President
Quinault Indian Nation

cc by email (letter only):

Governor Jay Inslee
Maia Bellon, Director, Ecology
Tom Laurie, Tribal Liaison, Ecology
Rob Duff, Senior Policy Advisor to Governor Inslee
Jim Kramer, Facilitator

ATTACHMENT 1

QUINAULT INDIAN NATION COMMENT/RESPONSE TABLE CHEHALIS PROGRAMMATIC EIS CHAPTER 1

	Section	Page	Review Comment
1	1.1	1	*"The Governor and Washington State Legislature have made it a priority to develop a comprehensive response that integrates flood damage reduction and aquatic species habitat restoration within the Chehalis Basin."* C: All actions should have mandatory floodplain regulations to prevent/restrict future development within the floodplain in accordance with NMFS Bi-OP specific to FEMA floodplain regulations (https://www.fema.gov/media-library-data/20130726-1900-25045-9907/nfip_biological_opinion_puget_sound.pdf). Any major WA state investment in capital project on this magnitude would be remiss if it did not lead the effort with a flood reduction strategy that was geared towards not making the situation worse than it presently is. While the draft PEIS describes recommendations to restrict floodplain development, no specific actions are proposed to evaluate the effects, impacts, and likelihood of actions being implemented by local communities.
2	1.2	4	Discussion of flooding inadequately describes the important role of floods in maintenance of ecologic and geomorphic processes including creation and maintenance of important habitats. The opening sentence notes ecological functions, however the remaining text (3 pages all focusses on the negative consequence of flooding. More detail is needed regarding floodplain development creating hazards in areas that are naturally flood prone and thereby create perception of flooding as an adverse response when to some extent the problem is not flooding but rather the problem is development in flood prone areas
3	1.2	5	*"Chehalis River near Grand Mound, the Newaukum River near Chehalis, and the South Fork Chehalis River. These extreme floods caused the losses of homes, farms, and businesses, and floodwater inundation resulted in the closure of Interstate 5 (I-5) for several days. The majority of the flood damage occurred in the cities of Chehalis and Centralia where there is more intensive development in the floodplain."*

	Section	Page	Review Comment
			C: This trend in increased peak flows has been observed in gage records across Puget Sound. How much of the noted flood damages for these events are attributed to the actual hydrologic event versus development within the floodplain regions?
4	1.2	7	*"Modeling estimates that the increase caused by fully protecting or filling the 300 acres behind the levee would increase the 100-year flood level at Anderson Road and Oakville by less than 1 inch"* C: This statement seems to mis-represent the role of floodplain development. The main hydraulic impact in this area is the levee. The evaluation should quantify the increase in water surface due to the levee and not just evaluate the effect of fill behind the levee.
5	1.2	7	*"Literature on this topic supports that extreme floods on the Chehalis River, such as those experienced in 2007 and 2009, are the result of atmospheric rivers that deliver high rates of rainfall in the upper Chehalis Basin above the Chehalis-Centralia area (Neiman et al. 2011; WSE 2014a); however, land uses and floodplain conditions also influence downstream flood timing and extents."* C: This statement gives the perception that land use and floodplain conditions are minor factors in the causes of flooding. Floods are caused by (1) heavy rain; (2) runoff production; and (3) routing through the stream network. All three factors must be considered to explain the cause of extreme flooding in any basin.
6	1.3	9	With water temperature established as a key environmental parameter (ASEPTC 2014), why is re-foresting the floodplain not a part of the ASHA? As new off-channel habitat and wetlands form and new channels develop in the floodplain, they will need shade. Ideally, this shade would be well-established when these features begin to develop.
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QUINAULT INDIAN NATION COMMENT/RESPONSE TABLE CHEHALIS PROGRAMMATIC EIS CHAPTER 2

	Section	Page	Review Comment
1	2.1	15	The fourth bullet points refers to "*refinements to forest practices, … [and] improvement to riparian buffers*" C: Does this mean that the PEIS is proposing a revision of the state Forest Practices? If not, how will forest practices be refined?"
2	2.2	19	C: Geologic and geomorphic description missing from "Local and Regional Setting" section 2.2. For example, Centralia/Chehalis are in a geologically formed bowl.
3	2.2	20	States that "*80% of the Chehalis Basin is forestland,*" and "*54% [is] classified as managed forests.*" C: What is the remaining 26%? Is it USFS land? A lot of that would still fall under managed forest, at least in its current conditions. 26% of the forest is not currently in mature or old-growth conditions.
4	2.2	20	"*Major infrastructure, including I-5 and the BNSF Railway and Union Pacific Railroad lines, cut through the middle of the Chehalis Basin within the Chehalis River floodplain.*" C: How will each of the alternatives affect the rail lines? Their existence is noted but no other details are provided, nor is there a map to help locate the lines.
5	2.3.2	25	Table 2.3-1 (also appears later in PEIS) C: This table shows the five alternatives and whether or not they include an "Action Element." This table is misleading because it indicates the same degree of benefit by Alternatives 1-4 where they overlap, despite these benefits being potentially very different. C2: Table 2.3-1 flood changes have not been modeled with ASHA or local scale flood damage reduction actions, making it difficult to compare Alternatives as they are presented in this table.

	Section	Page	Review Comment
6	2.3.3.1	26	Under description of Flood Retention Facilities (brown box), QIN disagrees that under the FRO, "*the river would flow normally during regular condition or in smaller floods.*" C: The act of retaining water during a major flood would have major impacts on the existing vegetation in the reservoir area (e.g., water retention would kill overstory trees, mid- and under-story vegetation, etc. depending on the duration of inundation). The river would no longer function "normally" due to the lack of vegetation in the area (there would be no more forested buffer along the river) and depletion of large woody debris under the Pre-Construction Vegetation Management Plan. All these effects would change the function of the riverine system, thus, it cannot be said that the river would flow "normally" during regular conditions. C2: Additionally, assessing the impacts of the FRO hinges on the feasibility of the proposed basal tunnel design and its ability to pass fish and sediment in a reasonably natural way. The PEIS does not present any evidence that such a design is technically feasible. See also, p. 259 (River "would continue to be a free-flowing river").
7	2.3.3.1	27	"*One of the goals of the Pre-construction Vegetation Management Plan would be to reduce the extent of tree clearing and vegetation removal in the reservoir footprint and to reduce the amount of woody material that would accumulate in the reservoir during a flood.*" C: This statement is unclear. Does this mean that timber harvest will be occurring within riparian buffers along the upper Chehalis, prior to dam construction? The impacts of harvesting timber along the upper Chehalis River needs to be addressed in this document.
8	2.3.3.1	27	*"Both dam types evaluated in this EIS would be constructed with roller-compacted concrete, which is more cost-effective than other types of construction methods, and would be designed to retain a flow volume similar to the 2007 flood."* C: Historical data will not suffice when looking at a future impacted by climate change. What data was used to determine how much water the dams should be able to retain? Historical or projected levels? 'Some short-term actions taken to lessen the risk from extreme events can lead to increases in vulnerability to even larger extremes. For example, moderate flood control measures on a river can stimulate development in a now "safe" floodplain, only to see those new structures damaged when a very large flood occurs (Chapter 1, section 1.6). –Weather and Climate Extremes in a Changing Climate

	Section	Page	Review Comment
9	2.3.3.1	27	"*This action element is not assumed or intended to result in residential or community development at or around the reservoir.*" C: Where is the guarantee that more development will not occur around the reservoir, nor downstream along the Chehalis River and its tributaries due to decreased flood risk? (i.e., "Build-out")
10	2.3.3.1	27	"*Fish passage facility designs in this EIS are conceptual in nature and would continue to be refined during project-level SEPA analysis.*" C: A full project-level EIS will be necessary if the dam alternative is selected because it is not described in enough detail here.
11	2.3.3.1	27	"*Construction of the FRO or FRFA dam would include development of a quarry site, material storage, material processing, and areas for construction offices and equipment storage.*" C: RCW 17.10.124 requires control of noxious weeds and development of an Integrated Pest Management Plan, which is not indicated in this PEIS. The quarry used should be certified weed-free and equipment be cleaned pursuant to a plan that prevents invasive species.
12	2.3.3.1	27	C: Fish passage facilities are often considered ecological traps if 1) attractive forces lead fish to ascend the passage 2) there is uni-directional movement and/or 3) the environment above the passage has poor conditions for fish recruitment (absence of spawning grounds and nursery areas (Pelicice and Agostinho 2008). There is no mention of fish passage measures associated with the FRO and FRFA reservoir that may further decrease salmon populations. Was this included in the analysis? If not PEIS should include that fish passage not only has <100% effectiveness for fish passage but may also be an ecological trap.
13	2.3.3.1	28	"*Construction would necessitate development of several miles of temporary construction roads to provide access between the materials storage and processing locations and the immediate construction area.*" C: Will these "temporary roads" be decommissioned once the dam is constructed? If yes, will they be ripped? Roads have major impacts on a wide range of wildlife species by reducing habitat effectiveness (e.g., displacing animals to lower quality habitat, increased vulnerability to human-caused mortality, reduced time spent foraging due to increased vigilance, etc). The negatives effects of roads have been widely demonstrated across many taxa. Large mammals, mid-sized mammals, amphibians and reptiles, and most bird species all exhibit predominately negative effects of roads and traffic on their abundance and distribution. A review of the empirical literature on effects of roads and traffic on animal abundance and distribution found that the number of documented negative effects across all taxa outnumbered the positive effects by a factor of 5 (Fahrig and Rytwinski 2009).

	Section	Page	Review Comment
14	2.3.3.1	31	*"The FRO dam would not impede Chehalis River flows under normal conditions".* C: Might not impede "flow" in regards to CFS, but will impede normal functioning and ecosystem processes even when water is not held back.
15	2.3.3.1	31	"*Construction activities would necessitate a detour or bypass road for FR 1000, which is a main access road for Weyerhauser forestry operations. The FR 1000 bypass or detour would also be needed during flood conditions while the dam is in operation and FR 1000 is inundated.*" C: Increased road density and increased vehicular traffic would result in adverse impacts on multiple terrestrial wildlife species. Impact of roads on wildlife behavior is widely documented in the empirical literature (e.g., displacing animals to lower quality habitat, increased vulnerability to human-caused mortality, reduced time spent foraging due to increased vigilance, etc). The indirect effects of roads and increased traffic on wildlife are not acknowledged in the impacts section (Ch. 4).
16	2.3.3.1	31	C: What are the impacts of a concrete batch plant? What kinds of chemicals are used, if any? Is there any risk of toxicity? Need to explain potential impact to fish and wildlife or lack thereof. Not mentioned in chapter 4 at all and must be addressed in a project-level EIS if Alternative 1 is chosen.
17	2.3.31	32	"*Flow augmentation would be timed and designed to increase flow and decrease temperature in the upper Chehalis River downstream of the dam*". C: How would augmentation flows be guaranteed? Under Washington water law, there is no guarantee that water in reservoir wouldn't just be used by senior water rights holders (e.g., farmers) during years with low precipitation. With longer dry spells forecasted due to climate change, QIN anticipates an increase in conflict over water needs (i.e., needs for fish vs. needs for water rights holders).
18	2.3.3.1	33	The first paragraph states without detail "*The FRFA dam would not incorporate hydropower facilities as part of this proposal.*" C: Given the amount of research that has gone into looking at the potential or building or adding hydroelectric power generating capacity to the proposed FRFA dam, the document needs more detail that the above statement provides. Generally, they have found a positive benefit/cost ratio and there remains interest in adding power generation to offset the costs. Given the amount of interest and research we recommend more analysis, and an explanation of the decision making process that resulted in the above statement.

	Section	Page	Review Comment
			In my review of the document "Chehalis_Dam_FishPass_TMv7-30-14" it notes: "Hydropower evaluation indicated additional costs of 20-25 million, 24,000 MWH electricity production (average annual value). Indicated "moderate to high likelihood of positive cost benefit ration for hydropower..." indicating a positive benefit cost ratio for hydropower on this dam. There are other references to hydropower in this document indicating substantial work has gone into looking at hydropower potential. The document "Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species *Comparison of Alternatives Analysis,* Final Report September 15, 2014, Prepared by: EES Consulting, Inc., and HDR, Inc. Prepared for the State of Washington." This document covers potential hydropower operation extensively and found a likelihood that operating hydropower facility within the parameters of providing summer supplemental flow was marginally cost effective. At the technical workshop held May 7, 2014 the possibility of adding hydropower to the dam after completed was mentioned and details of the analysis provided. The proposal was to operate as part of the flow augmentation operation of the option now referred to as the FRFA. Additionally, the issue has been raised fairly consistently as a method of paying for the dam; the most recent was at the Policy Workshop held October 11, 2016 where it was broached by one in the audience. Given the amount of previous analysis and the ongoing interest in using hydropower generation to offset the costs of the dam, the PEIS needs more detail covering the subject. It also needs to address the possibility of adding hydropower generating capacity at a future date.
19		38	Precise ASHA area is difficult to determine, it ranges from 20% of 21 RM and 20% of 1150 acres to 60% of 214 RM and 60% of 9750 ac, for a total of 4.2-128 RM or 230-5,850 ac. Presenting these areas as a percent of a range of scenarios is confusing.
20	2.3.3.1	39	*"At this planning-level stage of the process, the completed analysis is very coarse. A more detailed, site-scale analysis would be required to determine the areal coverage over which Restorative Flood Protection actions would be necessary to achieve the most substantial downstream flood damage reduction."* C: Some alternatives' analysis is very coarse while others are very detailed. QIN believes any decision based on this PEIS will not be an informed one.

	Section	Page	Review Comment
21	2.3.3.1	39	"*For purposes of this EIS, it is assumed that approximately 85% to 90% of the opportunity areas would be restored....*" C: Why 85-90%? How was this number chosen? Could Alternative 4 be effective if only 70% of opportunity areas were restored? Without proper evaluation of minimum area necessary for desired effectiveness, an accurate feasibility and/or economic cost analysis cannot be completed.
22	2.3.3.2	52	"*Farm pads*" C: Will these be constructed in areas already classified as "farmland", or will they be created through conversion of forests or other non-farmland cover types? If the latter, the impacts of this action should be analyzed.
23	2.3.3.2	53	"***Land Use Management*** *This action element involves local governments improving and revising land use regulations and practices. Improved Land Use Management would protect remaining floodplain functions and prevent future flood damage by minimizing floodplain development*" C: PEIS should expand upon the specific land use regulations and practices to be implemented as part of the local projects component of the PEIS. C2: The actions of improving and revising land use regulations to minimize floodplain development and preserve open spaces are only *recommendations*. There is no guarantee that these actions would occur but this is listed as an action under every alternative, to which environmental benefits appear to be attributed, and possibly fish abundance through EDT modeling (but that is not clear from the PEIS). This is misleading at best and likely results in incorrect assumptions and/or conclusions.
24	2.3.3	55	"*Filling anywhere in the floodplain would either be prohibited or compensatory storage would be required.*" C: Compensatory storage per the standard definition doesn't necessarily provide a 1:1 effect for proposed fill. Compensatory storage criteria should be require to provide equivalent conveyance in the same sub-reach as fill proposed.
25	2.3.3.3	57	"*Not all of these river reaches are likely to be restored under either restoration scenario, since restoration would be dependent on landowner willingness*"

	Section	Page	Review Comment
			C: This statement is in conflict with the stated goals to "restore bank erosion to naturally occurring rates" and "reconnect the floodplain". This suggests habitat benefits from the ASHA are overstated. Please explain how land owner willingness was considered within the draft PEIS and how lack of land owner willingness will affect the stated habitat benefits for each alternative. C: The ASHA and RFP are both dependent on landowner willingness to either sell property or allow flood easements. While the RFP includes quantification of needed buyout properties and relocation costs, the ASHA does not identify specifics of land acquisition outside of a riparian buffer. The most degraded reaches were selected for ASHA actions and these may not be the landowners willing to provide land for the ASHA. Therefore, the benefits of the ASHA reflect the minimum or no amount of land required (costs) for then assumes maximum benefit is achievable skewing the cost benefit ratio for the proposed actions. Given the amount of restoration proposed and stated goals of floodplain reconnection, bank migration, and re-initiated geomorphic process land acquisition costs for the ASHA will likely be significant. If land acquisition is not pursued then the benefit for the ASHA will be dramatically less than current EDT modeling results predict
26	2.3.3.3	57	"*Restoration of riparian and off-channel habitat would include adaptive management and monitoring to ensure these efforts are effective in meeting the goals....*" C: Will funding for monitoring automatically be included when ASHA's are funded? One of the biggest limitations of ecological restoration is lack of continued monitoring for restoration effectiveness. Monitoring is typically written into restoration plans, but funding is not provided. QIN would want to see funding for monitoring the effectiveness of ASHA's provided from the start. "Adaptive Management" cannot occur without monitoring efforts.
27	2.3.3	57	C: Make alternative descriptions the same level of detail and length. For example, the RFP description, at 5 pages of narrative with 7 figures, is much longer than the ASHA, at 1 ½ pages of narrative with 2 figures.
28	2.3.3.3	58	"*This action element would be...maintained adaptively over the long term to ensure effective restoration for aquatic species in the Chehalis Basin.*" C: Again, funding for long-term monitoring must be secured at the start in order to "ensure effective restoration".
29	2.3.3	58	"*The restoration actions identified in the final ASRP (being prepared by winter 2017) are dependent upon site conditions and landowner willingness, and would likely be within the low and high restoration scenarios*"

	Section	Page	Review Comment
			C: Based upon the information provided in the draft PEIS we disagree that final restoration actions that consider site conditions and landowner willingness are adequately bounded by the high and low restoration scenarios. It is likely the habitat restoration benefits for both these scenarios over-represented in the analysis provided. The lack of detail on specific actions provided on the ASHA does not allow for adequate evaluation of the likely benefits and impacts of this element.
30	2.3.3	58	"*This action element assumes the improved function of riparian areas on two types of lands within the Chehalis Basin: publicly and privately managed forestlands, most of which fall under the Washington Forest Practices Act (FPA) and Habitat Conservation Plans (HCPs);*" C: PEIS should include reasoning behind considering riparian improvements under current FPA actions. Current FPA actions have been in effect since 1974/1999 and QIN disagrees that there would be any improvement under the FPA beyond what has already been realized. Any consideration of improved riparian actions related to current (no proposal to change) FPA is inappropriate and should be removed from analyses and description of project effects. If effects of FPA actions are to be considered as part of the PEIS these should be considered as part of the "no-action" alternative as they are not actions proposed to occur as part of Alt1-4.
31	2	58	*"Restoration actions"* uses exceedingly vague language, including: *"adaptive management"* and *"monitoring."* How is it possible to quantify the benefit of restoration actions given this vague language?
32	2.3.3	General	C: A reduction in floodplain inundation and duration as part of Alternative 1 will decrease groundwater recharge (Trust et al. 2000, Westbrook et al. 2006, Stanford and Ward 1993, Ward 1989). This effect may offset stream temperature benefits from the FRFA component of Alternative 1. How was this evaluated as part of the draft PEIS and habitat evaluation?
33	2.3	59	Figures 2.3.13 and 2.3.14: The area in the upper Humptulips, Wynoochee and Satsop is not wilderness area or national park. It is forest service land, and has had the old growth timber harvested and contains an extensive forest road network. Some of these areas retain some level of timber harvest even under the NW Forest Plan. Mapping it as national park or wilderness is misleading.
34	2.3.4.1	63	C: The section on WSDOT is incomplete. The culvert removal of blocking culverts is part of a court ordered action and is expected to be completed in 17 years from March 2013. The current level of expenditures will not meet this requirement so we should assume increased funding until 2013. WSDOT

	Section	Page	Review Comment
			is required to maintain culverts in a passable condition following this initial correction. Under a 100 year timeframe we can assume increased funding over the short term with stable funding level after 2030. Assuming status quo is an incorrect assumption regarding WSDOT culverts under state highways.
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QUINAULT INDIAN NATION COMMENT/RESPONSE TABLE CHEHALIS PROGRAMMATIC EIS CHAPTER 3

	Section	Page	Review Comment
1			*"Due to the size and geographic variation of the Chehalis Basin, the effects of atmospheric river events may be concentrated in one area, but the area and amount of precipitation will depend on the orientation of the event as it arrives in the Chehalis Basin. The strongest effects of any given event could be centered on the Willapa Hills, the Cascade Range foothills, or the southern Olympic Mountains."* C: The variability in flow contributions from the 3 contributing sub-basins to a 100-year flood at Ground Mound are not accounted for in the presentation of benefits and impacts, nor is the uncertainty associated with using just one realization of a 100-year flood event at Grand Mound discussed. The flood retention benefit of a dam on the main stem Chehalis for a 100-year flood at Ground Mound will vary depending on what percentage of peak flood discharge at Ground Mound is generated in the main stem, versus in the South Fork or in the Newaukum basins. For example, the number presented - a 1.8' decrease in inundation height during a 100-year flood is based on ... The only mention of this variability is presented in Table 4.2-2 as differences in flood attenuation of peak flows for 3 historic floods, but without translation to flood elevation.
2	3.1.2.2	83	*"The effects of forest practices on peak flows have been evaluated through a literature review by the University of Washington"*. C: The statement suggests that an analysis of forest practice was completed as part of the EIS process and that is not the case. The UW report referenced did not EVALUATE effects of forest practices as suggested in text. It is a simple lit review with no technical analysis of the Chehalis Basin. The conclusions of the report include a recommendation to study the effects of forest practices (combined with effects of climate change) in a modeling framework.

	Section	Page	Review Comment
3	3.1.2.2	83-84	C: The unnumbered graph of the Peak Flow Rates for major Chehalis River Floods clearly labels the second highest flood as occurring in 1995, the text at the top of page 84 lists 1996. This error needs to be corrected.
4	3.1.2.4.1	88	*"Long-term Water Quality Trends"* C: There should be a determination of the existing water quality conditions in the water bodies impacted by the proposed construction and operation of the FRO and FRFA. Evaluation and current water quality standards are being met or not met.
5	3.1.2.4.2	89	C: The discussion of lack of riparian forest, shallow water depts., and direct solar heating is all correct, but they need to mention the effects of the altered, simplified channel, the altered hyporheic flows due to stream incision and channel simplification. They need to add a simplified channel and altered hyporheic flows as an issue that is affecting water temperature. Tim should cover in more depth. I found a couple of references outlining the importance of the hyporheic flows and how they affect stream temperatures, DO, and nutrients. Also should address any change in groundwater depth due to water withdrawals. Shallow groundwater often influences water temperatures, and nearby wells can eliminate this water source.
6	3.1.2.4.2	89	C: The last paragraph notes water temperatures of 28° C on July 29, 2009. This temperature is within the range of temperatures that can cause mortality in salmonid fish. The predictions of higher temperatures in the river increases the likelihood of temperature related mortalities – this needs to be evaluated in the document. While they acknowledge exceeding the temperature standard, the issue goes beyond simply exceeding a number in the regulations since it is at a level that can kill salmon. Optimal temperatures for salmonid fish ranges from 12° C to 14° C (MacDonald et al. 1991; Rashin et al. 1993). Lethal temperatures are variable depending on acclimation temperature and other factors (Konecki et al. 1993). Lethal effects on salmonid fish have been observed at temperatures of 23° C to 29° C (Rashin et al. 1993), and between 20° C and 25° C (MacDonald et al. 1991).
7	3.1.2.4.4	92	C: Section on pH is inadequate. The earlier section on temperature contains some values to describe the level of the problem while this section only notes that it was listed by DOE as a water of concern. Some pH values need to be added to put some context to the issue.

	Section	Page	Review Comment
8	3.1.2.5.3	96	C: Notes that the Skookumchuck dam is located at river mile 22. It mentions later that only the Wynoochee dam has fish passage, but it needs to be clearer that the dam totally blocks salmon and steelhead passage.
9	3.2.3	117	C: Figure 3.2-3 needs outline of proposed reservoir for reference.
10	3.2.4	118	C: This section should describe the process of valley formation and map the extent of alluvial deposits. The reviewer should be given the geomorphic context that much of the valley bottom areas where flood hazards exist are alluvial features that were formed by the river.
11	3.2.4.1.2	118	C: Introduce CMZ as planning level tool to define a corridor within which migration likely to occur. In some locations, CMZ can extend outside of 100-yr floodplain.
12	3.2.4	120	"*The analysis concluded that the channel migration takes place mostly during small floods (1- to 2-year), in areas that are not confined by bedrock, bank protection, or infrastructure.*" C: PEIS should expand upon how all alternatives will affect the frequency and duration of small floods. How was the effects from likely reduced channel migration taken into account during the effects analysis?
13	3.2.4	124	"*Of this sediment, 2.7 million tons was coarse sediment delivered in the Chehalis River headwaters, 180,000 tons was delivered between the headwaters and just north of Pe Ell (Doty gage), and 934,000 tons was delivered in the South Fork Chehalis River watershed*" C: How would the alternatives considered perform under similar circumstances? What proportion of storage is expected to be lost under both the FRO and FRFA for Alternative 1?
14	3.2.4.4	126	"*Based on an aerial photograph interpretation, the reaches of the mainstem Chehalis River with the most active channel migration (Reaches 2 and 4) also have the potential for active LWM recruitment.*" C: Discussion should clarify that riparian areas with potential for wood recruitment are generally dominated by immature forests with small, young trees and few trees remain that are sufficient in size to function as stable key pieces. Recruitment of key pieces is critical for retention of smaller wood pieces in transport and for development of stable log jams that increase hydraulic variability and channel complexity. Given the absence of key pieces and stable logjams in the Chehalis River, most wood recruited the channel during flood flows are generally flushed through system and the natural function is impaired.

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15	3.2.4	126	"*This is due to wood removal efforts after the 2007 flood*" C: What assurance is there that current proposals that include the re-introduction of wood will persist through time and not be removed or modified by local landowners and municipalities? This current absence of LW suggests that long-term benefits of the ASHA will likely diminish over time without programmatic efforts to prevent removal efforts.
16	3.3	127	According to the WA Dept. of Ecology description of 2011 Modeled Wetlands Inventory: (http://www.ecy.wa.gov/programs/sea/wetlands/StatusAndTrends.html) *"The locations of mapped wetlands are approximate due to the medium resolution scale – each pixel equals about ¼ acre. Therefore, wetland boundaries are accurate only within 100 ft." "Wetlands less than 1-acre were likely not mapped."" Absence of a wetland on the map does not mean absence of wetland in the field." -* C: Wetlands greater than 1/10th of an acre are considered jurisdictional wetlands according to the Army Corps of Engineers. These wetlands must be delineated within the flood protection area. Remotely sensed wetland data should not be used to make regulatory assumptions.
17	3.3	127	C: The wetland report for a project of this magnitude should be as extensive as the wetland chapter of the BPA I-5 corridor Reinforcement Project Environmental Impact Statement (https://www.bpa.gov/Projects/Projects/I-5/eis/Chapter_16_Wetlands_FEIS.pdf) Maps of similar detail should be produced from equally extensive field investigations of the preferred alternative. All wetlands adjacent to the Chehalis River or their hydrology is affected by the river must be field investigated in a project-level EIS for any chosen Alternative.
18	3.3.4	134	C: The proposed impacts to vegetation should be described in as much detail as the Vegetation chapter of the BPA I-5 corridor Reinforcement Project Environmental Impact Statement (https://www.bpa.gov/Projects/Projects/I-5/eis/Chapter_17_Vegetation_FEIS.pdf) See additional comments below for a list of state and federally threatened and endangered plant species that could potentially be present in the affected area. C2: There must be a section on Lichens and Bryophytes included in the vegetation section. WA DNR maintains a list of rare and endangered byrophytes and lichens. A summary of this list is as follows: "In 2011, Northwest Lichenologists (a non-profit) obtained funding from the U.S. Forest Service and the Bureau of Land Management to conduct a comprehensive review and to make recommendations to the

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			Natural Heritage Program regarding the status of rare lichens in Washington. The committee proposed that 28 taxa be considered Endangered, 13 Threatened, 11 Sensitive, and 1 Possibly Extirpated from Washington. In addition, they identified 23 taxa that should be monitored and 7 taxa with taxonomic questions. The committee's recommendations are currently under review by DNR." Potential Habitat for each of the following species, therefore, should be identified on maps with sufficient resolution to allow DNR to manage state and private lands for newly found populations. Populations must be mapped and described using a GPS to within 1 meter accuracy. See Tables of Lichens and Mosses following this Matrix. The lists can be found here: http://www1.dnr.wa.g ov/nhp/refdesk/lists/lichens.html and here: http://www1.dnr.wa.gov/nhp/refdesk/lists/mosses.html C 3: The Washington State Natural Heritage Program provides a list of rare and sensitive vascular plant species. Each of those species that may exist in the project area must be field investigated and mapped using GPS to within 1 meter accuracy. See Vascular Plant List following this Matrix. The list can be found here: http://www1.dnr.wa.gov/nhp/refdesk/lists/amp_nh_vascular_ets.pdf)
19	3.3.4	137	C: The "Herbaceous/Grassland" and "Prairie Oak" vegetation zones support the following federally endangered species: Mazama Pocket Gopher (*Thomomys mazama*), Streaked Horned Lark (*Eremophila alpestris strigata*), Taylor's Checkerspot butterfly (*Euphydryas editha taylori*), and Golden Paintbrush (*Castilleja levisecta*). These vegetation zones must be surveyed and mapped within the project area in order to assess the potential impacts to these species.
20	3.3.4.1	138	C: The table, as well as Table 3.3-2 lists priority habitats based on DFW decision and it identifies riparian habitats. The document does not describe the conditions of riparian habitats in any detail, acknowledges that they are degraded in places but little else. Given the importance of riparian forests to fish, water quality, and stream geomorphology it needs more detail, or if more detail is not available then it needs to identify it as a data gap and recommend a strategy for correcting the gap.
21	3.4.1.1.1	141	C: The sentence describing the distribution of salmon etc. leaves out cutthroat trout. The document needs to include cutthroat in its analyses and identify the associated data gaps. They are widespread throughout the basin, and since they have been proposed for ESA listing at least twice this species needs to be addressed by providing what data is available and identify the data gaps.
22	3.4.1.1	142	*"Among the rivers surveyed, juvenile salmon densities were highest in the upper Chehalis River (Zimmerman and Winkowski 2016)."*

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			C: : Alternative 1 would negatively impact these (and future generations of) juvenile fish by reducing the amount of habitat available as well as the future potential productivity and connectivity of this habitat. A reduction of this habitat could potentially increase competition among juveniles downstream. Increased competition would be another negative stressor on these fish.
23	3.4.1.1	142	*"Densities of steelhead and Chinook salmon were greater at sites within approximately 1 river mile of the proposed dam site than other sites farther away." And "Juvenile Chinook salmon were observed only within approximately 1 river mile of the proposed dam site."* C: It does not state whether the location is approximately one mile upstream or one mile downstream of the proposed dam site. If it is upstream, obviously that habitat would be lost with a dam. If the location was downstream, that would limit the potential migration of juveniles while foraging, escaping high flows or high temperatures, or hiding from predators to only downstream. It would also change the flow pattern that these fish have evolved with, and thus may negatively alter the emigration of juvenile fish. C2: Because this data has only been collected for the past couple of years (2013-2015) the accuracy of this information could be greatly biased and in no way should be interpreted as fact.
24	3	144	Table 3.4.2. C: The number of redds are quite large in this table, which will absolutely have an effect on future populations if lost or reduced. Please elaborate on how the FRO may impact salmon populations with this loss (projected estimate of impacts to future populations).
25	3	144	*"Within the Chehalis River, there is some uncertainty about the Chinook salmon population structure; additional genetic work is being conducted to determine if the current population designations are accurate (WDFW 2015a)."* C: This is the only mention of genetics in the PEIS. The potential loss of genetic diversity among various salmonid populations, especially Chehalis Spring Chinook due to their low numbers, is significant. C2: Genetic diversity is extremely important in the face of climate change (and other factors). The potential loss of genetic diversity by the creation of a dam is significant

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26	3	144	Under section "*Chinook Salmon*," "*additional genetic work is being done to determine if the current population designations are accurate.*" C: QIN requests elaboration as to whether there are less or more populations than thought. How many distinct population designations may be affected by the alternatives based on current knowledge?
27	3.4.1.1.2	147 - 148	C: Lack of habitat diversity resulting from a lack of large woody material (LWM) is discussed as a limiting factor. Is frequency of LWM included in EDT modeling?
28	3.4.1.1.2	148	"*Where urbanization has occurred, fish habitat complexity and access is reduced compared to historical levels, which is attributed to roads, buildings, levees, culverts, water withdrawals, and waste discharges. Until the 1950s, unregulated instream gravel mining to support road building directly damaged fish habitat in tributaries of the Chehalis River.*" C: This statement is incomplete. At a minimum it needs to acknowledge that streams were moved, channelized, and placed in culverts. A proper analysis should document the creeks that have been moved etc. in a table, or on a map. For example, Fry Creek in Aberdeen and China Creek in Centralia both have been moved, straightened, and run under developed portions of the cities in long culverts. While this text addresses urban creeks, the PEIS needs to acknowledge that creeks were often channelized and moved in the farm land as well.
29		148 - 149	"*Within the Chehalis Basin specifically, the impacts of habitat alteration have been estimated for several salmon and steelhead species using the Ecosystem Diagnosis & Treatment (EDT) model (ICF 2016). The results of this analysis indicate that each species is influenced by a different set of habitat alterations and factors that limit the suitability and availability of habitat (limiting factors). For coho salmon, spring-run Chinook salmon, and winter-run steelhead, the dominant limiting factor is lack of habitat diversity and quantity, as controlled by flow. Low flow is a limiting factor for coho salmon and Affected Environment Fish and Wildlife Draft Chehalis Basin Strategy Programmatic EIS 149 steelhead, with lower production following drier summers and higher production following wetter summers (Seiler et al. 2002). The lack of habitat diversity reflects historical and current land use practices that have limited the quantity and recruitment of instream LWM that would otherwise provide rearing habitat for salmon and steelhead. For fall-run Chinook salmon, channel stability and lack of habitat diversity are the top-ranked limiting factors at a Basin-wide scale. These reflect the artificial confinement of the river channel and widespread lack of floodplain access, as well as limited LWM. As a result of these and other limiting factors (see ASEPTC*

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			2014a for a comprehensive review), the existing habitat within the Chehalis Basin supports substantially fewer adult salmon and steelhead annually (ASEPTC 2014a) than would be expected under pre-European settlement conditions (see Table 3.4-3)." C: This paragraph claims that the limiting factor for spring-run Chinook in the Chehalis Basis is lack of habitat diversity and quantity, as controlled by flow. Low flow is not included as a limiting factor (it is for coho salmon and steelhead). Thus, increasing habitat diversity and quantity is a more important immediate action to protect the spring-run Chinook. Further, an FRO or FRFA dam facility would exacerbate the problems for spring-run Chinook by homogenizing flow, which would further decrease habitat diversity and quantity (their limiting factor).
30	3.4.1.1.2	148	*"The estuarine habitat within Grays Harbor has been altered by timber harvesting, polluted by pulp mill operations, and reshaped by dredging..."* C: This paragraph needs more detail to describe the amount of work and the timeframe where it occurred. The Corps of Engineers were working on altering Grays Harbor through wood removal (snag removal), dikes, channelization and dredging at least by 1890 (Secretary of War, 1895). They simply state that it has been changed, but there needs to be some indication of the magnitude of the change, and the timeframe where this change occurred (over a century). C2: In the same paragraph it mentions "dredging to support log exports" but the channel modifications were to support much more than log exports. The dredging was to support general commerce and navigation. See, Report of the Secretary Of War; Being Part of the Message And Documents Communicated to the Two Houses Of Congress, Beginning of the First Session Of The Fifty-Fourth Congress. In Three Volumes. Volume Ii-In Seven Parts. Part 5. Washington: Government Printing Office, 1895 pp 3405-3416 and 3517-3433.
31	3.4.1.1.2	149	*"The distributions of juvenile coho salmon, subyearling trout, redside shiner, and dace were also influenced by habitat characteristics, such as substrate size, pool frequency, and wetted width measured on a smaller spatial scale, within 1 km reaches."*

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			C: The PEIS did not record riparian conditions in these areas but should have or this should be noted as a data gap.
32	3.4.1.1.2	152	C: The paragraph just above table 3.4-5 documents fish other than salmon and steelhead found in the reservoir footprint. It needs to be more clear when it notes that Pacific lamprey ammocoetes were only found in this area, thus could be extirpated from the upper watershed. These fish are important to the tribes and are part of the reserved fishing right.
33	3.4.1.3	155	C: Just before section 3.4.1.4 is a paragraph on freshwater mussels. It seems to just hang there without context. It has no context on the habitat, it mentions high densities without quantification, and then ends with an ambiguous statement about not knowing the distribution or species composition of freshwater mussels in the watershed. It needs to be clearer, and should identify the data gap.
34	3.4.1.4	155 - 156	C: In describing "*Commercial Fisheries*," the PEIS fails to recognize that the vast majority of harvest of Chehalis Basin chinook salmon takes place in Canadian and Alaskan waters. "Washington coastal indicator stocks exhibit a mortality distribution consistent with a far north migration pattern. [From 1979 to 2013], "[o]n average, 86% of all fishery-related mortality, which accounts for approximately a third of total mortality, results from fisheries occurring north of the US and Canada border." Pacific Salmon Commission Chinook Technical Committee, 2014 Exploitation Rate Analysis and Model Calibration, Vol. 1, 51. In addressing commercial fishing, the PEIS should look beyond the Chehalis Basin itself to recognize and take account of the role of these impacts on Chehalis Basin stocks.
35	3.4.2	157	"*Wildlife*" C: Section 3 should describe how they would survey for species that are shy, nocturnal, crepuscular, or may use the habitat in the proposed PEIS areas during the fall and winter or seasonally. In addition to direct observation methods for identifying these species could include trapping, searching for signs such as prints, markings or scats.
36	3	158	"*WDFW is currently in the process of performing multi-year wildlife surveys as part of their development of the ASRP. WDFW has released preliminary distribution data from four amphibian surveys.*" C: It is necessary to have statistically sound data to understand what will be lost potentially through alternative actions. It seems these amphibian survey results are preliminary. The final results (peer reviewed) should be available and in order to understand what the impacts of the alternatives may be to amphibians.

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37	3.4.2.3	161	*"Birds"* C: PEIS should consider surveys for those species impacted by the indirect effects, such as disturbance, and survey with disturbance buffers in mind. For example, survey may reside outside the project areas but within the indirect effects area of the proposed projects. C2: QIN has a concern of the disturbance and impacts to raptors and their nests. QIN recommends that additional surveys be conducted in the indirect disturbance buffer of the proposed projects. The surveys should conduct raptor nest surveys, unless construction will be planned outside of the breeding season and projects will not remove/degrade raptor habitat. C3: In reference to the Evenson 2016 document, these show preliminary results. Given that this study likely was initiated in order to inform the decision process for choosing alternative actions for this PEIS, it is imperative that this study is completed before concluding what any effects may be to waterfowl. This study describes the use of the Chehalis Basin by important wildlife species that will be affected by each alternative action.
38	3.4.3	168	"*Among the most significant of predators [of the Oregon Spotted Frog] are the various introduced species of fish and bullfrog (McAllister and Leonard 1997).*" C: Alternative 1 would likely increase the risk of predation by non-native species. On page 298, the PEIS itself states: "Disturbances to habitats of native species provide opportunities for the invasion of non-native wildlife species (e.g., European starling and American bullfrog) that could prey on or out-compete native wildlife species for resources".
39	3.4.3.1	168	C: Listed "Birds and Mammals" section has very limited description. Also, bald and golden eagles should at least be mentioned here. Although not federally or state listed as threatened or endangered, they are protected under the Bald and Golden Eagle Protection Act and are considered "species of concern" in Washington State.
40	3.5	170	*"Tribal Resources"* C: QIN recommends a survey be completed for locations and types of cultural resources and historic sites within the potentially affected areas.

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			C2: PEIS doesn't make clear if there are any locations and types of Indian trust Assets within the proposed alternatives.
41	3.7.5	180	C: The PEIS presents analyses of climate change impacts based on a 66% increase in peak flows resulting from climate change. A 66% increase in peak flows resulting from climate change is an over-simplification of an analysis that utilizes a range of future climate projects in order to bracket some of the uncertainty in using Global Climate Model projections to model future streamflow. Whereas a single number is perhaps useful for communication, some effort to include a range of future streamflows needs to be considered, particularly in analyses that assess the future efficacy of flood protection benefits. For example, Table 4.2-12 (p310) presents the effect of a dam on a future 100-year flood. However, within the envelope of projected climate impacts on 100-year flow magnitudes, do you reach a point where the fixed volume capacity of the flood retention facility to buffer a peak flow is overwhelmed by the magnitude of the peak flow?
42	3.10	193+	C: This section is somewhat limited and largely states that there are a variety of regulations in place. It gives no useful detail on what is allowed where, what is not allowed, etc. There needs to be some quantification of floodplain regulations by government. It would be helpful to include a map of the jurisdictions and a summary of what is allowed to occur in the floodplain for each jurisdiction.
43	3.10.1	193	C: It states that the GMA requires protection of critical areas and names many specific types of critical areas including frequently flooded areas. The document needs to define how each jurisdiction is complying with this requirement and identify in relation to maps of these areas, those frequently flooded areas. If they are not defined, then it needs to be defined as a data gap. This PEIS addresses flood damage, and if frequently flooded areas are not identified in relation to land use requirements, it is difficult to understand the impacts of these alternatives.
44	3.10.1	193	*"Ecology actively encourages local governments to adopt higher-than-minimum FEMA standards in their flood ordinances, and makes recommendations on local Critical Area Ordinances to better align with flood management regulations."* C: The effectiveness of FEMA and associated programs will depend on the local jurisdiction's rules and ordinances and has nothing to do with DOE's encouragement in the absence of requirements. The PEIS needs to describe what rules and ordinances are in place and where and how they relate to regulating flood-prone areas.

	Section	Page	Review Comment
45	3	196	Land ownership C: There is no mention of how much land is owned by small landowners, as defined by the Washington Administrative Code 222-21-010(6). This information is important because small landowners are generally allowed more variance in buffer width than large landowners, which may therefore reduce the amount of managed riparian buffer and therefore reduction the environmental benefit actually recognized from these "managed forests."
46	3.11.1	203 - 204	C: In describing "*Recreational Fishing and Boating*," the PEIS fails to recognize that the vast majority of harvest of Chehalis Basin chinook salmon takes place in Canadian and Alaskan waters. "Washington coastal indicator stocks exhibit a mortality distribution consistent with a far north migration pattern. [From 1979 to 2013], "[o]n average, 86% of all fishery-related mortality, which accounts for approximately a third of total mortality, results from fisheries occurring north of the US and Canada border." Pacific Salmon Commission Chinook Technical Committee, 2014 Exploitation Rate Analysis and Model Calibration, Vol. 1, 51. In addressing recreational fishing, the PEIS should look beyond the Chehalis Basin itself to recognize and take account of the role of these impacts on Chehalis Basin stocks.
47	3	[216]	Table 3.13-1. C: The description of Highway 12 is inadequate and incorrect in several ways. It starts in Aberdeen and travels along the Chehalis River from Elma to Grand Mound where it meets I-5, it travels with I-5 until heading east toward White Pass. It leaves the Chehalis Watershed soon after leaving I-5, somewhere east of Mary's Corner. At a minimum the description needs to be accurate within the Chehalis Watershed, and ideally it would contain the number of miles within the watershed, and the number of miles where it is in or near the floodplain.
48	3.13.1	217	The description of I-5 notes it as a national, regional, and local issue. The loss of the fishery is also a national, statewide, regional, and international issue as fish from the Chehalis River are part of international negotiations. The fish need an equal mention here – they are not a sideshow.
49	3.13.2.2	220	It describes the flooding in Bucoda as "periodical" but in other areas it provides actual frequencies. We need quantified information for decision making.

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50	3.13.2.2	220	The description of the communities in Thurston County is wrong. Oakville, and Porter-Malone are in Grays Harbor Counties.
51	3.13.2.3	220	It states that the Wynoochee valley and others were inundated in the 1997 flood. This flood is not on the list of major floods in Executive Summary. An error, or a localized flood that did not affect the Centralia and Chehalis area?
52	3.14.2.3	231	The section on Gas and Electric is misleading. It lists the Cowlitz Falls facility that is in the Cowlitz River watershed, not the Chehalis. It lists the Yelm project which is on the Deschutes River, not the Chehalis. And while the Wynoochee power plant is within the Chehalis Watershed, it is operated by Tacoma Power so the power is moved out of the watershed. The section would be more correct if it simply stated that the power was moved into the watershed on BPA powerlines or something similar.
53	3.3.4	135	Figure 3.3-4: This vegetation map is either misleading or incorrect. It has a lot of land classified as "scrub-shrub" in the Satsop, Wynoochee and to a lesser extent the rivers to the west. It extends to the north to a pretty straight line that probably reflects a property line boundary (USFS probably). The area also includes some lands classed as "herbaceous-grasslands" and the classification needs to be verified as much of the land in these areas is most likely commercial forest land, with some smaller farm/forest land acreages and some rural development. As the figure currently appears, it is more confusing than helpful. Summing the percentages in the table one arrives at 49% of the land in some form of forest and this is a major contrast with the normal classification of 82% forest for the watershed. They have classed young forest reproduction as scrub-shrub as the definition indicates trees less than age 10 are in scrub-shrub classification. Adding the 19% scrub-shrub to the 49% gives 68% forest. Still not matching the 82% number used regularly. This needs to be explained or corrected.
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Washington Natural Heritage Program 2015 Endangered, Threatened, and Sensitive Vascular Plant List

Compiled by Joseph Arnett, Rare Plant Botanist, January 2015

Nomenclature, including classification of families, generally follows the Washington Flora Checklist.

Species name	Common Name	Family Name	Global Rank	State Rank	Status	
					WA	FWS
Abronia umbellata var. *acutalata*	pink sand-verbena	Nyctaginaceae	G4G5T2	S1	E	
Agoseris aurantiaca var. *camea*	pink agoseris	Asteraceae	G4	SU	S	
Agoseris elata	tall agoseris	Asteraceae	G4	S3	S	
Agrostis mertensii	northern bentgrass	Poaceae	G5	S1S2	T	
Aliciella leptomeria	Great Basin gilia	Polemoniaceae	G5	S1	T	
Allium bisceptrum	twincrest onion	Amaryllidaceae	G4G5	S1	S	
Allium campanulatum	Sierra onion	Amaryllidaceae	G4	S1	T	
Allium constrictum	constricted Douglas' onion	Amaryllidaceae	G2G3	S2S3	S	
Allium dictuon	Blue Mountain onion	Amaryllidaceae	G2	S2	T	
Ammannia robusta	grand redstem	Lythraceae	G5	S1	T	
Anemone patens var. *multifida*	pasqueflower	Ranunculaceae	G4T5	S1	T	
Antennaria corymbosa	meadow pussy-toes	Asteraceae	G5	S1	T	
Arabis crucisetosa	cross-haired rockcress	Brassicaceae	G4G5	S1	T	
Arenaria paludicola	swamp sandwort	Caryophyllaceae	G1	SX	X	E
Artemisia campestris var. *wormskioldii*	Wormskiold's northern wormwood	Asteraceae	G5T1	S1	E	C
Asclepias cryptoceras	Davis' milkweed	Apocynaceae	G4TNR	S1	T	
Astragalus arrectus	Palouse milk-vetch	Fabaceae	G2G4	S2	T	
Astragalus arthurii	Arthur's milk-vetch	Fabaceae	G5	S2	S	
Astragalus asotinensis	Asotin milk-vetch	Fabaceae	G2	S2	E	
Astragalus australis var. *cottonii*	Cotton's milk-vetch	Fabaceae	G5T2	S2	T	
Astragalus columbianus	Columbia milk-vetch	Fabaceae	G3	S3	S	
Astragalus diaphanus	transparent milk-vetch	Fabaceae	G3G4	SX	X	
Astragalus geyeri var. *geyeri*	Geyer's milk-vetch	Fabaceae	G4	S1	T	
Astragalus kentrophyta var. *douglasii*	thistle milk-vetch	Fabaceae	G5TX	SX	X	
Astragalus microcystis	least bladdery milk-vetch	Fabaceae	G5	S2	S	
Astragalus misellus var. *pauper*	pauper milk-vetch	Fabaceae	G4T3	S3	S	
Astragalus multiflorus	loose-flower milk-vetch	Fabaceae	G5	S1	T	
Astragalus pulsiferae var. *suksdorfii*	Ames' milk-vetch	Fabaceae	G4T2	S1	E	
Astragalus riparius	Piper's milk-vetch	Fabaceae	G1G2	S1S2	E	
Astragalus sinuatus	Whited's milk-vetch	Fabaceae	G1	S1	E	
Baccharis pilularis ssp. *consanguinea*	coyotebush	Asteraceae	G5TNR	S1	T	
Bergia texana	Texas bergia	Elatinaceae	G5	SNR	X	
Boechera cascadensis	littleleaf rockcress	Brassicaceae	G5T1Q	SNR	X	
Bolandra oregana	bolandra	Saxifragaceae	G3	S2	S	

Species name	Common Name	Family Name	Global Rank	State Rank	Status	
					WA	FWS
Botrychium ascendens	triangular-lobed moonwort	Ophioglossaceae	G2G3	S2	S	
Botrychium crenulatum	crenulate moonwort	Ophioglossaceae	G3	S3	S	
Botrychium hesperium	western moonwort	Ophioglossaceae	G3G4	S1	T	
Botrychium lineare	skinny moonwort	Ophioglossaceae	G2?	S1	T	
Botrychium paradoxum	two-spiked moonwort	Ophioglossaceae	G2	S2	T	
Botrychium pedunculosum	stalked moonwort	Ophioglossaceae	G2G3	S2	S	
Brodiaea rosea	harvest brodiaea	Asparagaceae	GNR	SX	X	
Calochortus longebarbatus var. *longebarbatus*	long-bearded sego lily	Liliaceae	G4T4	S2S3	S	
Calochortus macrocarpus var. *maculosus*	sagebrush mariposa-lily	Liliaceae	G5T2	S1	T	
Calochortus nitidus	broad-fruit mariposa	Liliaceae	G3	S1	E	
Calyptridium roseum	rosy pussypaws	Montiaceae	G5	S1	T	
Campanula lasiocarpa	Alaska harebell	Campanulaceae	G5	S2	S	
Carex anthoxanthea	yellow-flowered sedge	Cyperaceae	G5	S1	S	
Carex capillaris	hair-like sedge	Cyperaceae	G5	S1	T	
Carex capitata	capitate sedge	Cyperaceae	G5	S1	S	
Carex chordorrhiza	cordroot sedge	Cyperaceae	G5	S1	S	
Carex circinata	coiled sedge	Cyperaceae	G4	S1	S	
Carex comosa	bristly sedge	Cyperaceae	G5	S2	S	
Carex densa	dense sedge	Cyperaceae	G5	S1	S	
Carex eburnea	bristleleaf sedge	Cyperaceae	G4TNR	SNR	S	
Carex flava	yellow sedge	Cyperaceae	G5	S3	S	
Carex gynocrates	yellow bog sedge	Cyperaceae	G5	S1	S	
Carex heteroneura	smooth-fruit sedge	Cyperaceae	G5TNR	S2	S	
Carex macrochaeta	large-awn sedge	Cyperaceae	G5	S1	T	
Carex magellanica ssp. *irrigua*	poor sedge	Cyperaceae	G5T5	S2S3	S	
Carex media	intermediate sedge	Cyperaceae	G5	S2	S	
Carex obtusata	blunt sedge	Cyperaceae	G5	S2	S	
Carex pauciflora	few-flowered sedge	Cyperaceae	G5	S2	S	
Carex pluriflora	several-flowered sedge	Cyperaceae	G4	S1S2	S	
Carex proposita	Smoky Mountain sedge	Cyperaceae	G4	S2	T	
Carex rostrata	beaked sedge	Cyperaceae	G5	S1	S	
Carex scirpoidea ssp. *scirpoidea*	Canadian single-spike sedge	Cyperaceae	G5T5	S2	S	
Carex stylosa	long-styled sedge	Cyperaceae	G5	S1S2	S	
Carex sychnocephala	many-headed sedge	Cyperaceae	G4	S2	S	
Carex tenera var. *tenera*	quill sedge	Cyperaceae	G5	S1	T	
Carex tenuiflora	sparse-flowered sedge	Cyperaceae	G5	S1	T	
Carex vallicola	valley sedge	Cyperaceae	G5	S2	S	
Cassiope lycopodioides	clubmoss cassiope	Ericaceae	G4	S1	T	
Castilleja cryptantha	obscure indian-paintbrush	Orobanchaceae	G2G3	S2S3	S	
Castilleja levisecta	golden paintbrush	Orobanchaceae	G1	S1	T	T

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Castilleja victoriae	Victoria's paintbrush	Orobanchaceae	G1	S1	E	
Chaenactis thompsonii	Thompson's chaenactis	Asteraceae	G2G3	S2S3	S	
Cheilanthes feei	Fee's lip-fern	Pteridaceae	G5	S1	T	
Chrysolepis chrysophylla var. *chrysophylla*	golden chinquapin	Fagaceae	G5T5	S2	S	
Chrysosplenium tetrandrum	northern golden-carpet	Saxifragaceae	G5	S2	S	
Chylismia scapoidea ssp. *scapoidea*	naked-stalked evening-primrose	Onagraceae	G5T5	S1	S	
Cicuta bulbifera	bulb-bearing water-hemlock	Apiaceae	G5	S2	S	
Cimicifuga elata	tall bugbane	Ranunculaceae	G3TNR	S3	S	
Cirsium remotifolium var. *remotifolium*	weak thistle	Asteraceae	G5TNR	SNR	S	
Claytonia multiscapa ssp. *pacifica*	pacific lanceleaved springbeauty	Montiaceae	G5T3	S1	T	
Cochlearia groenlandica	scurvygrass	Brassicaceae	G5	S1S2	S	
Coeloglossum viride var. *virescens*	long-bract frog orchid	Orchidaceae	G5	S1	T	
Collinsia sparsiflora var. *bruceae*	few-flowered collinsia	Plantaginaceae	G4T4	S1S2	S	
Collomia macrocalyx	bristle-flowered collomia	Polemoniaceae	G3G4	S1	S	
Comastoma tenellum	slender gentian	Gentianaceae	G4G5T4	S1	S	
Coptis asplenifolia	spleenwort-leaved goldthread	Ranunculaceae	G5	S2	S	
Coptis trifolia	goldthread	Ranunculaceae	G5	S1	T	
Corispermum pallidum	pale bugseed	Amaranthaceae	GH	SH	X	
Corispermum villosum	hairy bugseed	Amaranthaceae	G4?	SU	S	
Corydalis aquae-gelidae	Clackamas corydalis	Papaveraceae	G3	S2S3	S	
Crassula connata	erect pygmy-weed	Crassulaceae	G5	S1S2	T	
Cryptantha gracilis	narrow-stem cryptantha	Boraginaceae	G5	S2	S	
Cryptantha leucophaea	gray cryptantha	Boraginaceae	G2G3	S2S3	S	
Cryptantha rostellata	beaked cryptantha	Boraginaceae	G4	S2	T	
Cryptantha scoparia	miner's candle	Boraginaceae	G4?	S1	S	
Cryptantha spiculifera	Snake River cryptantha	Boraginaceae	G4?	S2?	S	
Cryptogramma stelleri	Steller's rockbrake	Pteridaceae	G5	S1S2	S	
Cuscuta denticulata	desert dodder	Convolvulaceae	G4G5	S1	T	
Cusickiella douglasii	Douglas' draba	Brassicaceae	G4G5	S1	T	
Cypripedium parviflorum	yellow lady's-slipper	Orchidaceae	G5	S2	T	
Damasonium californicum	fringed waterplantain	Alismataceae	G4	S1	E	
Delphinium leucophaeum	pale larkspur	Ranunculaceae	G2Q	S1	E	
Delphinium viridescens	Wenatchee larkspur	Ranunculaceae	G2	S2	T	
Diplacus cusickii	Cusick monkeyflower	Phrymaceae	G4G5	S1	T	
Dodecatheon austrofrigidum	frigid shootingstar	Primulaceae	G2	S1	E	
Draba aurea	golden draba	Brassicaceae	G5	S1S2	S	
Draba cana	lance-leaved draba	Brassicaceae	G5	S1S2	S	
Dryas drummondii var. *drummondii*	yellow mountain-avens	Rosaceae	G5T5	S2	S	
Dryopteris cristata	crested shield-fern	Dryopteridaceae	G5	S2	S	

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Eatonella nivea	white eatonella	Asteraceae	G4G5	S1	T	
Eleocharis atropurpurea	purple spike-rush	Cyperaceae	G4G5	SX	X	
Eleocharis coloradoensis	dwarf spike-rush	Cyperaceae	GNR	SNR	S	
Eleocharis rostellata	beaked spike-rush	Cyperaceae	G5	S2	S	
Eremogone franklinii var. *thompsonii*	Thompson's sandwort	Caryophyllaceae	G4THQ	SU	S	
Eremothera minor	small-flower evening-primrose	Onagraceae	G4	S2	S	
Eremothera pygmaea	dwarf evening-primrose	Onagraceae	G3	S3	S	
Erigeron aliceae	Alice's fleabane	Asteraceae	G4	S2	S	
Erigeron basalticus	basalt daisy	Asteraceae	G2	S2	T	
Erigeron davisii	Davis' fleabane	Asteraceae	G5T3	SNR	S	
Erigeron disparipilus	Snake River daisy	Asteraceae	G5	SNR	S	
Erigeron elatus	tall bitter fleabane	Asteraceae	G4?	S1	E	
Erigeron howellii	Howell's daisy	Asteraceae	G2	S2	T	
Erigeron oreganus	gorge daisy	Asteraceae	G3	S2	T	
Erigeron peregrinus var. *thompsonii*	Thompson's wandering daisy	Asteraceae	G5T2	S2	S	
Erigeron piperianus	Piper's daisy	Asteraceae	G3	S3	S	
Erigeron salishii	Salish fleabane	Asteraceae	G2G3	S2	S	
Eriogonum codium	Umtanum desert buckwheat	Polygonaceae	G1	S1	E	T
Eriogonum maculatum	spotted buckwheat	Polygonaceae	G5	SX	X	
Eriophorum viridicarinatum	green keeled cotton-grass	Cyperaceae	G5	S2	S	
Eritrichium nanum var. *elongatum*	pale alpine-forget-me-not	Boraginaceae	G5T4	S1	S	
Eryngium articulatum	jointed coyote-thistle	Apiaceae	G5	SH	X	
Eryngium petiolatum	Oregon coyote-thistle	Apiaceae	G4	S1	T	
Erythranthe jungermannioides	liverwort monkey-flower	Phrymaceae	G3	SH	X	
Erythranthe patula	stalk-leaved monkeyflower	Phrymaceae	G3Q	S1	T	
Erythranthe pulsiferae	Pulsifer's monkey-flower	Phrymaceae	G4?	S2	S	
Erythranthe suksdorfii	Suksdorf's monkey-flower	Phrymaceae	G4	S2	S	
Erythranthe washingtonensis	Washington monkey-flower	Phrymaceae	G4	SX	X	
Erythronium quinaultense	Quinault fawnlily	Liliaceae	G2	S1S2	T	
Erythronium revolutum	pink fawn-lily	Liliaceae	G4	S3	S	
Euonymus occidentalis var. *occidentalis*	western wahoo	Celastraceae	G5TNR	S1	S	
Eurybia merita	arctic aster	Asteraceae	G5	S1S2	T	
Eutrochium maculatum var. *bruneri*	spotted joe-pye weed	Asteraceae	G5T4T5Q	SH	X	
Filipendula occidentalis	queen-of-the-forest	Rosaceae	G2G3	S2S3	T	
Fritillaria camschatcensis	black lily	Liliaceae	G5	S2	T	
Gaultheria hispidula	creeping snowberry	Ericaceae	G5	S2	S	
Gentiana douglasiana	swamp gentian	Gentianaceae	G4	S2	S	
Gentiana glauca	glaucous gentian	Gentianaceae	G4G5	S2	S	
Geranium oreganum	Oregon crane's-bill	Geraniaceae	G4G5	SX	X	
Geum rivale	water avens	Rosaceae	G5	S2S3	S	

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Geum rossii var. *depressum*	Ross' avens	Rosaceae	G5T1	S1	E	
Githopsis specularioides	common blue-cup	Campanulaceae	G5	S3	S	
Hackelia cinerea	gray stickseed	Boraginaceae	G4?	S1	S	
Hackelia diffusa var. *diffusa*	diffuse stickseed	Boraginaceae	G4T3	S2	T	
Hackelia hispida var. *disjuncta*	sagebrush stickseed	Boraginaceae	G4T2T3	S2S3	S	
Hackelia hispida var. *hispida*	rough stickseed	Boraginaceae	G4T4	S1	T	
Hackelia taylorii	Taylor's stickseed	Boraginaceae	G2	S2	T	
Hackelia venusta	showy stickseed	Boraginaceae	G1	S1	E	E
Hedysarum occidentale	western hedysarum	Fabaceae	G5T5	S1	S	
Heterotheca oregona	oregon goldenaster	Asteraceae	G4T4?	S1	S	
Howellia aquatilis	water howellia	Campanulaceae	G3	S2S3	S	T
Hypericum majus	Canadian St. John's-wort	Hypericaceae	G5	S2	S	
Iliamna longisepala	longsepal globemallow	Malvaceae	G3	S3	S	
Impatiens noli-tangere	western jewel-weed	Balsaminaceae	G4G5	S1	T	
Isoetes nuttallii	Nuttall's quillwort	Isoetaceae	G4?	S1	S	
Juncus hemiendytus var. *hemiendytus*	dwarf rush	Juncaceae	G5T5	S1	T	
Juncus howellii	Howell's rush	Juncaceae	G4	S1	T	
Juncus kelloggii	Kellogg's rush	Juncaceae	G3?	S1	E	
Juncus tiehmii	Tiehm's rush	Juncaceae	G4	S1	T	
Juncus uncialis	inch-high rush	Juncaceae	G3G4	S2	S	
Kalmia procumbens	alpine azalea	Ericaceae	G5	S1	T	
Lasthenia glaberrima	smooth goldfields	Asteraceae	G5	S1	E	
Lathrocasis tenerrima	delicate gilia	Polemoniaceae	G5	SU	S	
Lathyrus holochlorus	thin-leaved peavine	Fabaceae	G2	S1	E	
Lathyrus torreyi	Torrey's peavine	Fabaceae	G5	S1	T	
Lathyrus vestitus var. *ochropetalus*	Pacific pea	Fabaceae	G5TNR	S1	E	
Lepidium oxycarpum	sharpfruited peppergrass	Brassicaceae	G4	S1	E	
Leptosiphon bolanderi	Baker's linanthus	Polemoniaceae	G4G5	S2	S	
Liparis loeselii	twayblade	Orchidaceae	G5	S1	E	
Lipocarpha aristulata	awned halfchaff sedge	Cyperaceae	G5?	S1	T	
Lobelia dortmanna	water lobelia	Campanulaceae	G4G5	S2	T	
Lobelia kalmii	Kalm's lobelia	Campanulaceae	G5	S1	E	
Loeflingia squarrosa	loeflingia	Caryophyllaceae	G5T4?	S1	T	
Lomatium bradshawii	Bradshaw's lomatium	Apiaceae	G2	S1	E	E
Lomatium knokei	desert-parsley	Apiaceae	GNR	SNR	S	
Lomatium laevigatum	smooth desert-parsley	Apiaceae	G3	S2	T	
Lomatium rollinsii	Rollins' desert-parsley	Apiaceae	G3	S2	T	
Lomatium sandbergii	Sandberg desert-parsley	Apiaceae	G4	S1	T	
Lomatium serpentinum	Snake Canyon desert-parsley	Apiaceae	G4	S2	S	
Lomatium suksdorfii	Suksdorf's desert-parsley	Apiaceae	G3	S3	S	

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Lomatium tuberosum	Hoover's desert-parsley	Apiaceae	G2G3	S2S3	S	
Lupinus oreganus	Kincaid's sulfur lupine	Fabaceae	G5T2	S1	E	T
Lupinus sabinianus	Sabin's lupine	Fabaceae	G4	S1	E	
Luzula arcuata ssp. *unalaschcensis*	curved woodrush	Juncaceae	G5T3T5	S1	S	
Lycopodiella inundata	bog clubmoss	Lycopodiaceae	G5	S2	S	
Lycopodium dendroideum	treelike clubmoss	Lycopodiaceae	G5	S2	S	
Meconella oregana	white meconella	Papaveraceae	G2G3	S1	E	
Micranthes tischii	Tisch's saxifrage	Saxifragaceae	G1?	S1?	S	
Micromonolepis pusilla	red poverty-weed	Amaranthaceae	G5	S1	T	
Microseris bigelovii	coast microseris	Asteraceae	G4	SX	X	
Microseris borealis	northern microseris	Asteraceae	G4?	S2	S	
Minuartia nuttallii var. *fragilis*	Nuttall's sandwort	Caryophyllaceae	G5T4	S1	T	
Minuartia pusilla	annual sandwort	Caryophyllaceae	G5T3T5	SNR	S	
Monolepis spathulata	prostrate poverty-weed	Amaranthaceae	G5	SU	S	
Montia diffusa	branching montia	Montiaceae	G4	S2S3	S	
Muhlenbergia glomerata	marsh muhly	Poaceae	G5	S1S2	S	
Muhlenbergia mexicana var. *mexicana*	Mexican muhly	Poaceae	G5T5	SNR	S	
Myosurus clavicaulis	mousetail	Ranunculaceae	G3?	S2	S	
Navarretia tagetina	marigold navarretia	Polemoniaceae	G5	S1	T	
Nicotiana attenuata	coyote tobacco	Solanaceae	G4	S2	S	
Nuttallanthus texanus	Texas toadflax	Plantaginaceae	G4G5	S1	S	
Nymphaea tetragona	pygmy water-lily	Nymphaeaceae	G5	SH	X	
Oenothera cespitosa ssp. *cespitosa*	cespitose evening-primrose	Onagraceae	G5T5	S2	S	
Oenothera cespitosa ssp. *marginata*	tufted evening-primrose	Onagraceae	G5T3T5	S1	T	
Oenothera flava ssp. *flava*	long-tubed evening-primrose	Onagraceae	G5T3T5	SH	X	
Ophioglossum pusillum	adder's-tongue	Ophioglossaceae	G5	S1S2	T	
Orobanche californica ssp. *grayana*	cancer-root, California broomrape	Orobanchaceae	G4T3T4	SX	E	
Orthocarpus bracteosus	rosy owl-clover	Orobanchaceae	G3?	S1	E	
Oxalis suksdorfii	western yellow oxalis	Oxalidaceae	G4	S1	T	
Oxytropis borealis var. *viscida*	sticky crazyweed	Fabaceae	G5T4?	S1S2	S	
Oxytropis campestris var. *columbiana*	Columbia crazyweed	Fabaceae	G5T1	S1	E	
Oxytropis campestris var. *gracilis*	slender crazyweed	Fabaceae	G5T5?	S2	S	
Oxytropis campestris var. *wanapum*	Wanapum crazyweed	Fabaceae	G5T1	S1	E	
Packera bolanderi var. *harfordii*	Harford's ragwort	Asteraceae	G4TUQ	SNR	S	
Packera macounii	Siskiyou Mountain ragwort	Asteraceae	G5	SNR	S	
Packera porteri	Porter's butterweed	Asteraceae	G4	S1S2	S	
Parnassia fimbriata var. *hoodiana*	fringed grass-of-parnassus	Celastraceae	G5T3	S1	T	
Parnassia kotzebuei	Kotzebue's grass-of-parnassus	Celastraceae	G5	S1	T	

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Parnassia palustris var. *neogaea*	northern grass-of-parnassus	Celastraceae	G5TNR	S2	S	
Pedicularis pulchella	Mountain lousewort	Orobanchaceae	G3	SNR	S	
Pedicularis rainierensis	Mt. Rainier lousewort	Orobanchaceae	G2G3	S2S3	S	
Pediocactus nigrispinus	snowball cactus	Cactaceae	G4	S2	S	
Pellaea brachyptera	Sierra cliff-brake	Pteridaceae	G4G5	S2	S	
Pellaea breweri	Brewer's cliff-brake	Pteridaceae	G5	S2	S	
Penstemon barrettiae	Barrett's beardtongue	Plantaginaceae	G2	S2	T	
Penstemon deustus var. *variabilis*	hot-rock penstemon	Plantaginaceae	G5T1T2	S1S2	T	
Penstemon wilcoxii	Wilcox's penstemon	Plantaginaceae	G4	S1	S	
Perideridia oregana	Oregon yampah	Apiaceae	G4G5	S1	S	
Petrophytum caespitosum ssp. *caespitosum*	Rocky Mountain rockmat	Rosaceae	G5T3T5	S1	T	
Petrophytum cinerascens	Chelan rockmat	Rosaceae	G1	S1	E	
Phacelia lenta	sticky phacelia	Boraginaceae	G2	S2	T	
Phacelia minutissima	least phacelia	Boraginaceae	G3	S1	E	
Phacelia tetramera	dwarf phacelia	Boraginaceae	G4	S1	S	
Physaria didymocarpa ssp. *didymocarpa*	common twinpod	Brassicaceae	G5T4	S1	T	
Physaria douglasii ssp. *tuplashensis*	White Bluffs bladderpod	Brassicaceae	G4?T2	S2	T	PT
Pilularia americana	American pillwort	Marsileaceae	G5	S1S2	T	
Pityopus californicus	pine-foot	Ericaceae	G4G5	S1	T	
Plantago macrocarpa	Alaska plantain	Plantaginaceae	G4	S2	S	
Platanthera chorisiana	Choris' bog-orchid	Orchidaceae	G3G4	S2	T	
Platanthera obtusata ssp. *obtusata*	small northern bog-orchid	Orchidaceae	G5	S2	S	
Poa laxiflora	loose-flowered bluegrass	Poaceae	G3G4	S2S3	S	
Poa nervosa	Wheeler's bluegrass	Poaceae	G3?	S2	S	
Poa unilateralis ssp. *pachypholis*	ocean-bluff bluegrass	Poaceae	G3TNR	S2	T	
Polemonium carneum	great polemonium	Polemoniaceae	G4	S1S2	T	
Polemonium pectinatum	Washington polemonium	Polemoniaceae	G2	S2	T	
Polemonium viscosum	skunk polemonium	Polemoniaceae	G5	S1S2	S	
Polyctenium fremontii	Fremont's combleaf	Brassicaceae	G4T4	S1	T	
Polygonum austiniae	Austin's knotweed	Polygonaceae	G4	S1	T	
Polygonum parryi	Parry's knotweed	Polygonaceae	G4	S1?	T	
Polystichum californicum	California sword-fern	Dryopteridaceae	G4	S1S2	T	
Potamogeton obtusifolius	blunt-leaved pondweed	Potamogetonacea	G5	S2	S	
Potentilla breweri	Brewer's cinquefoil	Rosaceae	GNR	S1	T	
Potentilla glaucophylla var. *perdissecta*	diverse-leaved cinquefoil	Rosaceae	G5T4	S1	S	
Potentilla newberryi	Newberry cinquefoil	Rosaceae	G3G4	SH	X	
Potentilla nivea	snow cinquefoil	Rosaceae	G5	S2	S	
Pyrrocoma hirta var. *sonchifolia*	sticky goldenweed	Asteraceae	G4G5T3	S1	S	
Pyrrocoma liatriformis	Palouse goldenweed	Asteraceae	G2	S2	T	

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Pyrrocoma scaberula	Palouse goldenweed	Asteraceae	GNR	SNR	T	
Ranunculus cooleyae	Cooley's buttercup	Ranunculaceae	G4	S1S2	S	
Ranunculus hebecarpus	downy butter-cup	Ranunculaceae	G5	SNR	S	
Ranunculus populago	mountain buttercup	Ranunculaceae	G4	S2	S	
Ranunculus triternatus	obscure buttercup	Ranunculaceae	G2	S1	E	
Ribes cereum var. *colubrinum*	squaw currant	Grossulariaceae	G5T3	S1	E	
Ribes oxyacanthoides var. *irriguum*	Idaho gooseberry	Grossulariaceae	G5T3T4	S2	T	
Ribes wolfii	Wolf's currant	Grossulariaceae	G4	S3	S	
Rorippa columbiae	persistentsepal yellowcress	Brassicaceae	G3	S1S2	T	
Rotala ramosior	lowland toothcup	Lythraceae	G5	S1	T	
Rubus arcticus ssp. *acaulis*	nagoonberry	Rosaceae	G5T5	S1	T	
Rubus nigerrimus	northwest raspberry	Rosaceae	G1	S1	E	
Salix candida	hoary willow	Salicaceae	G5	S1	T	
Salix glauca var. *villosa*	glaucous willow	Salicaceae	G5T5?	S1S2	S	
Salix maccalliana	Maccall's willow	Salicaceae	G5?	S1	S	
Salix pseudomonticola	false mountain willow	Salicaceae	G4G5	S1	S	
Salix sessilifolia	soft-leaved willow	Salicaceae	G4	S2	S	
Salix tweedyi	Tweedy's willow	Salicaceae	G4	S3	S	
Salix vestita	rock willow	Salicaceae	G5T3T4Q	SH	S	
Samolus parviflorus	water-pimpernel	Primulaceae	G5	S1	S	
Sandbergia perplexa	puzzling rockcress	Brassicaceae	G4T3	S1	T	
Sanguisorba menziesii	Menzies' burnet	Rosaceae	G3G4	S1	T	
Sanicula arctopoides	bear's-foot sanicle	Apiaceae	G5	S1	E	
Sanicula marilandica	black snake-root	Apiaceae	G5	S2	S	
Saxifraga cernua	nodding saxifrage	Saxifragaceae	G4	S1S2	S	
Saxifraga hyperborea	pygmy saxifrage	Saxifragaceae	G5?	S3	S	
Saxifragopsis fragarioides	strawberry saxifrage	Saxifragaceae	G3?	S1	T	
Schizachyrium scoparium var. *scoparium*	little bluestem	Poaceae	G5T5	S1S2	T	
Schoenoplectus saximontanus	Rocky Mountain bulrush	Cyperaceae	G5	S1	T	
Sclerolinon digynum	northwestern yellowflax	Linaceae	G5	S1S2	T	
Scribneria bolanderi	Scribner-grass	Poaceae	G4	S1	S	
Sericocarpus oregonensis ssp. *oregonensis*	oregon white-top aster	Asteraceae	G5TNR	S1	T	
Sericocarpus rigidus	white-top aster	Asteraceae	G3	S3	S	
Sidalcea hirtipes	hairy-stemmed checker-mallow	Malvaceae	G2	S1	T	
Sidalcea nelsoniana	Nelson's checker-mallow	Malvaceae	G2	S1	E	T
Sidalcea oregana var. *calva*	Wenatchee Mountain checker-mallow	Malvaceae	G5T1	S1	E	E
Sidalcea virgata	rose checker-mallow	Malvaceae	G5TNR	S1	E	
Silene scouleri ssp. *scouleri*	Scouler's catchfly	Caryophyllaceae	G5TNRQ	SU	S	
Silene seelyi	Seely's silene	Caryophyllaceae	G2G3	S2S3	S	
Silene spaldingii	Spalding's silene	Caryophyllaceae	G2	S2	T	T

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Sisyrinchium montanum var. *montanum*	strict blue-eyed-grass	Iridaceae	G5	S1	T	
Sisyrinchium sarmentosum	pale blue-eyed grass	Iridaceae	G1G2	S1S2	T	
Sisyrinchium septentrionale	blue-eyed grass	Iridaceae	G3G4	S3	S	
Sparganium fluctuans	water bur-reed	Typhaceae	G5	S1	T	
Spartina pectinata	prairie cordgrass	Poaceae	G5	S2	S	
Spiranthes diluvialis	Ute ladies' tresses	Orchidaceae	G2	S1	E	T
Spiranthes porrifolia	western ladies-tresses	Orchidaceae	G4	S2	S	
Sullivantia oregana	Oregon sullivantia	Saxifragaceae	G2	S1	E	
Swertia perennis	swertia	Gentianaceae	G5	S1?	S	
Symphyotrichum boreale	rush aster	Asteraceae	G5	S1	T	
Symphyotrichum hallii	Hall's aster	Asteraceae	G4	S1	T	
Symphyotrichum jessicae	Jessica's aster	Asteraceae	G2	S1S2	E	
Synthyris pinnatifida var. *lanuginosa*	cut-leaf synthyris	Plantaginaceae	G4T2	S2	T	
Tauschia hooveri	Hoover's tauschia	Apiaceae	G2	S2	S	
Tauschia tenuissima	Leiberg's tauschia	Apiaceae	G3	SX	X	
Thelypodium howellii ssp. *howellii*	Howell's thelypody	Brassicaceae	G2T2	SNR	S	
Thelypodium sagittatum ssp. *sagittatum*	arrow thelypody	Brassicaceae	G4T4	S1	S	
Trifolium douglasii	Douglas' clover	Fabaceae	G2	S1	E	
Trifolium plumosum var. *plumosum*	plumed clover	Fabaceae	G4T4	S1	T	
Trifolium thompsonii	Thompson's clover	Fabaceae	G2	S2	T	
Trillium parviflorum	small-flowered trillium	Melanthiaceae	G2G3	S2S3	S	
Utricularia intermedia	flat-leaved bladderwort	Lentibulariaceae	G5	S2	S	
Vaccinium myrtilloides	velvet-leaf blueberry	Ericaceae	G5	S1	S	
Veratrum insolitum	Siskiyou false-hellebore	Melanthiaceae	G3	S1	T	
Whipplea modesta	yerba de selva	Hydrangeaceae	G4	SNR	S	
Woodwardia fimbriata	chain-fern	Blechnaceae	G5	S2	S	
Wyethia angustifolia	California compassplant	Asteraceae	G4	SU	S	
Zeltnera muehlenbergii	Monterey centaury	Gentianaceae	G5?	SH	T	

Washington Status *of plant species is determined by the Washington Natural Heritage Program. Factors considered include abundance, occurrence patterns, vulnerability, threats, existing protection, and taxonomic distinctness. Values include:*
E = Endangered. In danger of becoming extinct or extirpated from Washington.
T = Threatened. Likely to become Endangered in Washington.
S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state.
X = Possibly extinct or extirpated from Washington.

Federal Status *of plants under the U.S. Endangered Species Act is determined by the U.S. Fish and Wildlife Service:*
E = Listed as Endangered. In danger of extinction.
T = Listed as Threatened. Likely to become endangered.
C = Candidate species. Sufficient information exists to support listing as Endangered or Threatened.

Global Rank *characterizes the relative rarity or endangerment of the element world-wide.*
G1 = Critically Imperiled - At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
G2 = Imperiled - At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
G3 = Vulnerable - At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
G4 = Apparently Secure - At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5 = Secure At very low risk or extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.
GH = Possibly Extinct - Known from only historical occurrences but still some hope of rediscovery.
GU = Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GX = Presumed Extinct - Not located despite intensive searches and virtually no likelihood of rediscovery.
GNR = Unranked - Global rank not yet assessed.
G#G# = Range Rank - A numeric range rank (e.g., G2G3, G1G3) is used to indicate uncertainty about the exact status of a taxon or ecosystem type.

State Rank *characterizes the relative rarity or endangerment within the state of Washington.*
S1 = Critically Imperiled - At very high risk of extirpation in the state due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
S2 = Imperiled - At high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3 = Vulnerable - At moderate risk of extirpation in the state due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
S4 = Apparently Secure - At a fairly low risk of extirpation in the state due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
S5 = Secure - At very low or no risk of extirpation in the state due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
SH = Possibly Extirpated - Known from only historical records but still some hope of rediscovery.
SX = Presumed Extirpated - Species is believed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
SU = Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNR = Unranked - Subnational conservation status not yet assessed
SNA = Not Applicable - A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.

TABLES of Lichens and Mosses

The lists can be found here: http://www1.dnr.wa.g ov/nhp/refdesk/lists/lichens.html and here: http://www1.dnr.wa.gov/nhp/refdesk/lists/mosses.html

The species are: **Table 1. Proposed Endangered lichens in Washington state.**

Scientific Name	Authority	Synonym(s)	Global Rank	State Rank
Acroscyphus sphaerophoroides	Leveille		GNR	S1
Alectoria ochroleuca	(Hoffm.) Massal.		G5	S1
Arctoparmelia incurva	(Pers.) Hale	Parmelia incurva, Xanthoparmelia incurva	G3G5	S1
Bryoria pseudocapillaris	Brodo & D. Hawksw.		G3	S1
Bryoria tenuis	(E. Dahl) Brodo & D. Hawksw.	Alectoria tenuis	GNR	S1
Catolechia wahlenbergii	(Ach.) Korber		G3G5	S1
Cladonia ciliata var. ciliata	Stirton	Cladina ciliata	GNRTNR	S1
Cladonia ciliata var. tenuis	(Flörke) Ahti	Cladina ciliata var. tenuis	GNRTNR	S1
Cladonia novochlorophaea	(Sipman) Brodo & Ahti	Cladonia merochlorophaea var. novochlorophaea	GUTNR	S1
Cladonia poroscypha	Hammer 1993		GNR	S1
Dactylina arctica	(Richardson) Nyl.		G4G5	S1
Dactylina ramulosa	(Hook.) Tuck.		G4G5	S1
Dermatocarpon moulinsii	(Mont.) Zahlbr.		GNR	S1
Fuscopannaria laceratula	(Hue) P. M. Jørg.	Pannaria laceratula	G5	S1
Heterodermia leucomela	(L.) Poelt		G4	S1
Hypotrachyna revoluta	(Flvrke) Hale		G3G4	S1
Leioderma sorediatum	D. J. Galloway & P. M. Jørg.		G4	S1
Leptogium burnetiae	C. W. Dodge	Leptogium burnetiae var. hirsutum	G3G5	S1
Leptogium cyanescens	(Rabenh.) Kvrber		G5	S1
Pannaria rubiginella	P. M. Jørg. & Sipman	Pannaria malmei (misidentifications)	GNR	S1
Pertusaria coccodes	(Ach.) Nyl.		GNR	S1
Pseudocyphellaria perpetua	McCune & Miadlikowska		G4	S1
Solorina saccata	(L.) Ach.		G3G5	S1
Umbilicaria lambii	Imshaug		G2G4	S1

Umbilicaria lyngei	Schol.	Agyrophora lyngei	G3	S1
Umbilicaria phaea var. coccinea	Llano		G5?T3Q	S1
Umbilicaria scholanderi	(Llano) Krog	Agyrophora scholanderi	G1	S1
Vulpicida tilesii	(Ach.) J.-E. Mattsson & M.J. Lai	Cetraria tilesii	G4G5	S1

Table 2. Proposed Threatened lichens in Washington state.

Scientific Name	Authority	Synonym(s)	Global Rank	State Rank
Alectoria nigricans	(Ach.) Nyl.		G5	S3
Bunodophoron melanocarpum	(Sw.) Wedin	Sphaerophorus melanocarpus	GNR	S1
Cladonia portentosa ssp. pacifica	(Ahti) Ahti	Cladina portentosa ssp. pacifica	GNRTNR	S2
Dermatocarpon meiophyllizum	Vain.		G3G5	S2
Erioderma sorediatum	D.J. Galloway & P.M. Jxrg.		G4	S2
Kaernefeltia californica	(Tuck.) Thell & Goward	Cetraria californica	G3	S2
Ramalina pollinaria	(Westr.) Ach.		G4	S2
Ramalina thrausta	(Ach.) Nyl.		G4G5	S2
Stereocaulon myriocarpum	Th. Fr.		G4	S2
Texosporium sancti-jacobi	(Tuck.) Nadv.		G3	S1
Umbilicaria rigida	(Du Rietz) Frey	Umbilicaria coriacea, Agyrophora rigida, Gyrophora anthracina	G4?	S2
Usnea lambii	R. Br.	confused with Usnea sphacelata	G4G5	S2
Usnea quasirigida	Lendemer & Tavares	Usnea rigida	GNR	S2

Table 3. Proposed Sensitive lichens in Washington state.

Scientific Name	Authority	Synonym(s)	Global Rank	State Rank
Chaenotheca subroscida	(Eitner) Zahlbr.		G3G4	S3
Collema nigrescens	(Huds.) DC.		G5?	S3
Hypogymnia heterophylla	Pike		G3	S3
Nephroma occultum	Wetm.		G4	S3
Niebla cephalota	(Tuck.) Rundel & Bowler		G3G4	S2

Peltigera hydrothyria	Miadl. & Lutzoni		G4	S3
Pseudocyphellaria rainierensis	Imshaug		G3G4	S4
Thelomma mammosum	(Hepp) A. Massal.		G3G4	S2
Tholurna dissimilis	(Norman) Norman		G3G5	S2
Usnea hesperina	Mot.	Usnea schadenbergiana, Usnea subgracilis	G4G5	S3
Usnea longissima	Ach.		G4	S4

Table 4. Lichens that we recommend be monitored for rarity in Washington. (Review List 1)

Scientific Name	Authority	Synonym(s)	Global Rank	State Rank
Bryocaulon divergens	(Ach.) Karnefelt		G4G5	SU
Buellia oidalea	(Nyl.) Tuck.		G3?	SU
Buellia tesserata	Körber	Buellia fimbriata	GNR	SU
Circinaria hispida	(Mereschk.) Hale & Culb.	Aspicilia hispida, Agrestia hispida	G3	SNR
Coccotrema pocillarium	(Cummings) Brodo		G2G4	S1
Flavoparmelia caperata	(L.) Hale		G5?	SU
Hypogymnia oceanica	Goward		G4?	S4
Leptogium rivale	Tuck.		G3G5	S3
Leptogium teretiusculum	(Wallr.) Arnold		G4G5 Q	S1
Lobaria linita	(Ach.) Rabenh.		G4G5	S4
Ochrolechia turneri	(Sm.) Hasselrot		GNR	SU
Pannaria rubiginosa	(Thunb.) Delise		G4G5	SU
Peltigera lepidophora	(Nyl. ex Vainio) Bitter		G4	S1
Pertusaria flavocorallina	Coppins & Muhr		GNR	SU
Phaeographis smithii	(Leighton) de Lesd.		GNR	SU
Pilophorus nigricaulis	Sato		G3G4	S3
Rhizocarpon cookeanum	H. Magn.		GNR	S1
Rinodina aspersa	(Borrer) Laundon		GNR	S1
Schaereria dolodes	(Nyl.) Schmull & T. Sprib.	Lecidea dolodes	G4	S1
Trapeliopsis glaucopholis	(Nyl. ex Hasse) Printzen & McCune	Trapeliopsis californica	G3G4	S1
Trapeliopsis steppica	McCune & Camacho		G2G4	S1
Umbilicaria hirsuta	(Sw. ex Westr.) Hoffm.		G2G4	SU
Vestergrenopsis isidiata	(Degel.) E. Dahl		G4?	S1

Table 5. Species with taxonomic questions (Review List 2).

Scientific Name	Authority	Synonym(s)	Global Rank	State Rank
Alectoria lata	(Taylor) Lindsay		G3G4	SNR
Bryoria pikei	Brodo & D. Hawksw.		G2	SNR
Dendriscocaulon intricatulum	(Nyl.) Henssen		GUQ	SNR
Lobaria silvae-veteris	Goward & Goffinet) Goward & Goffinet	Nephroma silvae-veteris	GNR	SNR
Pyrrhospora subcinnabarina	(Tonsberg) Hafellner		GNR	SNR
Umbilicaria arctica	(Ach.) Nyl.	Gyrophora arctica	G3	SNR
Umbilicaria nylanderiana	(Zahlbr.) H. Magn.		GNR	S1

Table 6. Species that are possibly extirpated from Washington.

Scientific Name	Authority	Synonym(s)	Global Rank	State Rank
Sulcaria badia	Brodo & D. Hawksw.		G3	SH

Global Rank characterizes the relative rarity or endangerment of the element world-wide.
G1 = Critically Imperiled - At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
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G4 = Apparently Secure - At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5 = Secure At very low risk or extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.
GH = Possibly Extinct - Known from only historical occurrences but still some hope of rediscovery.
GU = Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GX = Presumed Extinct - Not located despite intensive searches and virtually no likelihood of rediscovery.
GNR = Unranked - Global rank not yet assessed.
G#G# = Range Rank - A numeric range rank (e.g., G2G3, G1G3) is used to indicate uncertainty about the exact status of a taxon or ecosystem type.
Rank Qualifiers
? = Inexact Numeric Rank - Denotes inexact numeric rank.

Q = Questionable taxonomy that may reduce conservation priority Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.

Infraspecific Taxon status ranks

T# = Infraspecific Taxon (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above.

State Rank (SRank)

State Rank characterizes the relative rarity or endangerment within the state of Washington.

S1 = Critically Imperiled - At very high risk of extirpation in the state due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S2 = Imperiled - At high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S3 = Vulnerable - At moderate risk of extirpation in the state due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

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S5 = Secure - At very low or no risk of extirpation in the state due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

SH = Possibly Extirpated - Known from only historical records but still some hope of rediscovery.

SX = Presumed Extirpated - Species is believed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

Rank Qualifiers

S#? = Inexact Numeric Rank - Denotes inexact numeric rank.

S#S# = Range Rank - A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species.

SU = Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

SNR = Unranked - Subnational conservation status not yet assessed

SNA = Not Applicable - A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.

Bryophytes:

Scientific Name	Author	Family Name	Global Rank	State Rank
Andreaea megistospora	B. Murr.	Andreaeaceae	G4G5	S1
Andreaea rothii	Web. & Mohr	Andreaeaceae	G5	S1
Barbula eustegia	Card. & Ther.	Pottiaceae	G3?	S1
Bartramiopsis lescurii (E)	(James) Kindb.	Polytrichaceae	G3G5	S1
Brachydontium olympicum	(Britt.) McIntosh & Spence	Seligeriaceae	G2G3	S1
Brachydontium trichodes	(Web.) Milde	Seligeriaceae	G2G4	S1
Brotherella roellii (T)	(Ren. & Card. in Roll) Fleisch.	Sematophyllaceae	G3	SH
Bryoerythrophyllum columbianum	(Herm. & Laut.) Zand.	Pottiaceae	G3G4	S2
Bryoxiphium norvegicum	(Brid.) Mitt.	Bryoxiphiaceae	G5?	S1

Bryum calobryoides	Spence	Bryaceae	G3	S1
Bryum violaceum	Crundw. & Nyh.	Bryaceae	G5?	S1
Buxbaumia aphylla	Hedw.	Buxbaumiaceae	G4G5	S3
Buxbaumia viridis	(D.C.) Moug. & Nestl.	Buxbaumiaceae	G4G5	SU
Calliergon trifarium (Pseudocalliergon trifarium)	(Web. & Mohr) Kindb.	Amblystegiaceae	G4	SNR
Campylium stellatum	(Hedw.) C. Jens.	Amblystegiaceae	G5	SNR
Campylopus atrovirens	De Not.	Dicranaceae	G4G5	S1
Campylopus fragilis	(Brid.) Bruch & Schimp. in B.S.G.	Dicranaceae	G5?	S1
Campylostelium saxicola	(Web. & Mohr) Bruch & Schimp. in B.S.G.	Ptychomitriaceae	G3G5	S1
Conostomum tetragonum	(Hedw.) Lindb.	Bartramiaceae	G5	S1
Crumia latifolia	(Kindb. in Mac.) Schof.	Pottiaceae	G3	S1
Dicranodontium denudatum	(Brid.) Britt. in Williams	Dicranaceae	G4G5	S1
Dicranum muehlenbeckii	Bruch & Schimp. in B.S.G.	Dicranaceae	G3G5	S1
Discelium nudum	(Dicks.) Brid.	Disceliaceae	G3G4	S1
Ditrichum schimperi	(Lesq.) Kuntze	Ditrichaceae	G3G5	S1
Ditrichum zonatum var. scabrifolium	Dix.	Ditrichaceae	G3G5T2T3	S1
Drepanocladus crassicostatus	Janssens	Amblystegiaceae	G3G5	S1
Encalypta brevicollis (E)	(Horton) Crum & Anderson	Encalyptaceae	G4T1	S1
Entosthodon fascicularis	(Hedw.) C. Mull.	Funariaceae	G4G5	S1
Fissidens fontanus	(B. Pyl.) Steud.	Fissidentaceae	G5	S1
Fissidens grandifrons	Brid.	Fissidentaceae	G4	S2
Fissidens osmundioides	Hedw.	Fissidentaceae	G5	S1
Fissidens pauperculus	Howe	Fissidentaceae	G3?	S1
Fissidens ventricosus	Lesq.	Fissidentaceae	GU	S3
Funaria muhlenbergii	Turn.	Funariaceae	G4	S1
Grimmia incurva	Schwaegr.	Grimmiaceae	G4G5	S1
Hedwigia ciliata	(Hedw.) P. Beauv.	Hedwigiaceae	G5	SNR
Helodium blandowii	(Web. & Mohr) Warnst.	Helodiaceae	G5	S1
Herzogiella seligeri	(Brid.) Iwats.	Hypnaceae	G3G4	S1
Homalia trichomanoides	(Hedw.) Schimp. in B.S.G.	Neckeraceae	G5	S1
Hookeria acutifolia	Hook. & Grev.	Hookeriaceae	G4G5	S1
Hygrohypnum norvegicum	(Schimp. in B.S.G.) Amann	Amblystegiaceae	G2	S1
Iwatsukiella leucotricha (E)	(Mitt.) Buck & Crum	Pterigynandraceae	G4G5	S1
Meesia triquetra	(Richt.) Angstr.	Meesiaceae	G5	S1

Meesia uliginosa	Hedw.	Meesiaceae	G4	S1
Mnium arizonicum	Amann	Mniaceae	G5?	S1
Myurella julacea	(Schwaegr.) Schimp . in B.S.G.	Pterigynandraceae	G5	S1
Neckera pennata	Hedw.	Neckeraceae	G5	S1
Oncophorus wahlenbergii	Brid.	Dicranaceae	G5	S1
Orthothecium chryseum	(Schwaegr. in Schultes) Schimp. in B.S.G.	Hypnaceae	G5?	S1
Orthotrichum bolanderi	Sull.	Orthotrichaceae	G2G4	S1
Orthotrichum hallii	Sull. & Lesq. in Sull.	Orthotrichaceae	G4	S1
Orthotrichum praemorsum (E)	Vent. in Roll.	Orthotrichaceae	G2	S1
Orthotrichum pylaisii	Brid.	Orthotrichaceae	G4G5	S1
Orthotrichum sordidum	Sull. & Lesq. in Aust.	Orthotrichaceae	G5	SNR
Plagiopus oederiana	(Sw.) Crum & Anderson	Bartramiaceae	G5?	S2
Platyhypnidium riparioides	(Hedw.) Dix.	Brachytheciaceae	G4	S1
Pleuroziopsis ruthenica	(Weinm.) Kindb. ex Britt.	Pleuroziopsidaceae	G3	SNR
Pohlia cardotii	(Ren. in Ren. & Card.) Broth.	Bryaceae	G2G3	S1
Pohlia columbica	(Kindb. in Mac. & Kindb.) Andrews	Bryaceae	G3G5	S1
Pohlia erecta	Lindb.	Bryaceae	G3G5	S1
Pohlia sphagnicola	(Bruch & Schimp.) Lindb. & Arnell	Bryaceae	G3?	S1
Polytrichum strictum	Brid.	Polytrichaceae	G4	S2
Ptilium crista-castrensis	(Hedw.) De Not.	Hypnaceae	G5	SU
Racomitrium aquaticum	(Brid. ex Schrad.) Brid.	Grimmiaceae	G3G5Q	S3
Racomitrium lawtonae	Irel.	Grimmiaceae	G3G4	SU
Racomitrium microcarpon	(Hedw.) Brid.	Grimmiaceae	GNRQ	S1
Rhytidium rugosum	(Hedw.) Kindb.	Rhytidiaceae	G5	S1
Schistostega pennata	(Hedw.) Web. & Mohr	Schistostegaceae	G3G4	S2
Scouleria marginata (T)	Britt.	Scouleriaceae	G3	S2
Sphagnum austinii	Sull. in Aust.	Sphagnaceae	G4	S1
Sphagnum centrale	C. Jens. in Arnell & C. Jens.	Sphagnaceae	G5	S1
Sphagnum contortum	Schultz	Sphagnaceae	G5	S1
Sphagnum jensenii	H. Lindb.	Sphagnaceae	GU	S1
Sphagnum riparium	Angstr.	Sphagnaceae	G5	S1
Tayloria serrata	(Hedw.) Bruch & Schimp. in B.S.G.	Splachnaceae	G4	S1
Tetraphis geniculata	Girg. ex Milde	Tetraphidaceae	G3G5	S2

Tetraplodon mnioides	(Hedw.) Bruch & Schimp. in B.S.G.	Splachnaceae	G4	S1
Tetrodontium brownianum	(Dicks.) Schwaegr.	Tetraphidaceae	G3G4	S1
Thamnobryum neckeroides	(Hook.) Lawt.	Thamnobryaceae	G4	S2
Tomentypnum nitens	(Hedw.) Loeske	Brachytheciaceae	G5	SNR
Tortula laevipila var. meridionalis	(Schimp.) Wijk & Marg.	Pottiaceae	G3G4TNR	SNR
Tortula papillosa	Wils. in Spruce	Pottiaceae	G5	S1
Trichostomopsis australasiae	(Grev. & Hook.) Robins.	Pottiaceae	G5?	S2

Description of Rank Codes

Global Rank (GRank)

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Q = Questionable taxonomy that may reduce conservation priority Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.

Infraspecific Taxon status ranks

T# = Infraspecific Taxon (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above.

State Rank (SRank)

State Rank characterizes the relative rarity or endangerment within the state of Washington.

S1 = Critically Imperiled - At very high risk of extirpation in the state due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S2 = Imperiled - At high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S3 = Vulnerable - At moderate risk of extirpation in the state due to a fairly restricted range, relatively few

populations or occurrences, recent and widespread declines, threats, or other factors.
S4 = Apparently Secure - At a fairly low risk of extirpation in the state due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
S5 = Secure - At very low or no risk of extirpation in the state due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
SH = Possibly Extirpated - Known from only historical records but still some hope of rediscovery.
SX = Presumed Extirpated - Species is believed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
Rank Qualifiers
S#? = Inexact Numeric Rank - Denotes inexact numeric rank.
S#S# = Range Rank - A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species.
SU = Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNR = Unranked - Subnational conservation status not yet assessed
SNA = Not Applicable - A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.

QUINAULT INDIAN NATION COMMENT/RESPONSE TABLE CHEHALIS PROGRAMMATIC EIS CHAPTER 4

	Section	Page	Review Comment
1	4	237	C: Specific design elements should be in similar detail across the Alternatives in order to compare and evaluate them well.
2	4.1.2	238 - 242	C: Short-term impacts associated with construction activities are inappropriately grouped to encompass all potential alternatives. Construction impacts associated with "*Upland excavation and clearing activities*," "*Temporary road construction and use*," "*Borrow pit and quarry pit development*" and, "*Concrete production and use*" are solely related to construction of the FRO and FRFA alternatives and are not common to the remaining alternatives. This is specifically mentioned within the "*Avoidance and Minimization*" section of the "*Borrow pit and quarry pit development*" section where it is specified that borrow sites will be located "*as close to the dam site as possible*." The grouping of short-term construction impacts for all alternatives in section 4.1.2 is misleading and too broad.
3	4	239	C: The language in Table 4.1-1 is extremely vague, for example, *"mitigation: restore or compensate for fish and wildlife"*. C: The PEIS should identify specific actions that will take place in order to mitigate, and identify if these action elements are considered minor, moderate or significant since they are not currently specified.
4	4.1-1	239	*"Restore and/or compensate for temporary impacts on fish and wildlife"* and *"Restore and/or compensate for temporary impacts on natural resources, such as wetlands or vegetation, to maintain ecological function"* C: There is no information for what is needed (or costs) to restore and/or compensate for the temporary impacts and if these impacts can even realistically be restored. The negative impacts on certain fish could have long term consequences that are not addressed here.
5	Table 4.1-1	239	*"Summary of Short-term Impacts and Possible Mitigation for Action Elements"*

	Section	Page	Review Comment
			C: Invasive species were not considered but should be.
6	4	241	Table 4.1-1. C: "Borrow pit and quarry pit development" is listed in a table of short-term impacts. These actions should be analyzed for their long term impacts, as an open pit will disturb the earth, expose rocks beneath the surface and likely invite invasive species in the long-term.
7	4.1.3	243	C: The evaluation period needs to be clearly defined. This statement appears to indicate a 100-year evaluation for each action element once it is completed. Culvert replacement functions will be nearly immediate, and some instream structures could also be nearly immediate, while riparian restoration from a farm field could take centuries to reach full historical function.
8	4.1.4	244	*"Long-term significant adverse impacts of the Flood Retention Facility would be greater than the rest of the action elements, and include the following:* *•Increase in turbidity and temperature and decrease in DO* *•Conversion of a reach of the upper Chehalis River from a free-flowing river to a permanent reservoir impoundment (FRFA facility only)* *•Landslide potential around the reservoir footprint (FRFA facility only)* *•Damage to the dam if an earthquake were to occur on the CSZ to the west of the Flood Retention Facility or Doty Fault Zone to the north, which would also effect environmental health and safety* *•Geomorphic impacts on the Chehalis River and its floodplain downstream of the dam due to changes in sediment and* *wood transport processes* *•Permanent loss of approximately 68 acres (FRO facility) and 98 acres (FRFA facility) of wetlands* *•Permanent loss of vegetation: 6 acres for the FRO facility (in the dam footprint) and 720 acres for the FRFA facility (9 acres in the dam footprint, 711 acres in the reservoir area)* *•Reduced fish passage for adult and juvenile salmonids* *and Pacific lamprey* *•Reduced habitat for fish and wildlife species, including instream and off-channel habitat in the reservoir area* *•Change in visual quality of the area due to clearing of vegetation"* C: These impacts are being minimized and are very non-specific. Effects and consequences of these changes should be included in the report in much greater detail.

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			C2: The PEIS admits negative impacts to the QIN Treaty Rights of the QIN. Juvenile pacific lamprey should not be included in "reduced passage" the same as salmonids and adults of their own species, as their ecology will prohibit passage downstream through a FRFA with an estimated passage rate of less than 1%. This could eliminate pacific lamprey from the upper mainstem of the Chehalis River. There could be significant impacts to the genetic diversity of the basin-wide population by eliminating this population. These pacific lamprey that spawn in the upper mainstem of the Chehalis River could be a genetically diverse group (race) of pacific lamprey that could be completely lost with building of a FRFA dam. As mentioned previous, genetic loss could be detrimental to other species as well such as spring run Chinook salmon. These negative impacts (among others) could collapse the spring run Chinook salmon run in the upper mainstem, which could ultimately lead to the complete loss of wild spring run Chinook in the Chehalis River. Thus this list should also include the potential permanent loss of various fish (and potentially wildlife) species in the area (watershed) as well as the economic costs associated with a listing of a species (negative impacts leading to a listing of these spring run Chinook).
9	4.1.4	244	*"Conversion of a reach of the upper Chehalis River from a free-flowing river to a permanent reservoir impoundment (FRFA facility only)."* C: PEIS should specify the exact number (6.3 miles of river), and acknowledge "significant" reduction in fish passage and fish habitat.
10	4.1.4	244	C: In long-term impacts, does not mention for potential increase in mercury levels and potential impacts on wildlife demography (e.g., loon reproduction impairment).
11	4.1.4	244	C: The bullet list describes how the increase in landslide potential would only be completed for the FRFA facility. It needs to be done for the FRO as well since the temporary reservoir could saturate hillslopes for 30 days, enough to increase landslide initiation.
12	4.1.4	244	C: How were groundwater effects from reduced frequency and inundation of the floodplain considered as part of the draft EIS? By reducing floodplain inundation and frequency with the FRFA benefits from cool water and summertime releases could be offset by reduced groundwater effects in the mid to lower basin (Trust et al. 2000, Westbrook et al. 2006, Stanford and Ward 1993, Ward 1989)
13	4.1.4	245	"*Approximately 462 high-value structures would be relocated or experience more flooding.*" C: Clarify that no structures will experience more flooding with RFP. A key component of the project action is to relocate existing infrastructure outside of flood hazard areas. Treatment cannot be implemented without landowner cooperation, thus no structure will experience more flooding.

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14	4.1.4	245	*"Significant adverse impacts on visual quality would also occur due to the construction of engineered-floodplain structures over an area up to 21,000 acres within the treatment areas".* C: Discussion of Impacts of ASHA (Section 4.8.9.2) states that Depending on personal preference, these changes could be considered beneficial to visual quality. A similar statement could apply to impacts of RFP on visual quality described in this section.
15	4.1.4	246	*"While the low restoration scenario would still result in reductions of spring-run Chinook salmon and coho salmon (when applied to 20% of the reaches), the abundance of fish under the high restoration scenario would exceed the habitat potential for these two species."* C: This statement does not make sense. The fish abundance estimates are done with EDT, and one cannot exceed the habitat potential using this modeling approach. The potential is as high as the model is going to predict, and then only if the habitat if fully restored to intrinsic potential. The statement is in error and needs to be corrected.
16	4.2.1.2	247	*"The results and findings of this analysis are presented in the following studies, some of which are currently in development:"* C: QIN questions the credibility of drafting this PEIS *before* modeling of long-term impacts are complete. The results of impact analyses should be the basis of the PEIS. (This comment also applies to the wildlife impacts analysis in section 4.2.4, where the PEIS was drafted before the final reports for the waterfowl and amphibian studies are complete). Incomplete information should not be used to guide decision making.
17	4.2.1.2	248	*"Floodwaters would be retained in the reservoir (see Figure 4.2-1) when flows are predicted to exceed a major flood. Floods of this magnitude occur, on average, once every 7 years (15% probability of occurring in any given year)."* C: Clarify that 7 year recurrence interval is estimated based on historical records and that substantial increasing flood magnitude are projected for the region. As such, retention of floodwaters in the FRO reservoir will likely occur at a more frequent interval in future decades (potentially once every 3 or 4 years, twice as frequently, based on projected increases in peak flows presented in CIG 2016 report for the Chehalis River Basin).

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18	4.2.1	248	*"No adverse impacts on water use and water rights downstream of the dam are anticipated because flow changes would not affect the ability of water users to divert their water right downstream of the dam during its operation. Water stored in the FRFA reservoir during the winter and released during low-flow periods would augment flows and improve temperature (for the benefit of aquatic species; other uses would be secondary)."* C: Under Washington water law, water rights have priority dates as of their initial use. Senior water right holders downstream of the dam would be entitled to divert surface water to their maximum water right. Without a calculation of all downstream water users to determine the maximum potential use, this statement cannot be confirmed as correct.
19	4.2.1.2.1	250	*"Adverse impacts on water quality constituents, including violations of state water quality standards: sediment and turbidity; temperature, DO, and nutrients; and mercury (Hg)* *Potential pollutant loading at the Flood Retention Facility from operations, and reduction in downstream pollutant loading (heavy metals, hazardous materials) during peak floods* *Flow augmentation and temperature reductions downstream of the dam in the mainstem Chehalis River (FRFA facility only) would result in a beneficial effect to surface water quality."* C: It is shortsighted to conclude a "beneficial effect" to water quality from flow augmentation to the Chehalis. Even if water released from a hypothetical dam reduced temperatures, the water coming from the reservoir would be oxygen poor, nutrient rich, acidic, and may contain damagingly high mineral concentrations, as well as have very low dissolved oxygen levels, which can suffocate aquatic species.
20	4.2.1.2.1	250	*"The effects of these erosion processes have the potential to cause a significant adverse impact on water quality with respect to suspended sediment and turbidity conditions by violating the state water quality criterion for turbidity (5 Nephelometric Turbidity Units [NTU] over background)."* C: Turbidity and suspended sediment have far reaching deleterious effects on water quality. High turbidity has been shown to increase bacteria counts, as light slows down bacteria growth and darkness promotes it. "Intermittent illumination results in an increase in the time required for *E. coli* inactivation. No bacterial growth was observed after illumination of a contaminated TiO_2 suspension. In contrast, without catalyst, illuminated bacteria recovered its initial concentration after 3 h in the dark."

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			(Photocatalytical Inactivation of *E. coli*: Effect of (Continuous–Intermittent) Light Intensity and of (Suspended–Fixed) TiO_2 Concentration). This effect is not mentioned in the PEIS and should be fully explained and explored, considering there are serious Fecal Coliform Bacteria issues in the Chehalis and some of its tributaries, and is a major impairment. Increasing turbidity and temperature simultaneously would exacerbate the bacteria issues in the watershed.
21	4.2.1.2.1	250	*"Downstream of the dam, changes in the suspended sediment and turbidity levels in the Chehalis River would occur due to the following:* • *Capture of sediment in the reservoir* • *Change in the rate and timing of suspended sediment transport out of the reservoir"* C: Sediment transport downstream is necessary for many river functions such as the formation of depositional features like river deltas, alluvial fans, braids in the river, and levees. C2: The impact on flood elevations due to a decrease in sediment transport capacity downstream of both the FRO and FRFA facilities is not evaluated in the PEIS. A reduction in sediment transport rates could cause aggradation at tributary junctions along the main stem Chehalis because the river would not be capable of moving sediment loads downstream. This could cause an increase in channel bed elevation – which could locally increase water surface elevations and thus flood risk – until a new equilibrium channel is reached.
22	4.2.1.2	250	C: The potential concentration of pollutants in reservoir sediment and subsequent leaching into surface water is not mentioned as a long-term impact. A reduction in downstream pollutant loading of heavy metals and hazardous materials is cited as an effect of the FRO and FRFA alternatives, however this material would be concentrated within reservoir sediments and pose a long-term impact once dam operations cease or reservoir sediments need to be dredged to increase flood storage quantities.
23	4.2.1.2.1	250	C: The bullets predict a violation of current water quality standards, which needs to be quantified.
24	4.2.1.2.1	251	*"For both the FRO and FRFA facilities, the potential for prolonged, controlled releases of turbid water exists as the reservoir draws down after a major flood (occurrence once every 7 years on average). Based on proposed facility operations, this drawdown period could last up to 32 days. For both configurations, some fine sediment would be trapped during the flood retention period, reducing the overall quantity of suspended sediment released during that time. For the FRO facility, high flows that occur outside of flood retention periods can erode previously deposited fine sediment in the reservoir, causing higher rates of*

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			suspended sediment to be released than under existing conditions. This would create more frequently occurring turbid conditions in the Chehalis River downstream of the dam. The effects of these processes have the potential to result in a moderate to significant adverse impact on downstream water quality relative to suspended sediment and turbidity conditions." C: The negative effects of the FRO on downstream water quality would be a negative impact on the fisheries resources. Having poor water quality for prolonged periods of time (from both FRO and FRFA) could have negative chronic impacts on certain species that may have evolved to be able to handle turbid conditions for short periods of time (less than 32 days). Again, this is another potential negative impact on aquatic resources from both FRO and FRFA proposals. The paragraph goes on to claim an overall reduction of sediment delivery in the system due to some of it being "trapped during flood retention period." That would not be true for the typical operation of the FRO dam as it would not have a reservoir to trap sediment (6 of 7 years). There would be a large increase in sediment delivery due to the loss of vegetation upstream and further increased by the buildup of sediment every seventh year behind the FRO dam. C2: Long-term constant turbidity could cause a large reduction of primary productivity. This decrease in the primary productivity could extend throughout the food chain and include a negative impact to juvenile salmonid success.
25	4.2.1.2.1	251	*"For both configurations, some fine sediment would be trapped during the flood retention period, reducing the overall quantity of suspended sediment released during that time. For the FRO facility, high flows that occur outside of flood retention periods can erode previously deposited fine sediment in the reservoir, causing higher rates of suspended sediment to be released than under existing conditions. This would downstream water quality relative to suspended sediment and turbidity conditions."* C: Sedimentation and turbidity is already impairing the Chehalis watershed, and increasing those levels will put an undue strain on the aquatic organisms living there that may not be sustainable. "Decreases in primary production are associated with increases in sedimentation and turbidity and produce negative cascading effects through depleted food availability to zooplankton, insects, freshwater mollusks, and fish. Direct effects at each trophic level are mortality, reduced physiological function, and avoidance; however, decreases in available food at trophic levels also result in depressed rates of growth, reproduction, and recruitment."---Effects of Sedimentation and Turbidity on Lotic Food Webs

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			Suspended sediment can damage the gills of fish and the feeding apparatus of invertebrates, as well as replaces course substrates that fish and invertebrates use as habitat with sand and silt. Suspended sediment also increases contaminants because nutrients, bacteria and toxic chemicals attach to sediment, and that is how they are transported and deposited.
26	4.2.1.2.1	251	*"The effects of these processes have the potential to result in a moderate to significant adverse impact on downstream water quality relative to suspended sediment and turbidity conditions."* C: The PEIS needs to evaluate the effects of these water quality reductions on fish and wildlife. It is not clear how they or if they have done so.
27	4.2.1.2.1	251	*"When in operation, the FRO facility flood retention periods are shorter than in the FRFA facility, limiting the potential for temperature and DO impacts as compared to the FRFA facility."* C: The temporary reservoir will have no riparian trees along the river channel for most of its length. The existing forest around the reservoir will not withstand frequent or deep long term flooding, thus the trees will die. Once these trees die, we will have an unshaded channel for the length of the reservoir. The FRO will increase temperatures during the summer months as the water flows through the temporary reservoir, which will have little to no riparian shade. This statement appears to contradict the statements below about increasing stream temperature.
28	4.2.1.2.1	251	*"Predictions of a water quality model that simulated the anticipated changes to temperature indicated a nearly 4°increase in summer water temperatures (over existing temperatures) could occur along the mainstem at the dam site … ."* C: The estimate that water in the reservoir inundation area might be nearly 4°C warmer in the summer means that, since water temperatures currently reach 18.9-22.2° C in the summer in this system (WDOE 2001), projected future temperatures could reach 22.9-26.2°C in the inundation area associated with the FRFA reservoir. In this warmer ponded environment, there would likely be a high level of nutrient loading (primary production) and low dissolved oxygen compared to the pre-dam environment. This warmer environment would create a lower quality habitat for species currently occupying that space. Impacts that the warmer reservoir would have on wildlife were not fully addressed in the PEIS. For instance, food-

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			web structure and function would drastically change. Pond warming has shown to vastly change vegetation, and thus, fish and bacteria that feed on the vegetation (Shurin et al. 2012). The area surrounding the reservoir will likely be acquiring different nutrients (non-marine derived), which may affect the riparian areas surrounding the reservoir. This new system will likely support different species in comparison to the pre-dam environment. With a reduced water quality, there would be a simpler biotic system in the inundation area (reducing the food web to fewer interactions), which may, in turn, alter the terrestrial food web in the immediate areas as well. A detailed plan to protect and restore water quality was developed in the Department of Ecology's 2004 document *The Chehalis/Grays Harbor Watershed Dissolved Oxygen, Temperature, and Fecal Coliform Bacteria TMDL Detailed Implementation (Cleanup) Plan*, Because the FRO and FRFA dam alternatives increase temperature and likely increase nutrient loading, water quality will not be either protected nor restored, which is in conflict with this protection plan. Washington State Department of Ecology, 2001. Upper Chehalis River Basin Total Maximum Daily Load.
29	4.2.1.2.1	251	*"Modeling predicts this temperature effect to diminish upstream along the mainstem Chehalis River, where at RM 114 the predicted increase is approximately 1˚C."* C: This increase still violates current water quality standards and given the current temperatures in this part of the watershed could have detrimental effects on salmonid fishes.
30	4.2.1.2.1	256	*"In addition, the reservoir would be drained between flood retention operations and sediment and organic materials would be transported out of the reservoir by river flows."* C: The FRO reservoir will retain sediment and some organic material. It is incorrect to assume it will all be moved through the dam during reservoir drawdown. They are drawing it down at a rate much slower than a flood would, thus the flows through the reservoir will be less than the flood flow that delivered the sediment. With the reduced flows, much sediment will be retained in the reservoir.
31	4.2.1.2.1	257	C: There is still the potential for long term adverse impacts to mercury pollution within the reservoir despite the removal of local atmospheric sources. Mercury is a global pollutant and thus removing a local source will not lessen the atmospheric concentration that the reservoir is exposed to (Driscoll et al 2013)

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32	4.2.1.2.1	257	Discusses "*potential ... for the conversion of ... Hg to ... (MeHg), a more toxic form that accumulates in the food web and fish.*" C: Why are these potential adverse impacts not discussed in the wildlife section? Furthermore, there must be monitoring of MeHg levels and monitoring of MeHg accumulation (or lack thereof) in birds (e.g., collection of feathers for analysis of MeHg concentrations).
33	4.2.1.2.1	257	"*A reduction in the area of the floodplain inundated by a major flood downstream of a dam could reduce the contamination of surface water, and the release of pollutants and hazardous materials from flooding urban areas and agricultural fields and facilities.*" C: The rich floodplain agricultural soils are good soils due to the past regular flooding where the river provided new sediment and new organic material to the soil. This process will stop as well, necessitating the use of artificial nutrients to these farm lands. These chemicals create a risk to both surface and ground water. This should be evaluated.
34	4.2.1.2.1	252	"*The model predictions also show that algal activity (which produces oxygen) would be increased in the upper layers of the reservoir over late spring through mid-summer, resulting in a condition where DO exceeds 100% saturation (condition known as supersaturation). However, model simulations also showed that decomposition of the algae (that die and settle from the surface layers) and the organic matter (from the watershed that settles) in the reservoir sediments result in increased oxygen demand (i.e., consumption) in the lower layers, resulting in lower DO levels than at the surface. Since the reservoir is predicted to stratify, oxygen cannot mix from the surface layer to the lower layers to meet this oxygen demand, thereby resulting in lower oxygen concentrations (hypoxic conditions) in the bottom waters in late summer (see Figure 4.2-3).*" C: Dissolved oxygen levels are one of the most important elements of a healthy freshwater ecosystem. Algae growth in the stagnant water of a reservoir will not only affect the water quality of the reservoir itself, where it will become unable to provide for the oxygen demands for aquatic life and plants, but will also affect water quality downstream when water is released. Water released from behind the dam will have very low dissolved oxygen levels that may counteract the supposed benefits of cold-water releases for fish. Another issue caused by decreasing oxygen levels is a rise in the acidity of the water, which decreases the natural process of dissolving minerals such as iron and manganese in the water, as well as disabling the natural processes of breaking down bacteria, pollution, and organic detritus.

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			Decreases in dissolved oxygen causes increases in ammonia, which is included in the Department of Ecology 2000 TMDL for DO in the Chehalis River and its tributaries. In the TMDL, the entirety of the Chehalis River as well as Cedar Creek, Rock Creek, Garrard Creek, the Black River, Independence Creek, Scatter Creek, Lincoln Creek, Salzer Creek, Coal Creek, Dillenbaugh Creek, the Skookumchuck River, the Newaukum River, Stearns Creek, Bunker Creek, the South Fork of the Chehalis, Elk Creek, Mima Creek, Beaver Creek, Littlerock Ditch, and Demsey Creek are all listed as impaired for not only dissolved oxygen levels but also ammonia levels. According to the EPA, "Impoundment of water may contribute to elevated ammonia concentrations. Lack of turbulence and mixing will decrease volatilization of ammonia, resulting in higher ammonia concentrations downstream. Thermal stratification in impoundments can lead to higher concentrations of ammonia in the hypolimnion which, with bottom-release dams, can result in increased ammonia in downstream waters. Slow-moving or stagnant water may have high ammonia concentrations because of lack of turbulence and volatilization and greater accumulation of metabolic waste and decomposition products—including ammonia (WHO 1986). Ammonia is very toxic to aquatic animals, particularly fish, because it can readily diffuse across gill membranes (Sampaio et al. 2002). Ionized ammonia does not pass as easily through gill membranes, so it is appreciably less toxic than the unionized form (Camargo and Alonso 2006). In most fish, ammonia is excreted by passive diffusion of NH_3 across the gills according to its partial pressure gradient (Wilson et al. 1998). Disruption of this gradient causes internal ammonia concentrations to increase, affecting internal organs, nervous system function, and respiration. Salmonids tend to be particularly sensitive in acute exposures associated with episodic sources. Early life stages of fish are more sensitive than juveniles or adults. Hence, effects are more likely to occur during seasons when early life stages are present." Low levels of dissolved oxygen have equally catastrophic effects on salmonids. Reduced concentrations of dissolved oxygen can negatively affect the swimming performance of migrating salmonids (Bjornn and Reiser 1991). Sustained swimming over long distances requires high expenditures of energy and therefore requires adequate levels of dissolved oxygen. Low levels of dissolved oxygen can be directly lethal to incubating salmonids, and can also have sublethal effects such as changing the rate of embryological

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			development, the time to hatching, and size of emerging fry (Spence et al. 1996). The embryonic and larval stages of salmonid development are especially susceptible to low dissolved oxygen levels as their ability to extract oxygen is not fully developed and their relative immobility inhibits their ability to migrate to more favorable conditions. The dissolved oxygen requirements for successful incubation of embryos and emergence of fry is tied to intragravel dissolved oxygen levels. The TMDL for the Chehalis calls for dissolved oxygen not to fall below 8 mg/L, however at 8 mg/L incubating salmonids exhibit symptoms of oxygen distress, and at 6.5 mg/L a large portion of the incubating eggs may be affected. In summary, the Chehalis and its tributaries are already impaired in regards to dissolved oxygen and ammonia and have been on the 303d list for over 20 years for these impairments, without significant improvement. It is well documented that damming a river causes dissolved oxygen levels to go down and ammonia levels to go up. Therefore it is irresponsible to proceed with plans that push the limits for water quality parameters that are already nearing the limit for sustaining aquatic life and natural chemical processes, and these issues are not properly addressed in the PEIS.
35	4.2	255	*"For the FRO facility, the greatest downstream impact is predicted immediately below the reservoir (approximately 2 to 3°C warmer than existing conditions) during summer (July 15) with negligible impacts below the confluence of the South Fork Chehalis River (RM 88). This would result in a moderate adverse downstream impact with regard to stream temperature during peak summer temperatures."* C: According to the Chehalis watershed TMDL created in 1999 and updates in 2001, "Temperature shall not exceed 18.0°C (freshwater)...due to human activities. When natural conditions exceed 18º C (freshwater)...no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3º C." and "Incremental temperature increases resulting from point source activities shall not, at any time, exceed t=28/(T+7) (freshwater)...Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°C." The PEIS presents a 2-3 degree Celsius change as only a "moderate adverse" impact, however this is a very large and drastic change in a river that provides habitat for salmonids. The Chehalis and many of its tributaries are already listed as impaired for temperature, and the goal of achieving 18 degrees in these

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			rivers is already above ideal temperatures for salmonids. Higher temperatures will also exacerbate the *E.Coli* issues in the Chehalis, for which it is listed as impaired. A 3-degree increase has huge effects and impacts that are not being properly addressed or discussed in this document.
36	4.2	257	*"The potential exists in the FRFA reservoir for the conversion of atmospheric inorganic Hg to organic methylmercury (MeHg), a more toxic form that accumulates in the food web and in fish."* C: With subsistence harvest concentrated on this watershed, even incremental increases in methylmercury consumption is completely unacceptable in light of the medical consequences, and would unequally effect the Quinault population through their dependence on their subsistence harvest. According to the National Research Council Committee on the Toxilogical Effects of Methylmercury, "Dietary intake is one of the most important sources of non-occupational exposure to Hg, fish and other seafood products being the dominant source of Hg in the diet. Most of the Hg consumed in fish or other seafood is the highly absorbable MeHg form. The substantial variation in human MeHg exposure is based on the differences in frequency and amount of fish consumed and Hg concentration in the fish. MeHg exposure is a major problem in some populations, especially subsistence fish eaters who consume large amounts of fish (EPA 1997a)." "Human exposure to MeHg from contaminated fish and seafood can pose a variety of health risks. The fetus is considered much more sensitive than the adult. Prenatal exposures interfere with the growth and migration of neurons and have the potential to cause irreversible damage to the developing central nervous system (EPA 1997a). At much lower doses that result from chronic maternal fish consumption, infants might appear normal during the first few months of life but might later display deficits in subtle neurological end points (e.g., IQ deficits, abnormal muscle tone, decrements in motor function, attention, and visuospatial performance)." The PEIS states that the "potential exists in the FRFA reservoir for the conversion of atmospheric inorganic Hg to organic methylmercury (MeHg)." To clarify, however, research suggests that this is not a remote possibility but indeed very likely, and its negative impact on the Quinault population through fish consumption is something that has happened to many other native populations internationally.

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			According to the book *Silenced Rivers: The Ecology and Politics of Large Dams,* "Ten years after the La Grande 2 Reservoir (in Quebec) was first impounded, mercury levels in pike and another predatory fish called walleye had risen to six times their pre-reservoir level and showed no signs of levelling off. As fish are a major part of the traditional diet of the local Cree native people, mercury levels in their bodies rose dangerously. By 1984, six years after La Grande 2 Dam was completed, 64 per cent of the Cree living on the La Grande estuary had blood mercury levels far exceeding the World Health Organization tolerance limit." In another example, the Nunatsiavut Inuit tribe in the Arctic led an unsuccessful effort to challenge the building of the Muskrat Falls hydroelectric dam on the estuarine fjord of Lake Melville that is set to be finished in 2017. In response, the Nunatsiayut government hired Dr. Elsie Sunderland of Harvard School of Medical Health to research methylmercury levels and effects from an existing dam on the Churchill River which feeds Lake Melville. Her research revealed astonishingly high levels of methylmercury in Lake Melville, and very high levels found in hair samples of the Nunatsiayut tribal members, who depend on fish from the lake. Dr. Sunderland concludes in one of her papers that "Soil flooding experiments indicate that near-term changes expected from reservoir creation will increase methylmercury inputs to the estuary by 25–200%, overwhelming climate-driven changes over the next decade."
37	4.2.1.2.2	259	*"The dam would alter the Chehalis River from a free-flowing river to a reservoir. For the FRO facility,* ***these changes would result in a moderate adverse impact on surface water quantity*** *because the river within the reservoir footprint would be periodically inundated once every 7 years on average (or 15% probability of occurring in any given year) for a period of up to 32 days. When the FRO facility is not operational, the river would continue to be a free-flowing river. For the FRFA facility, these changes would result in a significant adverse impact because the Chehalis River would be changed from a free-flowing river to a permanent reservoir, affecting instream habitat conditions currently used by aquatic species in the system."* C: This assertion, based on a qualitative assessment, that FRO facility alterations of the natural flow regime would have only "moderate adverse impacts" on downstream waters and wetlands is not substantiated without an analytical hydrologic modeling analysis of groundwater and surface water. Adverse impacts are defined as: "Adverse but limited in scope and effect; limited in extent on a Basin-

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			wide scale (smaller footprint and would result in limited changes); potentially consistent with regulatory standards; mitigation requirements would be straightforward and reasonable achievable." Downstream impacts could be potentially adverse, extensive and significant, resulting in permanent alterations of waters and wetlands supported by the natural groundwater and surface water flow regimes (Nilsson et al. 1991; Jansson et al. 2000b).
38	4.2.1.2.2	261	C: Flood elevation reductions are presented for the combination of this alternative with levee construction and are not associated with solely the FRF. This is misleading and should be adjusted accordingly.
39	4.2.1.2.3	262	*"Groundwater"* The section indicates that downstream impacts of the FRO facility upon the natural flow regime would potentially result in alterations of floodplain groundwater regimes. Dam alterations of downstream surface water flow regimes have been documented to result in altered floodplain wetland groundwater regimes by changing the pattern of overbank flooding of lateral floodplain water bodies resulting in depression of shallow floodplain alluvial aquifers (Braatne et al 2008). Depression of floodplain shallow aquifers has been documented to affect changes in plant species richness, plant growth rates and productivity, plant community composition, initiation of invasions of exotic plant species and mortality of riparian forests (Nilsson et al., 1991; Jansson et al 2000b; Stromberg and Patton 1990; Merritt and Cooper 2000; Merritt and Wohl 2006; Braatne et al 2008; Cooper et al. 2003; Rood and Mahoney 1990).
40	4.2.1.2.3	262	*"Overall, significant adverse impacts on groundwater flow regimes are not expected downstream of the Flood Retention Facility. However, this has not been quantified to support the preliminary analysis for this programmatic EIS."* C: The above analysis and conclusion of no significant adverse impacts on floodplain groundwater regimes is not based on any quantitative evidence. To conclude that reducing the Chehalis River floodplain by 4,480 acres, 10% of the floodplain area, during the 100-year flood would not result in adverse impacts to the groundwater regime of wetlands associated with these floodplains without an extensive groundwater and surface water modelling effort is a factually unfounded statement. Furthermore, no characterization of the extent, and degree of impacts, to waters of the United States, including wetlands in these floodplain areas during the 7-year to 100-year flood events is indicated in the

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			PEIS. Therefore, concluding that no "overall, significant adverse impacts on groundwater flow regimes are not expected downstream of the Flood Retention Facility" is specious and misleading.
41	4.2.1.2.3	262	*"No adverse impacts on groundwater quality are anticipated from either FRO or FRFA reservoir operations either within the reservoir footprint or downstream of the dam."* C: The conclusion that no "adverse impacts" on floodplain groundwater quality downstream of the dam is not supported by any factual evidence. Spatially explicit groundwater and surface water models may be developed to address these questions (Franz and Bazzaz 1976; Benjankar et al., 2011).
42	4.2.1.3.1	263	C: The last paragraph describes an ongoing sediment and erosion control program. Is this included in the cost estimate for maintenance?
43	4.2.1.3.1	263	C: The PEIS again uses the planting of flood resistant trees to mitigate erosion and sediment delivery. Specific tree species and some supporting literature are required to properly evaluate this proposal.
44	4.2.1.3.2	264	*"Avoidance and minimization measures for surface water quantity could include managed reservoir drawdown rates, release rates, debris management, and other factors. No long-term compensatory mitigation measures are proposed for water quantity because the overall effect would be beneficial due to the reduction in flooding (FRO and FRFA facilities) and the improvement in instream flow (FRFA facility)."* C: The above analysis and conclusion of no significant adverse impacts on floodplain groundwater regimes is not based on any quantitative evidence. To conclude that reducing the Chehalis River floodplain by 4,480 acres, 10% of the floodplain area, during the 100-year flood would not result in adverse impacts to the groundwater regime of wetlands associated with these floodplains without an extensive groundwater and surface water modelling effort is a factually unfounded statement. Furthermore, no characterization of the extent, and degree of impacts, to waters of the United States, including wetlands in these floodplain areas during the 7-year to 100-year flood events is indicated in the PEIS. Therefore, concluding that no "overall, significant adverse impacts on groundwater flow regimes are not expected downstream of the Flood Retention Facility" is specious and misleading.
45	4.2.1.3.3	264	*"No long-term adverse impacts on groundwater quantity or quality are anticipated so no mitigation is proposed."*

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			C: The statement is not based on fact. No modeling analysis supports this statement. This statement is misleading in that it implies that no downstream impacts to waters of the United States, including wetlands, supported by groundwater resources will occur under both the FRO and FRFA dam operations. Furthermore, the preponderance of scientific evidence concerning downstream impacts of dams on floodplain surface water and groundwater flow regimes indicates that alterations of the natural flow regime may result in significant impacts to groundwater supported floodplain aquatic, riparian and wetland ecosystems (Petts 1984; Jorde et al., 2008; Burke et al., 2009; Ligon et al., 1995; Jorde and Braticht al. 2000; Rood et al. 2005; Merritt et al.2009).
46	4.2.2	264	C: Does not address geomorphic and ecological impacts of curtailing the flood regime at approximately a 7 year level. For example, Poff et al. 1997 discusses the role of the natural flow regime in defining the geomorphic and habitat characteristics of the river.
47	4.2.2.2.1	266	C: Adverse impacts on water quality and dam stability due to land-slides within the potential FRO and FRFA construction areas are not adequately analyzed through modeling or quantitative analysis.
48	4.2.2.2.2	268	*"The potential adverse impacts on geomorphology are related to the following:* • *Changes in sediment load and sediment transport processes* • *Changes in large wood load, transport, and recruitment* • *Changes in geomorphic function and channel complexity* *The potential changes in wood and sediment transport processes resulting from implementation of both the FRO and FRFA facilities would have a significant adverse impact on geomorphology due to the interruption of these processes upstream and downstream of the dam, as described here."* C: It follows from the above statement that adverse impacts will occur resulting in changes in downstream geomorphic function and channel complexity due to operations of both FRO and FRFA facilities. Channel and floodplain geomorphic processes support floodplain waters of the United States, including wetlands. This fact points to the inadequacy of the hydrologic and geomorphic impact analysis conducted in this PEIS in that it does not address adequately impacts to downstream floodplain waters of the United States, including wetlands.
49	4.2.2.2.2	268	C: The discussion on landslides does not consider the effect on sedimentation rates for a FRFA facility, and impacts on the lifespan and continuing efficacy of the reservoir. 85,000 tons/year is presented as the bedload transport rate into the FRFA facility (per USGS study in Puget sound:

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			http://pubs.usgs.gov/fs/2011/3083/). But how much of an increase would episodic mass wasting contribute? And how long until the facility is full of sediment?
50	4.2.2.2.2	268	*"Changes to geomorphic processes (i.e., changes in sediment transport) are not anticipated to result in effects below RM 62."* C: This statement should be supported by both hydraulic and sediment transport modeling results. The rationale for claiming that "changes to geomorphic processes are not anticipated to result in effects below RM 62" is not explained in detail within the text.
51	4.2.2.2.2	268	C: The statement "*sediment entrainment of up to 1 food could occur upstream of the FRO dam throughout the reservoir footprint*" is not described in detail and should be further elaborated. It is unclear whether the statement is referring to a size class of sediment or depth of the channel bed. Furthermore, the statement does not specify where in the channel (i.e., mainstem Chehalis) or tributary the entrainment would occur.
52	4.2.2.2.2	268	C: Adverse impacts to channel morphology within the FRO reservoir footprint are not evaluated. Significant aggradation could occur within the reservoir footprint (9,000-17,500 tons per year as stated by the PEIS) which could cause significant changes to channel planform, bar-forming, spawning/rearing gravel distribution, and the size class distribution of bed material.
53	4.2.2.2.2	268	C: The impacts on changes to upstream channel morphology due to the establishment of a new, permanent grade control structure such as the FRO tunnel or FRFA impediment is not evaluated. Establishment of a permanent grade within the river corridor could cause either aggradation or deposition (and thus changes in channel morphology) depending on whether the new baseline is higher or lower than current conditions.
54	4.2.2.2.2	268	C: Description of impacts to sediment retention in FRO facility is unclear and does not provide sufficient evidence to claim, as done in the Executive Summary (page ES-22), that the FRO facility is only a temporary disruption to sediment transport. This section refers to Dube 2016 memorandum presenting modeling results of sediment transport through the reservoir footprint, however, I was unable to locate this memorandum in the supplemental EIS documents for review.
55	4.2.2.2.2	269	C: The impact to downstream geomorphic processes due to the loss of key-member sized (Abbe and Montgomery 2003) wood material transport through the FRO facility is not evaluated. It is well known

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			that large wood significantly affects channel morphology and habitat (e.g. Montgomery et al., 2003, Harmon et al 1986).
56	4.2.2.2.2	269	C: The impact of increased flood elevations due to a decrease in sediment transport capacity downstream of both the FRO and FRFA facilities is not evaluated. Sediment transported into the mainstem Chehalis river by tributaries could deposit at the mouth of these tributaries and continue to aggrade due to a reduction in the sediment transport capacity of the Chehalis River cause by the FRO and FRFA facilities. This could cause an increase in channel bed elevation - which could locally increase water surface elevations and thus increase flood risk. Furthermore, the potential increased sediment aggradation in these locations could cause increased channel migration rates which could also further increase local flooding.
57	4.2.2.2.2	269	*"Changes to water flow and sediment transport would have adverse impacts on the channel geomorphology downstream of the dam...* *This change in sediment transport could potentially have a significant adverse impact on channel processes, channel migration, and channel structure downstream of the dam. The largest impact would occur immediately downstream of the dam, where the sediment supply would be most depleted."* C: There is no analysis of sediment loads from tributaries downstream of the FRO and FRFA facilities. C2: A spatially explicit model of surface water, groundwater and sediment transport regimes should be developed to quantify the extent and degree of impacts to floodplain waters of the United States, including wetlands in support of this statement.
58	4.2.2.3.2	272 - 273	*"Geomorphology"* C: Description of impacts to sediment transport and retention in the FRO facility (section 4.2.2.3.2) is unclear and does not provide sufficient evidence to claim, as stated in the Executive Summary (page ES-22), that the FRO facility is only a temporary disruption to sediment transport. The EIS documentation in Appendix H (page H-26) states that during flood operations sedimentation would occur within FRO reservoir and tributary valleys draining in to the reservoir, then goes on to state that the bedload deposited during those dam operations would be eroded and transported downstream during subsequent, more moderate flood events (such flows that occur every 2 to 5 years). This assumption is

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			unsupported by any technical documentation available for review on the project website and has important implications for evaluation of geomorphic and ecologic impacts associated with the FRO dam operations. Further, the EIS references the UW CIG study evaluating projected increases in flood magnitudes associated with future climate change. The projected increase would result in a much more frequent operation of the FRO dam and thus more frequent interruption of the sediment regime than the 1 in 7 years average presented in the EIS.
59	4.2.2.3.2	272	*"Compensatory mitigation for the disruption of large wood transport would entail relocating large wood meeting the minimum criteria (12-inch-diameter breast height and 25-foot length) to a downstream channel location."* C: In a large river system such as the Chehalis basin, this size of wood would be inadequate. The most potentially influential pieces of wood would be much larger than 12-inch-diameter breast height and would have a large root-wad still attached. Without the root-wad the large wood is much less likely to become incorporated into the system. This wood needs to become part of the system, adding much needed complexity and habitat. Large wood with root-wads also have a more prominent role in altering sediment sizing in microhabitats.
60	4.2.2.3.2	272	*"The FRO dam would be designed to pass suspended sediment load, bedload, and most wood (up to 15 feet in length and 3 feet in diameter) at all times except during flood operations"* C: This size of wood would not avoid or minimize the long-term impacts on geomorphology as is claimed. Further, most root-wads, on trees that would be considered large wood, have a diameter greater than 3 feet. These larger trees with root-wads are the ones that are needed to lessen the long-term impacts on geomorphology such as loss of sinuosity.
61	4.2.2.3.2	272	*"This monitoring could include channel cross sections and substrate (bed material) sizes (i.e., pebble counts) to quantify and document changes"* C: Monitoring of spawning gravel should be much more in-depth than taking cross sections and substrate sizes to have the ability to quantify and document changes. Spawning bed habitat does not just consist of the size and number of rocks at the top portion of the streambed. Changes in spawning gravel substrates that would not be captured by taking cross sections and substrate sizes could have drastically negative effects on spawning salmonids. A couple examples of very important monitoring measurements are

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			permeability in the substrate (where eggs incubate and alevin hatch) and water quality such as dissolved oxygen and temperature at incubation depths.
62	4.2.2.3.2	272	C: The potential for adverse impacts associated with gravel augmentation including but not limited to a localized increase in channel bed elevations are not evaluated. C2: The costs associated with gravel augmentation are not included in the maintenance costs associated with the FRO or FRFA alternatives.
63	4.2.2.3.2	272	"*The FRO dam would be designed to pass suspended sediment load, bedload, and most wood (up to 15 feet in length and 3 feet in diameter) at all times except during flood operations*" C: Ability to pass wood up to 15 feet in length and 3 feet in diameter will not maintain a natural wood regime. Most wood that is sufficiently large to provide geomorphic function in the stream corridor is much longer than 15 feet in length and therefore will not pass through the FRO dam per the design criteria presented.
64	4.2.2.3.2	273	*"A Flood Retention Facility may cause adverse impacts that cannot be fully mitigated by the compensatory actions described here."* C: These adverse impacts (mitigated or not) are a negative impact to the fisheries resources and the QIN Treaty Rights.
65	4.2.2.3.2	273	C: The potential for adverse impacts associated with wood loading mitigation activities including but not limited to a localized increase in channel bed elevations are not evaluated. C: The costs associated with wood loading mitigation activities are not included in the maintenance costs associated with the FRO or FRFA alternatives.
66	4.2.3.1	273	*"Short-term impacts include the temporary disturbance (ranging from 19 acres for the FRO facility to 21 acres for the FRFA facility) of mixed coniferous/deciduous upland forest vegetation of varying sizes and age classes, as well as some scattered wetland communities, from the construction of temporary access roads and construction equipment and material staging areas."* C: The Vegetation Management Plan needs to address invasive species prevention before construction, during construction and after construction. The "temporary disturbance" could leave long-term impacts of invasive species if not managed properly. (Siegel and Donaldson 2003).

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67	4	273	"Anticipated adverse impacts are related the following: permanent loss of wetlands" C: Please provide exact value or acreage (estimated or modeled) to illustrate the magnitude of loss.
68	4	273	*"[T]he potential loss of vegetation and conversion of vegetated habitat is a small percentage of existing forested habitat."* C: This statement downplays potential significant impacts. Provide a specific number here instead of interpreting it for the reader that this is a small percentage. What about existing wetland habitat?
69	4.2.3.2.1	274	*"Downstream of the Flood Retention Facility wetlands in the Chehalis River Floodplain could be affected by reduced water inputs from overbank flooding events. Since FRO and FRFA facilities are designed to reduce flooding from a major flood, many floodplain wetlands would continue to receive floodwater inputs from smaller floods. Wetlands in the outer edges of the Chehalis River floodplain could experience a reduction in the frequency of floodwater inputs;* ***however, as flooding is already infrequent, these potential changes are unlikely to result in any major changes to the hydrology of these wetlands.*** *Modeled results for the decreased area of floodplain inundation and its potential effect on wetlands have been developed for the combined Flood Retention Facility and Airport Levee Improvements (Alternative 1) and are described in more detail in Chapter 5."* C: The statement "... as flooding is already infrequent, these potential changes are unlikely to result in any major changes to the hydrology of these wetlands." is unsupported by fact, and is misleading in that it implies there are no potential adverse impacts to these waters and wetlands. Without first mapping the extent of jurisdictional wetlands in question, and then conducting a spatially explicit surface water and groundwater model of the these mapped wetlands, this statement is specious at best. It is not based upon any logical presentation of fact and therefore is misleading as to the assessment of "unlikely" potential impacts to waters and wetlands.
70	4.2.3.2.2	275	*"Permanent impacts on vegetation include the removal of existing vegetation in the footprint of the dam, ranging in extent from 6 acres (FRO facility) to 9 acres (FRFA facility), for construction. This vegetation*

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			would not be expected to grow back or be replanted because these areas would be occupied by structures, access roads, and other features required for dam operations." C: What is the full species list of plants to be removed? Any special status plants? Culturally significant plants? The PEIS recognizes the hundreds of acres that will be disturbed by vegetation removal and inundation in the reservoirs and states that it will be mitigated for by planting appropriate native plants. Riparian areas are the most species-rich compared to surrounding habitat and are have a central role in the ecosystem (Nilsson and Svedmark 2002). Dammed systems are proven to be less diverse, more invasive species, and lack rare and sensitive plants (Hills et al 1998, Johnson et al 2012, Leyer 2005). In addition to supporting literature, my personal observations of numerous reservoirs show the species-rich riparian area turned into a barren bathtub beneath the upland habitat. The reservoir is completely bare ground scattered with the tree stumps that were harvest before construction of the dam. A ring of exotic plants is found at different levels of the "bath tub ring" that shows the fluctuating water level and establishment of invasive species within the reservoir.
71	4.2.3.2.2	275	"*Selective harvesting of up to 405 acres of mixed coniferous/deciduous forested riparian areas, which would convert the area to forests dominated by deciduous riparian shrubland*". C: Needs to provide list of tree species and the associated % volume or cover within the RMZ's in order to assess how "selective" the harvest actually will be. Composition of RMZ's within the reservoir footprint is not described here nor in Appendix J. The PEIS needs to include this information so that the reader can understand how much overstory removal will occur during the "selective harvest".
72	4.2.3.2.2.	275	C: The adverse impact to the dispersal of riparian pioneer riparian species such as willow and cottonwood through peak flows is not evaluated.
73	4.2.3.2.2	276	"Both the FRO and FRFA facility types would modify seasonal peak flows in the Chehalis River and reduce the extent of major floods in areas downstream. These changes could reduce the transport of water and nutrients to the **outer edges of the Chehalis River floodplain**, which could in turn affect the growth and survivorship of vegetation in those areas. Potential results include a gradual change in vegetation composition in those locations. Such changes in plant community composition could modify the types of habitat available in these areas, and affect the fish and wildlife currently using them (see Section 4.2.4)." (p. 276).

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			C: Dam operational changes to the natural surface water and groundwater flow regimes of downstream floodplain wetlands and riparian areas could potentially be extensive and permanent throughout a large area. To characterize the impacts as only occurring along the "outer edges of the Chehalis River floodplain" is simply untrue and not based on any factual analysis as presented in the PEIS. A spatially explicit surface water and groundwater model of downstream floodplains can address this question in a quantitative manner. Not only would the riparian and wetland vegetation composition and structure potentially change over time, the extent of waters of the United States, including wetlands, will likely be reduced. Accordingly, a surface water and groundwater model is necessary to predict such downstream impacts.
74	4.2.3.2.2	276	*"The reduction in flood extents downstream of the dam would also reduce the episodic disturbance of downstream riparian areas and wetlands by major or larger floods. This could result in a reduction in the occurrence of major channel avulsions and large-scale channel migrations, allowing the adjacent riparian forest to become more mature as the occurrence of periodic disturbance decreases. In addition to these changes, a reduction in the downstream flooding extents could also limit the establishment of invasive species that are spread by flood flows, as certain areas of floodplain would receive floodwaters less frequently."* C: Floods are a beneficial disturbance of riparian areas and floodplain forests. These floods recharge groundwater, sustain floodplain forested wetlands, and provide many other ecological benefits. Therefore, while this paragraph is true, it is unlikely to describe a beneficial effect for either the river or the floodplain. Although disturbances such as avulsions and channel migrations are amplified by forest practices, these occurrences are still natural processes and play an important role in diverse riparian plant community structure (Bunn and Arthington 2002, Naiman et al 1993). Alteration of flood waters would disturb the dispersal of all plants and the disturbance of the flood cycle would favor the establishment of invasive species (Bunn and Arthington 2002, Nilsson and Svedmark 2002, Johnson et al 2013). The migration capacity along riparian corridors is a major contributor to the species richness of the plant community (Naiman et al 1993, Mats et al 1996). C2: The statement, and the paragraph that precedes it, are at best contradictory in terms of their predictions of potential downstream impacts to waters and wetlands. First, it is stated that downstream

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			impacts will be restricted to "outer edges of the Chehalis River" and then it is stated that "a reduction in the occurrence of major channel avulsions and large-scale channel migrations, allowing the adjacent riparian forest to become more mature as the occurrence of periodic disturbance decreases." Together these statements indicate that downstream impacts of dam alterations of the natural flow and disturbance regimes will have significant impacts across the active floodplain, not simply along the "outer edges." Downstream impacts to waters and wetlands need to be assessed using a spatially explicit surface water and groundwater model to accurately characterize the spatial extent and degree of potential impacts
75	4.2.3.3	277	*"Additional compensatory mitigation for long-term impacts on vegetation could include the following:* • *Purchasing and preserving adjacent and off-site areas of forestlands within the same watershed* • *Replanting harvested areas with native vegetation* • *Restoring and enhancing downstream riparian areas by removing invasive species and replanting with native trees and shrubs* • *Using flow controls or irrigation and strategic removal of non-native or invasive plant species to stimulate recruitment of valued pioneer riparian trees such as cottonwoods (Poff et al. 1997) "* C: The mitigation is not adequate because one cannot recreate as well as nature and the value of a wetland or riparian area varies based on many factors including the location within the watershed (Smith et all 1995). Only trees are shrubs are mentioned throughout the PEIS and vegetation such as grasses and forbs play a critical role in riparian ecosystem function. Herbaceous plants are not considered in the PEIS. The above and below ground growth habitat specific to grasses remove sediment and slow runoff (Hawes and Smith 2005). Native grasses are nutritious forage to ungulates. Forbs provide food for pollinators. Herbaceous plants are important in nutrient cycling (Gilliam 2007). Grasses and herbs occur on the exposed portions of the active channels. The floodplains contain a mosaic of herbs, shrubs and trees (Gregory et al 1991). C2: The costs associated with mitigating for long-term impacts to wetlands and vegetation are not included in the economic analysis.
76			
77	4	277	C: Equal or no net loss of wetlands is not sufficient to protect species. Some species, such as the western toad, have critical habitat in the particular area near the dam site. Further, western toads are suspected to have high site fidelity across years, making it even more imperative to protect areas that they currently

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			occupy. Therefore, actions such as mitigation banking, for example, would not benefit the endangered western toad that occupies habitat in that particular area. Provide more detailed information on what mitigation actions will be expected and where actions will be carried out before a decision is made on an alternate plan.
78	4.2.3.3	278	*"Additional compensatory mitigation for long-term impacts on vegetation could include the following:* *• Purchasing and preserving adjacent and off-site areas of forestlands within the same watershed* *• Replanting harvested areas with native vegetation* *• Restoring and enhancing downstream riparian areas by removing invasive species and replanting with native trees and shrubs* *• Using flow controls or irrigation and strategic removal of non-native or invasive plant species to stimulate recruitment of valued pioneer riparian trees such as cottonwoods (Poff et al. 1997)"* C: The mitigation is not adequate because one cannot recreate as well as nature and the value of a wetland or riparian area varies based on many factors including the location within the watershed (Smith et all 1995). Only trees are shrubs are mentioned throughout the PEIS and vegetation such as grasses and forbs play a critical role in riparian ecosystem function. Herbaceous plants are not considered in the PEIS. The above and below ground growth habitat specific to grasses remove sediment and slow runoff (Hawes and Smith 2005). Native grasses are nutritious forage to ungulates. Forbs provide food for pollinators. Herbaceous plants are important in nutrient cycling (Gilliam 2007). Grasses and herbs occur on the exposed portions of the active channels. The floodplains contain a mosaic of herbs, shrubs and trees (Gregory et al 1991).
79	4.2.4.1.1	279	*"Since human disturbance from logging currently occurs in portions of the Flood Retention Facility site, some level of habituation by wildlife to noise and humanactivity has potentially occurred".* C: Timber harvests and associated activities that already occur in the area likely have much shorter duration than the construction of the dam (e.g., one timber sale might be completed in a few months and then harvest activities move to another area, whereas dam construction would be concentrated in one area for a longer period of 2-3 years). Thus, the impact of noise disturbance will likely be greater than what is described in this document. Furthermore, no raptor surveys were conducted in the area for active nest sites. Surveys for Golden Eagles, Bald Eagles, and other raptor species must be conducted both in the reservoir footprint and in areas around the construction site within the distance over which disruption of nesting and other

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			breeding behaviors could occur. The removal of overstory trees in the reservoir footprint could remove eagle nest trees (and nests of other raptor species), and if construction occurs during breeding seasons, disturbance could lead to reduced reproductive success and/or the abandonment of nest sites or nesting territories. The dam construction and reservoir site are within a State Priority Area (Breeding Area) for Golden Eagles, and Bald Eagles also have the potential to breed in this area. These species are also federally protected under the Bald and Golden Eagle Protection Act. Surveys should have been conducted for these species in order to fully assess the potential impacts of the FRO/FRFA, and this document does not provide any evidence that such surveys occurred. Without surveys for nest sites, occupancy should be assumed and seasonal restrictions should apply to the dam construction.
80	4.2.4.1.1	280	*"In regard to more transient construction disturbances such as increased noise levels and vehicle usage...some species would successfully relocate to other suitable habitat (e.g., larger mammals, birds)".* C: This statement assumes that the adjacent habitat is available for the relocating individuals. Many avian species are highly territorial during the breeding season, and there may not be available space for displaced individuals. It varies by species and depends on local population density, but the statement presented here in the PEIS seems to assume that mobile individuals would automatically be able to relocate to other suitable habitat.
81	4.2.4.1.1	280	*"Although many of these impacts would be of relatively short duration...."* C: What is the definition of "short duration"? Does short duration mean a couple months? Or a few years? How long does it take to construct a dam the associated roads and vegetation removal? In regards to avian species, it could mean reduced reproductive success over multiple nesting seasons.
82	4.2.4.2	281	*"Adverse impacts would primarily affect fish in the mainstem Chehalis River and immediately below the dam"* C: The use of the phrase "immediately below the dam" in the statement above is misleading and contradicts conclusions reached in section 4.2.2.2.2 regarding the impacts to geomorphology caused by the FRO and FRFA facilities. It is highlighted on figure 4.2-6 and in text on page 268 that changes to geomorphic processes will occur on the main stem Chehalis river between the region downstream of the dam at river mile 108 until river mile 62 - with impacts affecting 46 miles of the Chehalis River. Impacts to fish habitat associated with these 46 river miles account for far greater than the region "immediately below the dam" as stated in this section. This is further highlighted in section 4.2.4.2 on page 286 where

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			it states "There would be a reduction in fish habitat downstream of the dam to RM 62," and "changes to geomorphic processes downstream of the dam would result in a significant adverse impact on the formation of fish habitat. The adjective "immediately" is misleading and improperly used.
83	4.2.4.2	281	C: Consideration of the long-term impacts on water quality, geomorphology, and fish habitat from future dam removal or repair is missing from the EIS. Data from the Elwha dam removals could be used to better assess potential impacts including fish mortality from sediment pulses and high turbidity levels, impaired drinking water quality, and rapid geomorphic change. Considering the increased rate of dam removals in the US and the limited lifespan of the infrastructure, these long-term impacts should be considered.
84	4.2.4.2	281	*"Anticipated adverse impacts of the Flood Retention Facility on fish would be significant for fish populations in the Chehalis Basin."* C: This is a direct negative impact to QIN Treaty Rights.
85	4.2.4.2	281 - 282	*"Creation of reservoir habitat that some species and life stages that currently exist in the area could utilize for rearing or foraging, such as coho salmon, steelhead, largescale sucker, mountain whitefish, or sculpin; however, uses in the summer may be limited due to high water temperatures"* C: Although some of these species could use this reservoir habitat created by a dam, it would in general be much poorer quality of habitat for salmonid species.
86	4.2.4.2. 1	282	The list of fish that will benefit from the reservoir does not include northern pike minnow and bass. Both are in the river downstream of the dam so the possibility of them moving into the reservoir is quite high. The pike minnow is a native fish that consumes salmonid fish, and the bass is a non-native invasive that also consumes salmonid fish at a high rate. Both thrive in a lake environment.
87	4.2.4.2. 1	282	"It is important to evaluate the impacts of the proposed dams in context with historical impacts of existing dams throughout the Pacific Northwest; however, because of the unique design of the FRO and FRFA dams and flood control operations being proposed, it is equally important to evaluate the impacts of each dam type on fish independent from the known effects of other dams." C: The operations can be changed in the future, possibly without any review so we cannot assume static operations. Also the FRO is being designed to allow retrofitting with hydroelectric turbines, so again we must also consider this change in the future.

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88	4.2.4.2.1	282	C: The PEIS addresses the construction of new roads associated with the dam maintenance, but does not address the construction of new roads necessary to access the existing forest road network. The current main access is the mainline running through the reservoir footprint and it will need to be replaced. Given the terrain in this area this could increase landslide risk, increase impervious surface, and increase surface erosion input to the streams. It could also affect the hydrology of the area by intercepting groundwater flows and routing them to the stream more quickly than is currently occurring.
89	4.2.4.2.1	282	*"[S]pecifically for species that use the stream reaches just above and below the dam."* C: The wording does not emphasize, with due specificity, the area of impacts surrounding the dam location. PEIS should include more detail on a specific number of river miles above and below the dam and why these areas will be impacted (e.g. because flood levels will be altered, which will affect fish movement and populations.).
90	4.2.4.2	283	*"Flood retention with a dam would cause inundation that would similarly displace fish from the stream channel and suffocate redds, but may additionally interrupt normal behaviors (e.g. ,foraging, migration, spawning), and could reduce survival of resident fish species and immobile life stages for longer periods of time than occurs during an uncontrolled flood under existing conditions."* C1: This would be a direct negative impact on QIN Treaty Rights. C2: Suffocation of redds would be an ecological trap and could have even higher negative impact on the fisheries resources than is realized in this PEIS.
91			*"A small risk exists for MeHg to accumulate in the food web due to the conversion of atmospheric Hg to its toxic form, MeHg, by bacteria that thrive in summer reservoir conditions"* C: A small risk could have potentially large consequences. The potential for this mercury to flow downstream out of the reservoir should be discussed in detail in this PEIS.
92	4.2.4.2.1	284	*"A small risk exists for MeHg to accumulate in the food web due to the conversion of atmospheric Hg to its toxic form, MeHg, by bacteria that thrive in summer reservoir conditions."* C: This needs to be addressed in more detail and also needs to be discussed in the wildlife section. One sentence mentioning the potential for MeHg to accumulate, without any description of the potential

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			effects of such accumulation, is unacceptable. The construction of reservoirs fosters conditions that are conducive to Hg methylation and subsequent contamination of fish (Green et al. 2016). Both mammal and avian predators in these ecosystems (e.g., minks, river otters, common loons, bald eagles, and osprey) would be vulnerable to elevated dietary MeHg exposure, accumulation, and toxicity (Scheuhammer et al. 2007). Current MeHg levels among piscovorous mammals may already be high enough to have subtle neurotoxic and other effects (Scheuhammer et al. 2007); thus, an increase from the current levels could lead to greater toxic effects and possible demographic consequences for these species. Large, long-lived organisms at the top of long food chains, such as many raptor species, would experience the greatest degree of contamination (Green et al. 2016). Yet, it is not evident whether any raptor surveys were conducted in the areas around the proposed dam and reservoir, and the effects of MeHg contamination on these species--impaired growth, development, behavior, and survivorship (Bennett et al. 2007, Scheuhammer et al. 2007)--are not mentioned in the PEIS. Furthermore, the creation of a reservoir would likely attract Common Loons, and loon consumption of diets high in MeHg leads to severe reductions in reproductive success (Barr 1986, Scheuhammer et al. 2007). The potential for all the aforementioned effects from increased MeHg levels with the proposed FRO/FRFA must be addressed in this document. In addition, continued future monitoring of MeHg levels and potential contamination must be included in the proposal. For example, the collection of avian feathers would be a simple, effective non-invasive method for monitoring MeHg exposure in birds (Kaler et al. 2014) and should be included in any dam proposal.
93	4.2.4.2	284	*"Warmer waters in the FRFA reservoir would also hold lower DO; however, reductions in DO are not expected to reach levels considered lethal for juvenile salmon near the surface. In addition, decaying vegetation and lack of mixing could contribute to low DO levels deep in the reservoir, causing fish to avoid seeking refuge at depth."* C: Although expectations could predict that the levels of DO would not reach levels to be considered lethal, that does not mean that these low levels of DO could not become lethal. Juvenile salmon can tolerate certain low levels of DO under certain conditions, but increases in stress due to poor water quality (such as increased temperature) can increase the metabolic rates of these juvenile salmonids which can increase their DO needs. Just because DO levels are not expected to reach levels considered lethal for juvenile salmon does not mean these low levels of DO will not become lethal.
94	4.2.4.2	284	*"In addition, decaying vegetation and lack of mixing could contribute to low DO levels deep in the reservoir, causing fish to avoid seeking refuge at depth.*

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			Reduced water quality in shallower layers of the reservoir could force juvenile salmon to seek thermal refugia in deeper water, limiting their foraging opportunities and reducing the effectiveness of juvenile fish collection facilities, or could cause them to emigrate from the reservoir early in the summer, eliminating any benefit of the reservoir for rearing" C: The end of the first paragraph directly contradicts the beginning of the next paragraph. First it claims fish would not seek refuge at deep depths due to low DO levels, and then it says juvenile salmon would be forced to seek refugia in the deeper (low DO) water. Either way (swimming deep or staying at a warm surface) not only will any potential benefit of a reservoir be eliminated, but juvenile salmon will actually be negatively impacted by the reservoir.
95	4.2.4.2	284	*"Invasive predators (e.g., smallmouth or largemouth bass) are not anticipated because these species are located farther downstream at this time."* C: Although these invasive predators are not anticipated, they must be accounted for. There will be accessibility for these fish to potentially reach the reservoir (by natural or human causes). A reservoir is ideal habitat for these invasive predators to populate and heavily predate on juvenile salmonids.
96	4.2.4.2	284	C: The impact associated with the potential proliferation of harmful algal species downstream of the FRFA facility due to a reduction in peak flows and sediment transport is not evaluated (Davie and Mitrovic 2014).
97	4.2.4.2	284	C: The potential adverse impact to the biodiversity of downstream ecosystems is not evaluated. Dynamic flow regimes, which include pulse flood disturbances followed by periods of recovery, have been shown to increase the biodiversity and resiliency of riverine ecosystems (Power et al., 1996, Magilligan and Nislow 2005, Poff et al 2007, Marchetti and Moyle 2001). Both the FRO and FRFA facilities would decrease the magnitude and frequency of pulse flood disturbances, and thus could potentially have adverse impacts to the ecosystem as a whole.
98	4	285	*"Because lamprey abundance has not been as broadly quantified as salmon abundance, the magnitude of the impact that the loss of lamprey upstream of the FRFA dam presents to the whole Chehalis Basin population remains uncertain".* C: However, this has been studied and an estimate with confidence intervals should be given here.

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99	4.2.4.2.1	285	*"...possibly the elimination of lamprey upstream of the dam."* C: Lamprey are a species of tribal (and cultural) importance and are within the reserved treaty right, therefore this constitutes a treaty right taking.
100	4	285	*"Passage through tunnels with the FRO dam presents the least impact on migratory species because these would be designed to mimic the natural gradient of the river channel."* C: This statement needs clarification on what FRO is compared to. Is it compared to the restoration alternative? Is it compared only to FRFA permanent dam alternative? QIN recommends changing it to "...when compared to the FRFA dam, the FRO dam presents the least impact..."
101	4.2.4.2.1	286	*"Changes to geomorphic processes downstream of the dam would result in a significant impact on the formation of fish habitat.* *Flood control operations would reduce floodplain inundation by 10% (4,480 acres), eliminating some connections between the Chehalis River and off-channel or floodplain areas during and after floods that are large enough to trigger flood retention.* ***Floodplain areas that are ephemerally connected to the mainstem Chehalis River can be important rearing and holding habitat for fish, and a reduction in the floodplain's inundated area would be a minor impact on fish habitat function."*** C: Dam operational changes to the natural surface water and groundwater flow regimes of downstream floodplain wetlands and riparian areas could potentially be extensive and permanent throughout a large area. To characterize the impacts as only occurring along the "outer edges of the Chehalis River floodplain" is simply untrue and not based on any factual analysis as presented in the PEIS. A spatially explicit surface water and groundwater model of downstream floodplains can address this question in a quantitative manner.
102	4.2.4.2.1	287	*"A positive response of spring-run Chinook salmon reflects the potential effect of cooler summer water on pre-spawning survival, improved juvenile rearing, and potential for earlier spawning."* C: Earlier spawning is not necessarily a benefit. It could be an impact since spawning timing is often timed with having emergence coincide with food availability. This statement needs to be backed with citations or removed.

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103	4.2.4.2.1	288	*"The effect of an FRO 50 scenario could represent a more likely scenario because habitat would be disturbed only when floods are retained, approximately once every 7 years on average, and a Pre-construction Vegetation Management Plan would prevent total loss of riparian vegetation and riparian area function for fish."* C: With the 2007 and 2009 floods 14 months apart it seems likely that such flooding will occur again over the next 100 years, and once flooded to high depths (as both of these storms would) it is not likely that any reasonable riparian forest will occur. C2: How much is the frequency of a 7-year flood magnitude under current conditions expected to increase in the future, and how does that change impacts. For example, if inundation of the reservoir occurred every 2 years instead of every 7 years on average? Is the FRO 100 scenario more likely under the future conditions?
104	4.2.4.2.1	290	C: Part of the benefit assigned to the FRFA assumes that spring chinook will hold and spawn in the area below the dam. Currently this needs to be confirmed as the current spawning in the mainstem is totally upstream of the dam. The reduced sediment movement through the dam could eliminate any spawning gravels in this reach so this needs to be evaluated. It does not matter if the temperature is better if the fish will not or cannot adjust their spawning areas. The assumption is not supported.
105	4.2.4	295	*"Anticipated adverse impacts on wildlife...[include] potential loss of amphibian breeding habitat."* C: With the creation of a reservoir, loss of stream-breeding amphibian habitat is not 'potential'; said loss would occur for the entire footprint of the reservoir and result in the local extirpation of some amphibian species.
106			*"Adverse impacts on wildlife would primarily be driven by the following changes in the physical environment created by the construction and operation of the Flood Retention Facility:* • *Loss, conversion, and fragmentation of wetland and vegetation communities that function as wildlife habitat as a result of selective clearing and inundation in the dam and reservoir footprint*

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			• *Changes to wildlife habitat-forming processes downstream of the dam due to the streamflow management and vegetation community modification* *Each of these changes would modify habitat that is currently used by a variety of wildlife to breed, forage, rest, and overwinter, including invertebrates, amphibians, reptiles, and multiple species of, mammals and birds. Changing or eliminating existing habitat characteristics and functions would create conditions that reduce quality of habitat available for existing species, thereby affecting the ability of wildlife to occupy the modified habitat. As a result, the diversity and composition of species that occupy the affected habitats would change as some existing species adapt to and occupy the modified habitat, those that are unable to adapt or compete in the changed habitat perish or leave, and new species that were not there previously (e.g., invasive species) become established."* C: These PEIS statements indicate that there would be significant and permanent impacts to downstream riparian and floodplain ecosystems, vegetation and wetlands. This is inconsistent with assessments of minimal floodplain impacts cited above in Sections 4.3.2.1 & 4.2.4.2.1. The provisions of the CWA Sections 404 & 401 protect the physical, chemical and biological integrity of waters of the United States, including wetlands. Therefore, a consistent and spatially explicit modelling and analysis of such potential downstream impacts of dam operations effects is necessary to meet the intent of the Clean Water Act.
107	4.2.4.2.2	297	*"The clearing of vegetation to construct the dam structures and their supporting infrastructure (e.g., access roads, utility corridors) would cause a direct loss of wildlife habitat...."* C: Does not address impacts of road on wildlife *behavior*. Impact of roads on wildlife behavior is widely documented in the empirical literature (e.g., displacing animals to lower quality habitat, increased vulnerability to human-caused mortality, reduced time spent foraging due to increased vigilance, etc). The indirect effects of roads and increased traffic on wildlife must be included in this assessment.
108	4	298	*"Conversely, the more brushy vegetation that would likely replace several of the forested riparian zones in the reservoir footprint could provide additional foraging habitat for deer, elk, and birds of prey (Link 2004)"*

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			C: The reservoir footprint, which is a disturbed area, may just as likely be replaced with detrimental invasive species, like knotweed or scotch broom, which are common colonizers of disturbed habitat in this region. Invasive species management and prevention has not been adequately addressed.
109	4.2.4.2.2	298	*"Conversely, the more brushy vegetation that would likely replace several of the forested riparian zones in the reservoir footprint could provide additional foraging habitat for deer, elk, and birds of prey".* C: This could be true only for the FRO, and not when the reservoir is flooded. Furthermore, once the reservoir is drained after a major flood year, it could take a couple of years for shrub species to establish again and provide sufficient browse for ungulates (i.e., the reservoir footprint would not be available as foraging habitat all non-flood years).
110	4.2.4.2.2	298	*"In the FRFA reservoir area...species that utilize open-water habitat (e.g., waterfowl and osprey) would benefit from the changes in habitat types."* C: Not necessarily. The creation of the reservoir and the resulting raising and lowering of water level may actually create an "ecological trap" for certain waterfowl species. Animals may be "trapped" into using sub-optimal habitats when a species' resource-selection cues are no longer effective because the habitat conditions changed from those under which the species evolved (Schlaepfer et al. 2002, Andeau et al. 2012). For example, piping plovers that nested at a reservoir in the Northern Great Plains selected for habitat at multiple scales where they had low nest success most years; thus, the reservoir fit the definition of an ecological. These plovers experienced lower nest success than other breeding areas and were vulnerable to widespread nest failure from inundation (Anteau et al.2016). The same could occur for waterfowl species in the Chehalis that ground nest adjacent to large water bodies, such as the Common Loon.
111	4	298	*"In the FRFA reservoir area, the conversion from upland forest and wetlands to an inundated reservoir would remove and convert habitat used by terrestrial and semi-aquatic wildlife species; however, species that utilize open-water habitat (e.g., waterfowl and osprey) would benefit from the changes in habitat types."* C: The language in the quoted section above assumes that all animals preferring open-water systems will benefit from an inundated reservoir, yet this is not necessarily the case. Additional analysis of the potential negative effects that an inundated reservoir may have on certain animals or animals in certain life stages is needed.

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			Common Loons are one such species that may experience the FRFA reservoir as an ecological trap. Ecological traps are habitats that may appear to be attractive to individuals that settle there, when in actuality that habitat is harmful to individuals. In this case, the FRFA facility may look attractive to Common Loons as they seek breeding locations along lake edges or on islands. Since loons do not colonize readily, it may even take several years before they approach the reservoir to nest. However, because loons generally cannot tolerate quick fluctuations in water levels, they are particularly susceptible to nest abandonment in the context of impoundments (Fair 1979). Loons or even other ground-nesting waterfowl not able to withstand rapid fluctuations in water levels (15-20 cm water level rise over 2-3 days (Sayler and Willms 1997)) which can flood nests, causing nest abandonment. Falling water levels can also cause abandonment by preventing adults from visiting nests. Further, because loons have low colonization rates compared to other waterfowl, there may be other negative consequences of losing an important breeding site (for example, individuals may forgo breeding for multiple years in search of new breeding areas). Although Common loons may be particularly susceptible to flooding water, there are waterfowl species such as teal and mallards that to have had nests flood due to reservoirs (Sayler and Willms 1997) because these birds tend to nest on the ground. Piping plovers along the Missouri river are another such bird that experiences fluctuating water levels along reservoirs as an ecological trap because they prefer nesting in lowland areas, which tend to flood more often (Anteau et al. 2012).
112	4	298	*"The loss of trees from the riparian zone in the reservoir footprint by either selective removal under the proposed Pre-construction Vegetation Management Plan or by flood-induced mortality would directly remove nesting, denning, and feeding habitat used by wildlife including birds, mammals, amphibians, and other animals."* C: It is not only the loss of trees, but the loss of vegetation (shrubs, grasses, riparian-associated plants), that should be considered. Additionally, it is not only loss of trees [vegetation] that will cause nest/den loss, but also the raising of water levels that may directly flood nests and displace animals, which should be analyzed.
113	4.2.4.2.2	298	*"Reduction in the amount and variety of woody material entering the system would...limit instream habitat-forming processes that support stream-associated amphibians".*

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			C: This statement is correct, but what is not mentioned is that under the FRO, all in-stream habitat would be eliminated during a flooding year. Many amphibian species (e.g., many salamander species) have very limited movements. During a flood year, the inundation of the reservoir could wipe out an entire local population of a stream-breeding amphibian species, and recolonization may not occur due to the limited mobility of such species (i.e., there will not be a sufficient number of years between reservoir floodings to allow for recolonization by species with limited mobility). Indeed, the 2015 technical presentation found on the PEIS website states that the reservoir implementation would result in "significant loss" for Dunn's salamanders.
114	4.2.4.2.2	298	*"In addition to these impacts, conversion or removal of riparian areas would reduce, eliminate, or fragment habitat and travel corridors for wildlife including amphibians, reptiles, birds, and various mammals".* C: This is a very broad statement. A project-level EIS should provide more detailed description regarding impacts of corridor fragmentation, with species-specific examples.
115	4.2.4.2.2	299	*"Specific species that would be adversely affected by temporary (FRO reservoir) and permanent (FRFA reservoir) water retention include western toad and western pond turtle".* C: What about stream-associated salamanders? Dunn's salamanders, Van Dykes' salamanders, Columbia torrent salamanders were all observed within the reservoir footprint. Indeed, the 2015 technical presentation found on the PEIS website states that the reservoir implementation would result in "significant loss" for Dunn's salamanders (also mentioned in the Hayes 2016 presentation). Why were only western toad and western pond turtle acknowledged here? This statement is wholly inadequate and completely leaves out amphibian species that would likely be adversely affected by the FRO and FRFA.
116	4.2.4.2.2	299	*"Temporary inundation of these areas by the FRO reservoir during flood retention and permanent inundation in the FRFA reservoir conservation pool would eliminate this habitat, potentially contributing to the extirpation of western toad from this portion of the Chehalis Basin".* C: What are the impacts of local extirpation on the greater Western Toad population in WA? This document needs to address what effect (or lack of effect) that a loss of local populations would have on the larger population (and/or on connectivity of meta-population, if considered to be a meta-population).

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117	4.2.4.2.2	299-300	*"Western pond turtle, a state-endangered species that is potentially present in the Chehalis Basin, would also be affected by the direct loss of potential breeding habitat from the conversion of stream habitat to reservoir habitat (ASEPTC 2014c). Such losses would contribute to the local extirpation of that species."* C: What are the impacts of local extirpation on the greater Western pond turtle population in WA? This document needs to address what effect (or lack of effect) that a loss of local populations would have on the larger population (and/or on connectivity of meta-population, if considered to be a meta-population). Were turtle surveys conducted in the reservoir footprint? There are no turtle surveys provided as described for habitat above the proposed dam site.
118	4	300	*"Such losses would contribute to the local extirpation of that species."* C: While it is important to understand that these flood retention facilities may result in local extirpation of particular species (western pond turtle and western toad), there is not sufficient information for the reader to understand the full impacts to these species. Therefore, it is also important to provide projections on how the local extirpation of the western pond turtle and western toad in the Chehalis Basin may impact the state-wide status and population of each affected species, particularly if they are considered threatened or endangered in Washington state.
119	4	300	*"...conversion of stream and riparian habitats to a pool habitat under the FRFA would also result in the loss of salmon spawning habitat within the reach of the Chehalis River upstream of the dam. Salmon provide nutrients to a wide range of wildlife species that directly prey on live spawners, scavenge the carcasses of dead fish, or prey upon salmon eggs and juveniles after spawning. The range of mammal species that feed on salmon includes bears, weasels, shrews, and potentially deer, squirrels, and mice. Avian predators and scavengers include eagles, hawks, gulls, crows, and some songbirds (Willson and Halupka 1995)."* Although the language in the quote above alludes to the loss of marine-derived nutrients (MDN) in the forest and animals within riparian areas, there should be greater emphasis on the impacts of the loss of MDN to the terrestrial food web (language only calls them *"nutrients"*). There will be large stretches of river that will have far fewer or no salmon (that carry MDN) spawning in the future due to the FRO and FRFA facilities. However, MDN has shown to be an important indicator of body condition, and thus healthy offspring in American Dippers as shown in a study surrounding the Elwha dam (Tonra et al. 2016). It wasn't until the complete removal of the Elwha dam that allowed a return of MDN to reaches where

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			salmon had been absent for decades since dam construction (Tonra et al. 2015). Further consequences, such as the loss of MDN specifically and potential reduced fitness of animals should be addressed in this section.
120	4.2.4.2.2	300	C: Loss of marine-derived nutrients due to loss of salmon above dam -- why is no mitigation proposed for this?
121	4.2.4.2.2	302	*"Downstream of the dam, reduced flooding would reduce stream and riparian habitat-shaping processes. Wetlands and periodically inundated areas that serve as functional floodplain habitat for semi-aquatic species, such as amphibians and waterfowl, would also be reduced. These adverse impacts range from minor to moderate given the size of the entire Chehalis Basin relative to the change in the extent of flooding."* C: The PEIS should discuss the restoration efforts and money that have gone into creating four managed Wildlife Areas in the Chehalis Basin that will absolutely be altered by the Flood Retention Facility and should be accounted for in the discussion of long-term impacts to wildlife (and wetlands). Taken from the WDFW website on the four managed Wildlife Areas in the Chehalis Basin (http://wdfw.wa.gov/lands/wildlife_areas/chehalis/): *"The four units of the 2,160-acre Chehalis Wildlife Area lie in the Chehalis River Valley in Grays Harbor County on the Olympic Peninsula. Its estuary and wetland habitats support a diversity of wildlife, from big and small game species to songbirds, as well as native fish populations, some federally endangered. Units are managed either for recreation associated with fish and wildlife or for the protection of specific species and their habitats."*

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			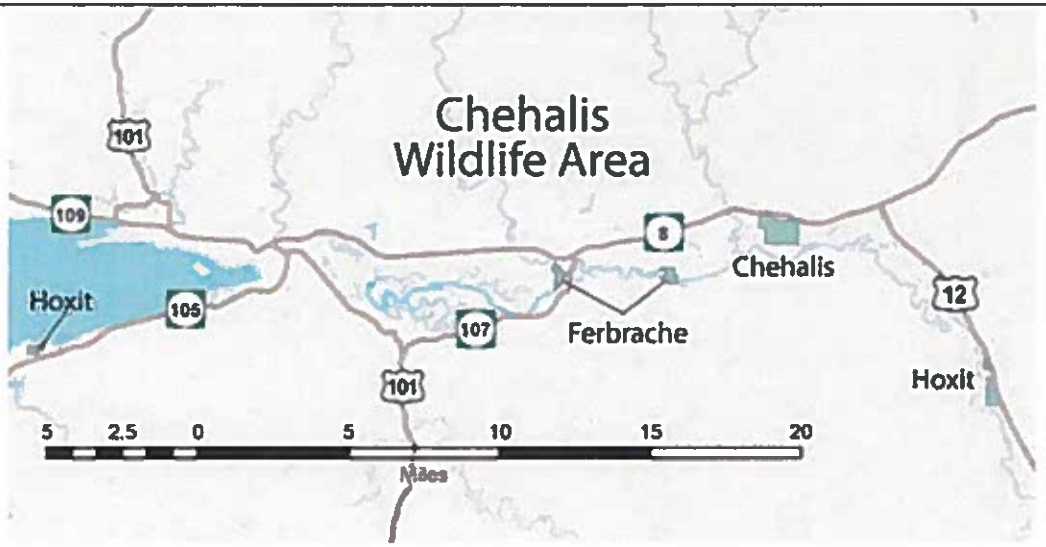 The four wildlife areas are as follows: • Chehalis Unit is 531 acres, managed for waterfowl habitat and associated recreation • Hoxit Wildlife Area is 80 acres, maintained for winter waterfowl habitat • Ferbrache Wildlife Area is 114 acres, managed for wintering waterfowl forage, fishing access and a pheasant release site for fall hunting. • Satsop Wildlife Area (not pictured) is 1,432 acres, maintained as floodplain habitat These wildlife areas provide quality habitat for birds of prey, shorebirds, songbirds, marshbirds, upland birds, waterfowl, deer, elk, small mammals, reptiles, amphibians and butterflies. These areas provide important nesting and roosting sites, cover, and forage for breeding, migration and/or wintering animals. Hoxit Wildlife area currently has ongoing restoration and waterfowl enhancement projects taking place. Alteration of the river and flooding events under the FRFA or FRO actions will likely significantly alter the consistent flooding that occurs at these sites, and consequently, how wildlife use them. The development of the Flood Retention Facilities will undermine these restoration efforts, and this should be mentioned in the discussion of long-term impacts to wetlands and wildlife.

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			C2: The assumption that the effects would be minor to moderate seems premature. The Hayes 2016 technical presentation states the following in regards to amphibian habitat downstream of the proposed dam/reservoir footpint: "1) Seasonal inundation footprint of oviposition habitat reduced for flows below operational maximum; effect more pronounced with proximity to proposed dam; effect magnitude uncertain, and 2) Major freshets (10-year floods or greater) with high channel reorganization and new off-channel creation capacity eliminated." The magnitude of the effects are yet unknown; depending on the species and its distribution and/or abundance through the Chehalis basin, effects may have the potential to be significant.
122	4.2.4.2	302	*"An increase in summer base flows and reduction in temperatures has the potential to delay or eliminate breeding habitat for the instream-breeding western toad, which appears to prefer warm, shallow, open water areas in the stream channel for breeding (Hayes et al. 2016b). To evaluate this potential, the change in usable downstream habitat for western toad based on the proposed changes in flow and temperature that would occur with an FRFA dam was modeled for the six consecutive river reaches below the proposed dam. The results of this modeling effort indicate that there would be no change in the area of usable habitat for western toad in the river reach immediately below the proposed dam, but a reduction in area of usable habitat for all subsequent reaches."* C: On page 299, the PEIS states that the dam will likely result in extirpation of western toads in the area of the FRO/FRFA and reservoir, but it sounds as though the impacts to Western Toads may be greater than previously described due to reduction of habitat downstream. The potential for serious declines in Western Toad populations across the entire basin should be mentioned, not just the potential for extirpation in and around the FRO/FRFA site.
123	4.2.4.3.1	303	*"4.2.4.3.1 Fish* *A range of possible mitigation measures for short-term impacts on fish are described in Table 4.1-1. However, instream work would be unavoidable and large in scale, and limiting work to times of the year when sensitive species are absent would not be possible. Year-round construction for 2 to 3 years would be required. Avoidance and minimization to reduce short-term direct impacts on fish could include construction of a temporary river bypass tunnel to pass water and fish downstream during the construction period. A trap-and-haul strategy would be implemented to provide upstream fish passage and maintain fish survival around the Flood Retention Facility construction site.*

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			Some potential long-term impacts on fish would be addressed through avoidance and minimization measures, including provision of fish passage around the dam, minimum instream flows released from the dam during flood retention periods, and release of cool water from the FRFA facility during late spring to early fall. New infrastructure such as roads and power lines could be planned to minimize the number of stream crossings that require permanent removal of intact riparian habitat. Compensatory mitigation would be required for loss of fish habitat and fish habitat function, and reduced fish population performance above and below the dam. Examples of compensatory mitigation could include fish habitat restoration, protection, or acquisition of land that presents an opportunity for in-kind compensation for fish habitat lost. *Consistent with state mitigation policy (WDFW mitigation policy POL-M5002), mitigation for unavoidable adverse impacts on fish would include continued collection of baseline data and detailed implementation plans based on identified population performance standards or goals for fish populations, fish passage, and life history diversity, including maintenance of recreational and harvest opportunities. Compensatory mitigation would be described in the Reservoir Operations and Management Plan, including an adaptive management plan for fish species affected by the Flood Retention Facility that includes regular monitoring and evaluation of fish passage and population performance (e.g., monitoring fish abundance, habitat processes upstream and downstream of the dam site) to ensure population viability goals are met. Compensatory mitigation measures would be developed during project-level design and permitting to address the loss of fish habitat and function. Adaptive management plans would include corrective actions to be taken if mitigation developments do not meet goals and objectives. A Flood Retention Facility may cause adverse impacts that cannot be fully mitigated by the compensatory actions described here* *4.2.4.3.2 Wildlife* *Potential mitigation measures to reduce short-term impacts on wildlife and wildlife habitat from construction of the Flood Retention Facility are described in Table 4.1-1.Some potential long-term impacts on wildlife could be addressed through avoidance and minimization measures, including developing and implementing a Post-construction Vegetation Management Plan (see Section 4.2.3.3) to address the loss of loss of forestland upstream of the dam. Compensatory mitigation measures would be developed during project-level design and environmental review that would create or*

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			improve wetland, wetland buffer, and riparian habitat conditions that support a variety of native wildlife species" C: During the Impact Analysis Ch. 4, under the wildlife section, long term impacts and mitigation measures to reduce impacts, ecological linkages between marine and terrestrial communities, were not given or analyzed in the PEIS. These linkages are important processes to ecosystem health in the Chehalis basin. The return of salmon and other anadromous fish, which return from the sea to spawn in the Chehalis basin, serve as an important food resource for multiple wildlife species. All life stages of salmon: eggs, fry, smolts, adults and carcasses, provide both direct and indirect foraging opportunities for terrestrial freshwater and marine wildlife (Pacific Salmon and Wildlife Ecological Contexts, Relationships and Implications for Management WDFW Technical Report) Salmon carcasses provide nutrients such as carbon, nitrogen, calcium and phosphorus to the terrestrial habitats (Wilson ME, Halupka KC; Anadromous fish as keystone species in vertebrate communities. Conserv. Bio 1995, 9: 489-497) (Gende S., Edwards R., Willson M., Pacific Salmon in Aquatic and Terrestrial Ecosystems. BioScience, 2002 52 (10) 917-928). Nutrients derived from salmon carcasses have become an important component of ecosystems that can have effects on both ecology, survival and productivity in terrestrial ecosystems and wildlife populations. Some of the minerals listed above have essential functions to the body for example both Phosphorus and calcium are largely associated with skeletal formation. Calcium is are also important in blood clotting, excitability of nerves and muscles, acid-base balance, egg shell formation, enzyme activation, and muscle contraction (Wildlife Feeding and Nutrition, Robbins, C. T. 1993). Phosphorus is important in wildlife metabolism, energy metabolism, muscle contractions, nerve tissue metabolism, and transport of metabolites, nuclei acid structure, carbohydrate, fat and amino acid metabolism (Wildlife Feeding and Nutrition, Robbins C.T. 1993). Nitrogen is another important nutrient transported from salmon and is an elemental building block of proteins which is fundamental to wildlife growth and reproduction in wildlife populations. Mineral deficiencies in wildlife may become more important in this ecosystem as humans interrupt these cycles. As discussed in Section 4.2.4.2.1, conversion of stream and riparian habitats to a pool habitat under the FRFA would also result in the loss of salmon spawning habitat within the reach of the Chehalis River

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			upstream of the dam. Salmon provide nutrients to a wide range of wildlife species that directly prey on live spawners, scavenge the carcasses of dead fish, or prey upon salmon eggs and juveniles after spawning. The range of mammal species that feed on salmon includes bears, weasels, shrews and avian predators and scavengers include eagles, hawks, gulls, crows, and some songbirds (Willson and Halupka 1995). The nutrients from spawners also benefit wildlife by fertilizing riparian and aquatic plant species which, in turn, provide food or cover for aquatic and terrestrial animal species (Schindler et al. 2003). Decreases in salmon abundance resulting from lost freshwater habitat will, therefore, have an adverse impact on wildlife species that either feed on or otherwise benefit from salmon-derived nutrients. The significance of the adverse impact on wildlife is proportional to the decrease in abundance and is also expected to be most intense in areas where salmon spawning is substantially reduced or prevented, such as the reservoir footprint. Additional analysis and mitigation planning is needed to look at the loss of marine derived nutrients into the terrestrial ecosystem of the Chehalis Basin. The loss or decline of anadromous species into the Chehalis Basin could lead to potential effects on the population of many wildlife species (black bear, bald eagle, Osprey, belted king fisher, common raven, gray wolf, mink, river otter, bob cat, common loon, Western grebe, western pond turtle, red-tailed hawk, American crow, coyote, shrew, water shrew, raccoon, American marten and fisher) and the overall health and function of the upper Chehalis ecosystem. The role of salmon populations is a key in in nutrient cycling inland from the Pacific Ocean to freshwater ecosystems functions of the Chehalis Basin. The QIN has always managed the landscape in a holistic manner. Salmon have a strong influence on the food webs, trophic structure and nutrient budgets of the freshwater and terrestrial ecosystems (Willson et al 1998). The loss of salmon and salmon carcass providing nutrients to terrestrial ecosystems in the FRO & FRFA alternatives has not been analyzed. Second there has been no long term management or mitigation proposed for the FRO or the FRFA proposals to mitigate the loss of marine derived nutrients in the Upper Chehalis River for the FRO or the FRFA alternatives.
124	4.2.4.3.1	303	*"Consistent with state mitigation policy (WDFW mitigation policy POL-M5002), mitigation for unavoidable adverse impacts on fish would include continued collection of baseline data and detailed implementation*

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			plans based on identified population performance standards or goals for fish populations, fish passage, and life history diversity, including maintenance of recreational and harvest opportunities." C: The document identified the potential for methylmercury formation in the reservoir. The PEIS needs to assess this risk either through monitoring mercury in the reservoir, or within the fish.
125	4	303	*4.2.4.3.2. "Potential mitigation measures to reduce short-term impacts on wildlife and wildlife habitat from construction of the Flood Retention Facility are described in Table 4.1-1."* C: The proposed mitigation measures shown in table 4.1-1 are exceedingly vague. For instance, a proposed mitigation action is to *"Restore and/or compensate for temporary impacts on natural resources, such as wetlands or vegetation, to maintain ecological function"* What specific actions will lead to this "restoration"--Planting? Monitoring? The entire table is written in this vague language that does not actually detail actions that will be carried out, so it is unclear if mitigation will be effective. C2: During and following reservoir-filling, displacement of elk and disruption of seasonal movement patterns would create abnormal concentrations of elk adjacent to the impoundments. This displacement would attract and concentrate predators, and hunters resulting in higher predation rates. Mitigation measures should include a road use plan and gates to support elk and deer populations which are important to tribal and non-tribal hunters. C3: The PEIS states in Table 4.2-1 that reservoir depth and water fluctuating levels will very, the water operating regime that is in proposed for the FRO and FRFA could be limiting to beaver and other aquatic wildlife species. There is uncertainty in the FRO and FRFA proposals about what impact this will have to native wildlife species both above the proposed dam and downstream that depend on constant natural water levels, beavers require stable water levels during winter (Wiillson, 1998). The highly fluctuating reservoirs, the loss of vegetation diversity and stratification could prove to be fatal for beaver populations. Chapter 1 page 1 states that the Governor and Washington State Legislature have made it a priority to develop a comprehensive response that integrates flood damage reduction and aquatic species habitat restoration within the Chehalis Basin. Beavers have been proven and are used more and more in the restoration process to accomplish stream, wetland and floodplain restoration.

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			Beavers are an important ecological species for the restoration of aquatic habitat, which is a priority in the Chehalis Basin PEIS. Beavers are known to establish dams that are used to restore stream, wetland and floodplains through impounding water and retaining sediments. Historically beaver dams have created streams systems with slow, deep water and floodplain wetlands dominated by emergent vegetation (Rea 1983 Pg 3). The ecological benefits that follow beaver dams benefit plants, fish, aquatic insects and wildlife. Some of the beaver's restoration benefits include expanding wetlands, improved water quality, great habitat complexity and a reconnected and expanded floodplain (Pollock M, Castro J and Lewallen G. The Beaver Restoration Guide Book Working with Beaver to restore streams, wetlands and floodplains June 30, 2015 UAFWS). To fully analyze the impacts both upstream and downstream of the FRO and FRFA proposals the loss of Beaver habitat should be analyzed and studied.
126	4.2.4.3.2	303-304	C: What about the loss of marine-derived nutrients in the landscape and the food web due to the loss of salmon carcasses from spawning salmon? Will salmon carcasses be trucked above the dam and dispersed? This should at least be mentioned as a possibility (or why it is not being considered) under mitigation.
127	4.2.4.3.2	304	*"Compensatory mitigation measures would be developed during project-level design and environmental review that would create or improve wetland, wetland buffer, and riparian habitat conditions that support a variety of native wildlife species".* C: This statement is too broad even for a PEIS. Other aspects of the FRO and FRFA are described in great detail, so potential mitigation should be described in greater detail as well.
128	4.2.6.	308	*"Air Quality"* C: The long term impacts focused on greenhouse gas emissions and global warming effects. What wasn't defined was to what extent will the FRO and FRFA reservoirs contribute to greenhouse gas emissions and would this lead to a decrease in air quality.
129	4.2.7.2.1	309	*"Effects of the Flood Retention Facility Contributing to Climate Change"* C: There is no analysis of the growing body of literature addressing the ways in which artificial reservoirs contribute to climate change. See, Deemer, et al, *Greenhouse Gas Emissions from Reservoir Water Surfaces: A New Global Synthesis*. When reservoirs flood a vegetated area, the organic matter stored in above and below ground biomass is converted to carbon dioxide, methane, and nitrous oxide. Second, the tendency of reservoirs to expand and contract at a greater rate than natural lakes leads to greater

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			rates of methane bubbling ("ebullition") as the reservoirs draw down. Moreover, the process of ebullition prevents the methane from oxidizing to carbon dioxide, which is a less potent greenhouse gas. C2: There was no analysis evaluating the effects of decaying algal blooms on the generation of greenhouse gases.
130	4.2.2.7.2	309	C: Include discussion of how increases in peak flow would affect the frequency of flood storage with FRO, table suggests that rather than 1-in-7 year event could become more like a 1-in-3 year event in future decades. How would this change description of impacts to wood and sediment regimes?
131	4.2.2.7.2	310	C: Table 4.2-12 highlights an important result, which is that, even with the dam, floods under future climate scenario are expected to be greater than baseline condition. As such, flood damages in Chehalis Valley should be expected to increase over time even with Alternative 1 (Dam). This underscores the need to focus on flood hazard management strategies that relocate infrastructure outside of flood prone areas.
132	4.2.10.2	321	C: An impacts analysis of potential increases in development in areas protected by Flood Retention Facility should be addressed here, not deferred to Chapter 5 or Appendix L. What happens when these facilities fail and/or need replacing?
133	4.2.11	322	*"For the FRFA facility, the area behind the dam would be permanently inundated and unavailable for recreational activities".* C: QIN questions whether this will be true. There are no mechanisms in place to restrict access for recreational use. In fact, the stretch above the proposed dam is navigable by kayakers.
134	4.2.11.2	322-323	*"Portions of the area that would be periodically or permanently inundated could be closed to hunting, but the conversion of forestland to deciduous riparian shrubland could increase hunting opportunities".* C: The PEIS should explain *how* this could increase hunting opportunities. The line of reasoning as to why hunting opportunities could be increased is not clear and needs to be explicitly stated. It seems the PEIS is referring to the conversion of forestland to shrubland by clearing and subsequent inundation of the reservoir footprint with the FRO in a major flood year, where shrublands could provide more forage to ungulates. However, according the statement the reservoir footprint could be permanently closed to hunting. Thus, the areas converted to shrubland may not be open for hunters. If the PEIS assumes that the potential increase in shrubland during non-flood years with the FRO would lead to increase

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			nutritional availability for ungulates and have positive demographic effects on the local ungulate population, QIN disagrees that the increase in forbs and shrubs in the FRO reservoir footprint would result in a positive net demographic effect. The shrubs and forbs would not be available during every non-flood year; inundation could kill many of the forbs/shrubs in the footprint, and it could take time for the plants to reestablish (especially if inundation is more frequent or of longer duration than anticipated). Furthermore, while there may be an increase in shrubs and forbs as forage for ungulates, it would take many years for the new shrubland to provide sufficient hiding cover. Ungulates would not forage as efficiently in this area because of increased vigilance due to higher risks of predation. The line of reasoning as to why hunting opportunities could be increased is not clear and needs to be explicitly stated.
135	4.3.4	344	C: The broad range of potential ASHA treatment reaches, 4.2 to 128 RM, makes the fish benefit difficult to compare to RFPA fish benefit. If all fish species and all scenarios are averaged for each alternative, the ASHA has a benefit of 41% and RFP of 127%.
136	4.3.4.2.2	346	*"Minor to moderate adverse impacts are anticipated because many of the wildlife species living and using these areas could also successfully occupy river greenways and Restorative Flood Protection treatment areas."* C: Difficult to assess impacts of relocation/land conversion on wildlife when the location is unknown.
137	4.7.1	410	*"Changes in Land Use Management include open space preservation and restrictions on floodplain filling, which could be a beneficial effect to water quantity because it would limit future uses and activities in the floodplain that increase flood elevations upstream and downstream. Restricting further floodplain fill and maintaining open spaces would prevent downstream rises in flood levels when compared to the baseline. However as noted in the Build Out Analysis (see Appendix L), Land Use Management recommendations designed to minimize creating future parcels in the Chehalis River floodplain may not be effective at limiting development due to the abundance of developable parcels that currently exist. Therefore, Land Use Management regulations that prohibit or restrict specific uses, such as fill in the floodplain, are likely to more effectively minimize future water quantity impacts from continued development in the floodplain."* C: Clarify what specific actions are proposed as part of the draft PEIS. As stated no specific action is proposed but recommendations for land use changes are included Appendix L. It is not possible and/or

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			difficult to evaluate the effects this element without more details on specific actions proposed. This comment pertains to all categories evaluated for the impacts to land-use management actions.
138	4.7.4.2.1	415	C: The local projects section describes the potential detrimental effects of these projects on fish. It mentions the potential impacts of bank stabilization. In addition bank stabilization reduces or eliminates the restoration potential of the affected reach and this needs to be more fully analyzed.
139	4.7.4.2.1	415	C: Why are changes in land use management, such as revising land use regulations and practices that could limit future development in the floodplain, described under local-scale flood damage reduction actions? Such changes could be described as a large-scale action.
140	4.7.10	422	"*Land Use Management changes that represent a departure from a community's current comprehensive plan or development regulations would need to demonstrate that such standards continue to provide sufficient suitable land for development to accommodate allocated housing and employment growth, per the provisions of GMA. Significant adverse impacts on land use are not anticipated under the proposed floodplain protection and construction standards.*" C: Have "sufficient suitable lands" been identified and how have costs associated with transfer of developable lands been incorporated into the draft PEIS?
141	4.8.1	427 - 450	*"Aquatic Species Habitat Actions (High and Low)"* C: The ASHA impact area is unclear and ASHA was not hydraulically modeled under the assumption it would not affect flood hydraulics. Based on the hydraulic modeling of the restorative actions in Alternative 4, the ASHA cannot be discounted as "no impact". The precise ASHA area is difficult to determine. It ranges from 20% of 21 RM and 20% of 1150 acres to 60% of 214 RM and 60% of 9750 ac, for a total of 4.2-128 RM or 230-5,850 acres, presenting these areas as a percent of a range of scenarios is confusing to the reader (pg 38). For example, the broad range of potential ASHA treatment reaches, 4.2 to 128 RM, makes the fish benefit difficult to compare to RFPA fish benefit. If all fish species and all scenarios are averaged for each alternative, the ASHA has aquatic benefit of 41% and RFP of 127% (pg 344). C: Based upon internal communication with Anchor Team regarding the frequency of LW and ELJ placements, there will likely be impacts of the ASHA throughout the basin that are not accounted for at this level of design. While the ASHA includes EDT modeling for fish habitat impacts for each alternative,

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			there is an inadequate level of design and hydraulic modeling detail in the ASHA. There is no evaluation of real land impacts, such as the flood effects of ASHA or lack thereof.
142	4.8.1	427	*"Water Resources"* C: The effects of ASHA actions on flooding have not been modeled, resulting in incomplete impacts analysis.
143	4.8	427	C: Since the ASHA (ASRP) development and the PEIS are being done concurrently, it has come to our attention that bank protection is part of the potential ASHA actions. This was not clear during the EDT analysis, and likely not included in the EDT modeling, thus the predicted benefits of the ASHA are overestimated. There needs to be some analysis of the potential impacts of bank protection actions on the future condition, both with no action and for the AHSA. We must assume that some new bank protection will occur, and the current analysis does not consider this change.
144	4.8.2	428	"*The activation of floodplain and off-channel areas has the potential to decrease flood extents and depths in adjacent areas*" C: This statement contradicts statements below describing the ASHA causing flooding and is not congruent with earlier statements in the draft PEIS regarding the goals of the ASHA to reconnect floodplain areas through LW and ELJ construction. Implementation of LW and ELJ projects on the scale needed to impart a significant geomorphic and hydraulic effect, as described, will increase flooding both in the local area and upstream of their location. We disagree with the assertion that the ASHA will not have potentially adverse effect of surface water quantity as proposed and in the draft PEIS. More information on specific actionable items and analysis to support those actions is needed to adequately address the impacts to flooding from the proposed action.
145	4.8.2.3	429	C: The section on mitigation describes some actions to prevent increasing landslide rates. It should add avoiding locations where the landslide risk could increase. Increased landslides in the areas of ASHA sites could destroy the project, and cause harm to aquatic habitats, so avoidance is always a good option.
146	4.8.4.2.1	431	C: The paragraph on restoring riparian vegetation should add the removal of invasive non-native species. Also, there will be a long term need to control invasive terrestrial species, which are a problem now and will remain so in the future.
147	4.8.4.2	431 - 432	*"For salmon species, removing all culverts could improve populations of salmon and steelhead from 2% (for fall-run Chinook salmon) up to 13% (for coho salmon), depending on the species."*

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			C: Where do these numbers come from (2% for fall-run Chinook salmon and 13% for Coho salmon)? There is no cited data source.
148	4.8.4.2.1	432	*"There is uncertainty as to the long-term effectiveness of riparian maturation in managed forestland. As a result, the effectiveness of riparian maturation in managed forestland was reduced from 100% to a range from 20% to 60% effective in the model to account for this uncertainty. Managed forestland was studied and modeled along with the Aquatic Species Habitat Actions to account for the overall habitat improvement in the Chehalis Basin as fish use both managed forestland and downstream areas for spawning, rearing and migrating."* C: The same level of riparian improved function needs to apply to all alternatives including the no-action alternative. The action alternatives should be compared to the no action alternative, not to current conditions. Comparing to current conditions biases the values for the action alternatives high when compared to current conditions. C2: Current FPA actions have been in effect since 1974/1999 and we disagree there would be any improvement under the FPA beyond from what has already been realized. Moreover, any consideration of improved riparian condition without an express action as part of the draft PEIS is not correctly evaluating the effects of only the project actions. Any consideration of improved riparian actions related to current (no proposal to change) FPA is inappropriate and should be removed from analyses and description of project effects.
149	4.8.4.2.1	432	*"The contribution of managed forestlands to salmon habitat potential varies, with a range of 63% (spring-run Chinook salmon) to 99% (chum salmon) benefit for the low restoration scenario, and a range of 18% (spring-run Chinook salmon) to 87% (chum salmon) benefit for the high restoration scenario, compared to current conditions (see Figure 4.8.2)."* C: These values have changed in the addendum, however, this section is unclear. It appears to state that of the predicted population improvement for each species most of this improvement is due to recovery of riparian function in managed forests. This points out a need to analyze for changes in fish production versus the no action alternative rather than current condition. While the latter is interesting to note, the actual difference due to the action is the difference between the action alternative and the no-action alternative. It introduces a bias to compare the action alternatives to current conditions when the improved riparian function from FP rules is added. These predictions must be compared to the no action

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			alternative with the same estimates of improved riparian condition from the FP rules, or the notion of benefits from managed forests should be deleted altogether so there is a consistent and equitable comparison of the alternatives.
150	4.8.4.2	432	*"The modeled current habitat potential for the Chehalis Basin to support each salmon species is depicted as the number of potential spawners (shown in Table 4.2-7), along with estimated total run size and escapement provided by WDFW over the past 10 years."* C: In terms of QIN Treaty Rights we should be modeling "habitat potential," not "current habitat potential." We should be looking at historical run sizes, not run sizes and escapement from only the past 10 years. 10 years is an inadequate "snap-shot" of a system heavily influenced by humans.
151	4.8.4.2	433	C: The broad range of potential ASHA treatment reaches, 4.2 to 128 RM, makes the fish benefit difficult to compare to RFPA fish benefit. If all fish species and all scenarios are averaged for each alternative, the ASHA has a benefit of 41% and RFP of 127%.
152	4.8.4.2.1	433	C: The table 4.8-1 and the subsequent discussion of the effects of the ASHA contain a bias due to the inclusion of bank stabilization in the ASHA. These values should be re-run with the predictions taking into account the presence of bank stabilization in the ASHA.
153	4.8.4.2.1	434	C: Table 4.8-2. While it is interesting to see the predicted improvements over current condition, QIN recommend analyzing and comparing the predicted improvements due only to the proposed actions alone (without any predicted benefit from the FP rules). C2: Update table 4.8-2 per 10/17 PEIS Addendum.
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2	5.2.2.1	456	C: There are no modeled results for the no action alternative. This needs to be done and the values from the action alternatives compared to the no action alternative. The total fish production is not the metric, but the difference in fish production between the action alternative and the no action alternatives is important to help decision makers understand the comparative merit of the alternatives.
3	5.2.2.1	456	*"The scope of restoration planned under the No Action Alternative would be limited and result in minor, with generally localized benefits; however, the changes would likely not be sufficient to restore reaches of Chehalis Basin rivers and streams in a way that substantially improves salmon abundance."* C: The analysis of the no-action alternative appears to ignore predicted benefits from the FP Act. Since these benefits are included in the evaluation of the action alternative they need to be included in the no action alternative. Including these benefits only for the action alternatives introduces a bias toward the action alternatives and is incorrect.
4		456	*"Any changes to forest management practices are not anticipated to reduce the frequency of extreme flooding in a watershed the size of the Chehalis Basin (Perry et al. 2016)."* C: This statement (which is also rephrased in section 5.8.1, p 519) represents an opinion on the part of the authors of the UW literature review on the effect of forest practices on peak flows. However, the actual literature review (Appendix A) reports that there is considerable controversy over statistical detection methods for changes to peak flows and there is therefore not a consensus in the scientific literature about the effect of forest practices on the frequency or magnitude of extreme peak flows.
5	5.2.2.1	456	*"Forest practices would continue to affect streamflow and landslides within the Chehalis Basin, as described in Section 3.1.2."* C: This is a true statement for the action alternatives. Either this statement needs to be added to the other alternatives, or moved to a section describing effects common to all alternatives.

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7	5.2.2.3	457	*"Under the No Action Alternative and when considering climate change, potential increases in channel erosion and incision, bank instability and erosion, and lateral bank migration could result from the projected increase in the number and severity of high-flow events."* C: Climate change is predicted to increase both frequency and severity of storm events but the PEIS is inconsistent with information provided by the UW Climate Impacts Group (CIG). In the distributed notes from a meeting on October 5 and those distributed by Nora Schlenker on October 17: "The University of Washington Climate Impact Group (CIG) study did not find evidence that there would be a shift in the direction of landfall of atmospheric rivers over the basin; the direction, frequency, and location would likely remain the same." The PEIS needs to be corrected to match the findings from the UW CIG, and the alternatives reviewed in light of this change.
8	5.2.2.3	458	*"Increased peak flows and frequency of winter storms would result in more frequent and greater flood damage."* C: Same comment as above. Again the predicted increases in frequency is not supported by information received from the UW CIG. Needs corrected.
9	5.3	464	*"In the long term, Alternative 1 would provide an increased benefit to aquatic species habitat function as compared to the No Action Alternative through implementation of Aquatic Species Habitat Actions."* C: The PEIS needs to compare Alt 1 to the no action alternative, and to include the predicted benefits of the FP rules in the no action alternative. They cannot compare to current conditions as this introduces a bias inflating the predicted benefits of the alternative.
10	5.3.1.1	464	C: The comparison of flood reduction benefits lacks any discussion of uncertainty in the numbers that are being compared, and whether the numbers represent an equivalent comparison. Modeling the flood reduction benefit from impounding a known volume of water behind a dam is more straightforward than modeling the effect of spatially distributed restoration actions. A discussion about the preliminary nature of the modeling for Alternative 4 would provide some context that the benefit may be more or less than presented here. C2: : The variability in flow contributions from the three contributing sub-basins (i.e., main stem Chehalis, south fork Chehalis, and Newaukum) to a 100-year flood at Ground Mound are not accounted for in the presentation of benefits and impacts of the FRO, FRFA, or RFP approaches. Nor is the uncertainty associated with using just one realization of a 100-year flood event at Grand Mound discussed. The flood

			retention benefit of a dam on the main stem Chehalis for a 100-year flood at Ground Mound will vary depending on what percentage of peak flood discharge at Ground Mound is generated in the main stem, versus in the South Fork or in the Newaukum basins.
11		465	C: It should be noted that the largest reductions (up to 10 feet) behind the airport levee are NOT due to the FRO, but are due to the levee projects. This amount of reduction in WS EL could potentially be achieved by Alternative 4 if paired with such levee projects (further hydraulic analysis would be necessary to confirm).
12	5.3.1.1	469	*"Flooding of rail lines, including BNSF, Union Pacific, and the Curtis Industrial Park line would also be reduced."* C: It is inappropriate to ascribe a benefit to a potential reduction of flooding in the Chehalis Centralia area when it is likely that other areas along the Skookumchuck and Chehalis Rivers as well as some of the larger creeks could all be flooding and precluding rail transport.
13	5.3.1.2	470	*"As compared to natural conditions, higher levels of sediment could be delivered to the temporary or permanent reservoir area from landslides that could potentially be triggered by fluctuating water levels, resulting in highly turbid conditions in the reservoir. The effects of these erosion processes have the potential to cause a significant adverse impact on water quality within the reservoir with respect to suspended sediment and turbidity conditions by violating the state water quality criterion for turbidity"* C: Increasing sediment delivery to a permanent reservoir would negatively impact water quality (as stated) and fisheries resources. Increasing sediment delivery to a temporary reservoir would also negatively impact water quality (as stated) and fisheries resources. Further, this increase in sediment could turn the spawning habitat above a FRO facility completely unproductive even during the years when the facility is not retaining water.
14	5.3.1.2	470	*"Impacts of Implementing Flood Damage Reduction Actions"* C: Infrastructure such as dams have a finite design life after which maintenance costs and risk of failure rise substantially. Should a dam be constructed in the Chehalis River Basin as described by Alternative 1, there will come a time at some future date when the dam will be obsolete and require removal. As such, evaluation of impacts associated with either flood control facility should describe the geomorphic impacts of remobilizing large volumes of sediment that accumulated upstream of the dam and the corresponding effects on ecological systems in the Chehalis River.
15	5.3.1.2	470	*"For both the FRO and FRFA facility types, the potential for prolonged, controlled releases of turbid water exists as the reservoir draws down after a major flood (occurrence once every 7 years on average)."* C: This comment applies throughout the document as well. Although the UW CIG does not predict increasing frequency of atmospheric rivers, the increased intensity of these storms will likely increase

			frequency of floods of a given flow. The predicted flow of a 100-year event at the end of the 100 year evaluation period is approximately equal to a current 500-year event. Since the PEIS proposes to retain water whenever the flows at Grand Mound are predicted to exceed a given amount, the frequency of water retention will increase in the future due to higher rainfall from the atmospheric rivers.
16	5.3.1.2	470	*"In the FRO reservoir, increased solar heating of the Chehalis River in the reservoir inundation area would occur due to a reduction in riparian vegetation."* C: C: This increased heating of the water and loss of riparian habitat would be a negative impact on the fisheries resources. This would also increase the temperature of the Chehalis River downstream when the FRO dam would expel all the water from the temporary reservoir. This could have large detrimental impacts on the fisheries resources. C2: An FRO facility could also function as an ecological trap any time it retained water (about every seven years). If salmon (or other fishes) spawn in the area of inundation prior to retention of water then their embryos (offspring) would not survive during inundation due to the change in water quality (loss of velocity and reduction of Dissolved Oxygen).
17	5.3.1.2	472	*"Alternative 1 would result in the most adverse impacts on fish as compared to the No Action Alternative and other action alternatives..."* C: Admitted negative impact on QIN Treaty Rights.
18	5.3.1.2	472	Discussing Alternative 1: *"Permanent changes to water quality, temporary or permanent inundation of what is currently stream habitat above the dam, and reductions in forces that shape habitat downstream would occur."* C: Negative impacts on QIN Treaty Rights. This is only scratching the surface of the impact to the natural processes of the system and how salmon evolved for this type of system (not one with a dam on it).
19	5.3.1.2	472	Alternative 1, cont'd: *"...there would be significant adverse impacts resulting in the potential decline of salmonids..." "These declines would be greater when factoring in climate change predictions during the next 100 years."* C: Negative impacts on QIN Treaty Rights. Further, the loss of future salmonid potential for the system by implementing Alternative 1 would not be recoverable.
20	5.3.1.2	472	C: The paragraph starting with "Alternative 1..." (second from the bottom of this page) describes predicted harm to fish due to climate change, but does not include a change in predicted inundation area or structures damaged due to increased flows from climate change. The analysis of the effects of the dam also needs to include climate change. The analyses are done using a current 100-year flood flow, but the predicted flood flows for a 100-year event in the future are much greater, as may be the

			inundation area, which should be analyzed and to address the potential for structures to be damaged under these higher flows.
21	5.3.2	475	Table 5.3-4 compares predicted salmon abundance for the alternative 1 against current conditions. This is an inappropriate comparison since the predicted abundance includes substantial increased production from the FP rules. Using this approach biases the analysis on the high side by giving credit for predicted benefits of the FP rules and comparing to today's abundance without any predicted benefit. (this error is universal throughout the document and needs to be corrected throughout) The PEIS should compare predicted abundance of salmon for all of the action alternatives against the no action alternative (with improvements predicted from FP rules). Comparing to current conditions is inappropriate and introduces a bias into the analysis by showing benefits from the FP rules for the action alternative when, in fact, the same benefits will occur in a no action scenario. The benefit of the action is the difference between the action and the no-action alternatives
22	5.3.3.2	481	Table 5.3-5. Same comment as Table 5.3-4.
23	5.6.2	508	Table 5.6-1: Same comment as 5.3-4.
24	5.7.1	514	Alternative 4 would decrease areal extents along the main stem of the Newaukum as well.
25	5.7.1	514	"Table 1: Action Elements and Combined Alternative for Evaluation in the Draft EIS" from the Draft Chehalis Basin Strategy Economic Study Update differs from the "Table 2.3-1 Action Elements and Combined Alternative for Evaluation in the Draft EIS" in the main PEIS. They should be identical. Does Alternative 1 include the I-5 Projects or not?
26	5.7.2	516	How does Alternative 1 result in an increased riparian area between 909 and 9,509 acres and Alternative 4 only increases between 562 and 6,552 acres? Is the total range of riparian habitat (up to 16,302 acres) part of a land acquisition? Alternative 4 has proposed acquiring land as a major component of the Alternative. Does Alternative 1 (with the ASHA) account for the necessary land acquisition and associated higher water levels and land use changes?
27	5.8.3	521	*"Construction of the Flood Retention Facility would cumulatively add to existing impacts on fisheries in a river basin that has already been extensively dammed and where habitat has been adversely affected by development, climate change, and other modifications to the system."* C: Negative impacts associated with a Flood Retention Facility (dam) on fisheries resources would be a negative impact on QIN Treaty Rights.
28	5	15	(in reference to Table 5.7-1) *"Note: Structures relocated are not included in this total because it is currently unknown whether property owners would be willing to relocate."*

			C: Given the uncertainty of property owner willingness, it is misleading to report the number of structures that would be saved from flooding at all in comparison based on the range of participation that is anticipated.
29	5.7.2	517	*"The contribution of managed forestlands to salmon abundance would on average contribute 87% of restoration benefit for the low scenario and 57% for the high scenario."* C: The line above shows how important it could be to compare to the no action alternative: only 13% of the predicted increase over current condition would be from the ASHA the rest is from the FP rules that apply in the no action alternative. This is in the review of Alt 4, but it applies to the evaluation of all alternatives.
30		517	Table 5.7-3. Same comment as 5.3-4.
31	5.8	518	*"Cumulative impacts are the effects that may result from the incremental impact of an action when added to other past, present, and reasonable foreseeable future actions (40 Code of Federal Regulations [CFR] 1508.7). 'Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time' (40 CFR 1508.7). Generally, an impact can be considered cumulative if: (a) effects of several actions occur in the same locale; (b) effects on a particular resource are similar in nature; and (c) effects are long term in nature."* See also, at 521: *"The cumulative effects of the Chehalis Basin Strategy are expected to be beneficial, although some cumulative impacts could occur as a result of individual actions."* C: The spatial and temporal cumulative effects of Alternative 1 FRO and FRFA dam operations include alteration of the Chehalis River natural flow regime, which may have significant and adverse cumulative impacts on downstream waters of the United States, including wetlands and reach scale riparian ecosystems and plant communities. A spatially explicit surface water, groundwater and sediment transport model of downstream effects of Alternative 1 flow regimes needs to be developed to quantitatively assess this question. There is overwhelmingly strong agreement in scientific literature conclusions regarding downstream spatial and temporal cumulative impacts of dam alterations of natural flow regimes on downstream geomorphology, riparian ecosystems and communities, and floodplain wetlands (R2 Resource Consultants and TetraTech 2014). Channel narrowing, and decoupling of channel and floodplain surface water hydrology due to the flood control dam capture of peak discharges, are reported to cumulatively result in vegetation channel encroachment and subsequent channel incision, has been a widely reported

			(Ligon et al. 1995; Johnson et al. 2012; Marren et al. 2014). The new, deeper channel requires higher discharges to overtop adjacent floodplains (Ligon et al. 1995). This type of hydrologic and geomorphic impact has been reported to result in a number of cumulative ecological impacts such as decreased riparian and aquatic species diversity and decreased standing biomass of fish (Ligon et al. 1995) as well as simplification of floodplain vegetation mosaic and associated riparian and aquatic habitat diversity (Amoros and Bornette 2002; Nilsson and Berggren 2000; Naiman et al. 2008). Hydroregulation reduction in natural peak flows, and attendant reduced flood regime, has been reported to result in a wide range of spatial and temporal cumulative impacts to riverine and riparian ecosystem geomorphology and ecological communities. Cumulative impacts of these alterations of the natural flow regime are reported to result in a diminishment of riparian ecological diversity (Nilsson and Berggren 2000, Naiman et al. 2005). Friedman et al. (1998) reported cumulative dam effects on riparian forests in southern Great Plains rivers resulting in channel narrowing along braided reaches from riparian tree establishment on newly exposed lateral channel margins. At the same time, in southern Great Plains rivers, the authors report a decline in riparian tree species reproduction associated with reduced channel migration and natural channel disturbance, therefore reducing new open mineral substrates required by these species for seedling establishment. These types of complex cascading temporal and spatial cumulative impacts, and ecological responses to alterations of natural flow and disturbance regimes, have been reported extensively in the dam downstream riparian effects literature (Petts 1984; Ligon et al. 1995; Nilsson and Berggren 2000; Bunn and Arthington 2002; Amoros and Bornette 2002; Petts and Gurnell 2005; Naiman et al. 2005; Osterkamp and Hupp 2010; Grant 2013).
32	5.8.1	518	*"One of earliest documented floods, occurring in 1887, inundated most of the area between Centralia and Chehalis (The Chronicle staff 2007). In the past 60 years, major floods have occurred in eight separate events, with flood levels rising and flood damage in the Chehalis Basin increasing"* C: This is a given: we continue to add infrastructure to the floodplain and the value of the structures increases the cost of flood damage will go up. Had construction in the floodplain stopped in 1887 there would be minimal flood damage today and the fish returns would be much better as well.
33		518	*"The influence of urbanization on flooding has generally been muted; overall, residential, commercial, and industrial land use collectively comprise a small portion (7%) of the overall land cover in the Chehalis Basin, and impervious surfaces are less than 2%."*

			C: This is an incorrect comparison. The potential effects of developed lands on flooding is concentrated within the floodplain, thus the amount of residential, commercial, and industrial land in floodplain should be a percentage of the total floodplain lands, not a look at the overall watershed. The developed lands outside of the floodplain have less impact. The impervious surface comparison is incorrect as well: it should not be calculated on a watershed wide basis but on a smaller scale to focus on where the impervious surface is located.
34	5.8.1	518	*"The influence of urbanization on flooding has generally been muted; overall, residential, commercial, and industrial land use collectively comprise a small portion (7%) of the overall land cover in the Chehalis Basin, and impervious surfaces are less than 2%."* C: The scale is incorrect for these calculations. They should be looking at a scale much smaller than the whole watershed, based on some work by Tyson Waldo at the NWIFC, closer to 33 square miles than the 207 square miles of the entire watershed.
35	5.8.2	520	*"Future growth would be constrained to an extent by water availability because issuance of new water rights within the basin are limited in part to maintain minimum instream flows for fish and to minimize potential impacts on groundwater."* C: QIN disagrees with this statement, which ignores likely future reliance on exempt wells, water right transfers, water banking, etc. existing water rights from farm land have been transferred to new, non-agricultural uses (Great Wolf Lodge is one example).
36	5.8.2	521	*"With respect to climate change, research has shown that although the mechanisms driving heavy rain events within the Chehalis Basin are not expected to change substantially in the future, atmospheric rivers are projected to increase across the region, resulting in higher moisture transport and rainfall associated with these storms."* C: This statement again assumes increased frequency of atmospheric rivers and this is contrary to the UW CIG report. The frequency of atmospheric rivers will remain the same, but the amount of water they deliver will increase. The result is that atmospheric rivers that currently do not create a flood will do so in the future and the events that are currently creating a flood will create bigger floods. The frequency of flooding is likely to increase, but the frequency of atmospheric rivers will not increase. The analysis should look at the frequency of atmospheric river-related storms and compare current flood-creating events with the predicted future higher rainfall events. For example if we get 3 atmospheric rivers per year, and 1 of 15 of these (or 1 every 5 years) creates a flood, how many floods will the 3 atmospheric rivers/year create in the future?
37	5.8.3	521	*"The cumulative effects of the Chehalis Basin Strategy are expected to be beneficial, although some cumulative adverse impacts could occur as a result of individual actions."*

			C: This statement is dependent on funding and completing an extensive habitat restoration program, likely over several years or even several decades and there is no guarantee that the ASHA will be completed or that they will be as effective as predicted. Washington is notorious for not completing or continuing long-term programs. The Chehalis Basin Partnership was big in the '90s and is now essentially unfunded. The TFW adaptive management program has struggled off and on for 25 years: it nearly died in the mid-'90s (with only two projects and one of these was funded by industry). The PEIS should acknowledge and address this uncertainty.
38	5	522	*"Alternative 4 does not reduce flood extents or depths, and therefore flood damage, as much as Alternative 1"* C: This statement comes to an incorrect conclusion based on the objectives of Alternative 4 [to relocate structures which will reduce flood damage]. Although the flood extent is not reduced in Alternative 4, that does not necessarily equal flood damage because this statement does not take into account the potential for relocating structures, which would indeed reduce flood damage. A statement similar to "it is likely that flood damage from Alternative 4 will not be reduced as much as in Alternative 1 based on a low participation of landowners to relocate" would be more appropriate.

QUINAULT INDIAN NATION COMMENT/RESPONSE TABLE CHEHALIS PROGRAMMATIC EIS APPENDICES

	Section	Page	Review Comment
1	A		C: There is controversy over statistical detection methods for changes to peak flows and there is therefore not a consensus in the scientific literature about the effect of forest practices on the frequency or magnitude of extreme peak flows (see Appendix A). The main PEIS does not fully reflect that this is an open question.
2	D	D-2 - D-3	*Upper Chehalis Temperature TMDL (Ecology 2001)* *Upper Humptulips River Water Temperature TMDL (Graber and Stoddard 2003)* *Table D-1 provides the Washington State Water Quality Standards, established by WAC 173-201A:* *"Char Spawning and Rearing: Not to exceed 12°C due to human activities.* *Core Summer Salmonid Habitat: Not to exceed 16°C due to human activities.* *Salmonid Spawning, Rearing, and Migration AND Salmonid Rearing and Migration Only: Not to exceed 17.5°C due to human activities.* *When natural conditions exceed the specified criteria above, the state allows no temperature increases that would raise water temperature by more than 0.3°C."* C: The Chehalis watershed is already severely impaired by high temperatures, and has a history of not meeting state water quality standards for temperature criteria. Any alternative that could raise the temperature of the river or its tributaries further should not be considered, as such rise in temperature would be in violation of Washington Water Quality Standards.
3	D	D-2 – D-3	*Upper Chehalis Dissolved Oxygen TMDL (Jennings and Pickett 2000)* *Black River Dissolved Oxygen and Phosphorus TMDL (Pickett 1994b)*

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			"Char Spawning and Rearing AND Core Summer Salmonid Habitat: Not to drop below 9.5 mg/L. *Salmonid Spawning, Rearing, and Migration: Not to drop below 9.5 mg/L.* *Salmonid Rearing and Migration Only: Not to drop below 8.0 mg/L.* *When natural conditions drop below the specified criteria above (or within 0.2 mg/L of the criteria), human actions considered cumulatively may not cause DO to decrease more than 0.2 mg/L."* C: DO levels are already dangerously low in the Chehalis watershed, it would be in violation of Washington Water Quality Standards to take actions that would reduce DO levels even further. Water poor in dissolved oxygen can make aquatic life unviable and make water unfit to drink. Dissolved oxygen is also vital to enable bacteria to break down organic detritus and pollution. Phosphorous levels are also an impairment in the Chehalis. Phosphorous limits primary productivity of many aquatic ecosystems, and increased river fluxes of phosphorous have been identified as a main cause of eutrophication of surface water bodies. The impoundment of sediment and therefore nutrients behind the dam will trap high phosphorous levels and guarantee eutrophication and low dissolved oxygen levels of the water released from the reservoir.
4	App. G	G-1	Table G-1 C: Herbaceous plants are listed under the shrub section. The table is incorrectly classifying plants.
5	App. H	H-2	*"The reduction in flow would be 200 cfs per hour, a rate of change which would minimize fish stranding downstream of the dam."* C: Is there supporting data that suggests a constant decrease at 200 cfs per hour is the most effective rate to minimize fish stranding? C2: If there is no science to back this claim up then we do not know if this flow could potentially increase fish stranding as compared to slower or faster rates of water reduction. This could be a negative impact to the fisheries resources.
6	App. H	H-6	*"For both the FRO and FRFA facility, sediment could be generated by surface runoff from exposed slopes along the reservoir footprint, along the shoreline from erosion at the reservoir waterline, and within*

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			the segment of the Chehalis River upstream of the reservoir where dynamic channel conditions would result from the fluctuating reservoir elevations" C: Sediment delivery is potentially harmful to spawning success of salmonids. The fact that the system could be losing enough flow to clean out sediment deposits downstream in spawning gravel may also be very impactful on spawning success and should be addressed
7	App. H	H-26 - 27	*"Vegetation"* C: Impacts are mentioned but there is no mitigation discussed. Even though there is "mitigation" discussed in other sections, this is the "Impacts and Mitigation" appendix. Only trees are shrubs are discussed. Herbaceous plants play a significant role in ecological function and are totally disregarded.
8	App. H	H-42	Table H-2. C: The fish passage survival numbers show an unacceptable negative impact on the fisheries resources. These numbers do not even include the reduced rate of survival due to the other factors included in Table H-2 such as a loss of 7 miles of riverine reaches, potential full loss of large woody debris, and temperature increases. Even more factors may exist that are not identified in Table H-2 such as increased predation or competition due to a reservoir habitat, increase in disease, and/or a loss or conversion of riparian vegetation.
9	App. J	1-2	*"Pre-construction Vegetation Management Plan"* C: This is not a vegetation management plan. This is a debris management plan. A vegetation management plan should include invasive species treatment pre-construction, invasive species prevention during construction and follow up after construction. A vegetation management plan should include more than trees and shrubs. Grasses, sedges, ferns and forbs play a vital role in ecosystem function.
10	App. J	2	"*Harvest marketable timber in areas where projected inundation depths and durations would be expected to kill tree species that do not tolerate extended flooding*". C: What is the tree species composition in these areas? This information must be provided in order to properly understand the extent and impacts of overstory removal.
11	App. J	2	*"Vegetation management actions during facility operation would be covered in a separate vegetation management plan for facility operations."*

	Section	Page	Review Comment
			C: Where is this post-construction vegetation management plan? It is difficult to adequately assess impacts of FRO/FRFA and mitigation without knowing the planned post-construction vegetation management.
12	App. J	3	"*common non-flood tolerant tree species identified in this document for the Pacific Northwest include Douglas fir (Pseudotsuga menziesii), bigleaf maple (Acer macrophyllum), red alder (Alnus rubra), and bitter cherry (Prunus emarginata)* " C: What species dominate the RMZ's along the upper Chehalis River? (If previously harvested, many RMZ's are dominated by red alder). This appendix needs to include a list of the tree species and their respective abundance/dominance within the RMZ's and analyze impacts of their loss.
13	App. J	4	Table 1 states that the 10% chance inundation zone will be "*Selectively harvested to remove non-flood tolerant species*". C: While this statement may technically be accurate, it could be misleading because if there are no flood-tolerant species in the RMZ's, no trees would be retained and it will essentially be a clearcut. This appendix should include a list of the tree species in these RMZ's and the proportion of volume or cover associated with each species (e.g., 60% of RMZ = Douglas fir, 30% = red alder, 7% = Western red cedar, 3% = black cottonwood).
14	App. J	3-5	*Inundation zone "1% chance of being flooded in a year (100-year event); will be under water for 1 day when flooded"* C: In light of climate change predictions, QIN questions whether this probability will remain. The potential impact of climate change on these expected inundation zones and expected vegetation communities should at least be mentioned here (at least one sentence acknowledging that these probabilities and frequencies are based on current and historical events and does not take climate change into account).
15	App. J	7	*"Although the deciduous riparian shrubland community type would not provide the same level of function as the existing conifer-dominated riparian zones, it would provide some degree of riparian functions, including bank stabilization, woody material recruitment, leaf litter fall, nutrient input, sediment filtration, and shading to the Chehalis River and other streams in the reservoir footprint."* C: This statement is misleading. Shrubs and the small deciduous trees described will not provide large woody material, the type needed for geomorphic function and habitat creation. The shade from shrubs

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			and the trees mentioned is not comparable to the natural shade provided by large conifer trees, or even the current mix of red alder and conifer trees.
16	App. J	8	*"A draft plan will be prepared once an alternative is selected by the Office of the Chehalis Basin."* C: Again, it is difficult to assess the environmental impacts of the FRO/FRFA when no specifics are given regarding post-construction vegetation management (e.g., how much live vegetation would continue to be removed post-construction).
17	App. K	1	*"Releasing cool water downstream of dams has been shown to support population productivity in some rivers by providing returning adult salmon with cool water refugia and reducing pre-spawning mortality."* C: What is the basis for this assertion? Which rivers?
18	App. K	1	*"The summary does not address other impacts of a dam on Chinook salmon in detail, such as the loss of spawning habitat or changes in substrate coarseness downstream of the dam."* C: It does not matter if the water is nice and cool if there are no spawning areas. Downstream of the dam will receive no sediment or bedload from the upper river, thus it may have very course rock or even largely a bedrock channel and this does not provide spawning habitat for chinook or other species. Without a sediment supply this reach may lack the deep pools chinook use for summer holding.
19	App. K	3	Figure 2. The PEIS predicts an increase in stream temperature both above and below the dam for the FRO when compared to current conditions due to the lack of riparian cover in the reservoir footprint. This increase in temperature is not reflected in these graphs.
20	App. K	3	Figure 2. There are no predictions for the September-October period, which is key because the temperatures during this period would be higher than current as they begin mixing the different water levels, and the lake mixes with the winds of October. This timeframe coincides with the spawning period so the temperatures need to be compatible with spring chinook spawning in order to demonstrate a benefit for spring chinook, and not at a level that will lead to early emergence since early emergence can be associated with low food supplies and increased mortalities. QIN recommends analysis of the effects of predicted temperature changes on spring chinook, both during their summer holding period, and the subsequent spawning and incubation period.
21	App. K	8	*"...changes in geomorphic habitat factors downstream of an FRFA dam that may affect the long-term survival of fish, including a coarsening of the substrate, a reduction in large wood, reduced bed scour, and changes in floodplain inundation during..."*

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			C: This is an incomplete description: it may be referring to reduced scour from major floods, but it is missing the repeated scour from lower level floods that will be retained. Seven year floods will move sediment coarsening the streambed that will not be replenished due to the dam stopping all sediment movement. Over time the bed will coarsen likely resulting in reduced suitable spawning gravel, and even large expanses of bedrock.
22	App. L	1	*"This effect has been seen in other river basins in Washington, such as the Green River valley after installation of the Howard Hanson Dam. However, the circumstances surrounding that facility are such that they cannot be compared to the Chehalis Basin Strategy"* C: The ASHA and RFP "broadly affect the extent of floodplain flooding", one of the main criteria used in the build-out analysis. Neither of these actions were included in this analysis, for different reasons. ASHA was not acknowledged as having a potential effect, and it was stated that details of the RFP were not known at the time of this analysis.
23	App. L	3	The South Fork Chehalis River, North Fork & South Fork Newaukum Rivers all have development in the 100-year floodplain, but those areas were not modeled nor included in the build-out analysis. This is an analysis gap.
24	App. L	10	*"The undeveloped parcels represent the development capacity that currently exists in the floodplain, and are referred to as existing developable parcels."* C: The analysis focuses on parcels, and this is proper, but an estimate of acreage could be useful as well. Or perhaps the length of river/stream associated with these estimates could be created to better allow evaluation of the effects on the aquatic habitats. The number of parcels gives an estimate of the future number of structures, but some measure of total floodplain influence or total riverbank influence could be useful.
25	App. L	17	*"Overall, the highest estimate of population growth would result in 1,720 additional residents in the floodplain by 2120."* C: Depending on what these residences are, we are looking at 430 million in additional potential flood damage at 250k per residence to 860 million at 500k per residence. This is damage that can be avoided by simply not building in the floodplain.
26	App. L	21	*Section 4.2. "The Land Use Management recommendations described in Section 2.2 consist of regulatory standards designed to protect remaining floodplain functions..."*

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			C: We need to restore floodplain functions not just retain the portion that remains. The state admits to a reduced population, and status quo will result in fewer salmon in the future based on their own analysis.
27	App. L	21	"*However, the extent to which these Land Use Management recommendations would prevent flood damage by constraining floodplain population growth and development is uncertain.*" C: QIN agrees with the statement and reiterates, any proposed alternative advanced as part of the PEIS that does not address, restrict, and prevent future floodplain development fails to meet stated project goals to reduce flood damages and improve habitat conditions.
28	App. L	A-1	*This is Appendix A for Appendix L. "...the floodplain would not change significantly; the dam would reduce flood extents in some areas but primarily serve to reduce flood elevations."* C: This statement seems to contradict the maps show areas flooded currently that are not under the FRFA proposal. The lands removed from flooding would see increased pressure for development because they would be removed from the regulated areas by FEMA. The idea that a dam will not increase development in the current floodplain is not supportable.
29	App. L	D-2	*Appendix D; Build Out Methods for Appendix L. "To accurately estimate the amount of parcel area that is available to be developed, these areas were filtered out of the analysis by using queries developed in GIS that selected only portions of parcels that met the following criteria:* • *More than 2,500 square feet of parcel in the modeled 100-year floodplain* • *Not in an inventoried wetland area (Ecology 2011)..."* C: This condition ignores the fact that wetland fill is possible so these acreages are not off-limits. While this review was ongoing, the City of Chehalis proposed to fill 40 acres of wetland. Public Notice NWS-2008-549-PN
30	App. L	D-4	*Appendix D in Appendix L. Fifth bullet in "Build Out Analysis Assumptions: "Wetland areas are not developable (no wetland buffer applied)"* C: This is not a valid assumption with wetland fill since it can be permitted by COE and the other governments. During this review City of Chehalis applied for 40 acres of wetland fill (some within floodplain). Public Notice NWS-2008-549-PN
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Quinault Indian Nation
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ATTACHMENT 2

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November 11, 2016

President Fawn Sharp
Quinault Indian Nation
P.O. Box 189
Taholah, WA 98587

Re: Review of draft Programmatic EIS for Chehalis Basin Strategy

Dear President Sharp:

This document provides my comments on the draft Programmatic Environmental Impact Statement (DPEIS) for the Chehalis Basin Strategy released at the end of September. My comments are based on my history of observations and assessments made on salmon[1] habitat and salmon populations in the Chehalis River basin, as well as on my experience in salmon ecology, habitat assessment and modeling, effects of fish passage issues, and restoration planning.

It bears noting at the outset that the DPEIS document is very large, complicated, and not easy to review due to its complexity and what seems like many subplots in a long movie.

Because of its complexity, I have organized my review around ten topics that I think will help convey more effectively my concerns and comments about the document. These topics, though overlapping in nature to some extent, provide my perspectives regarding the status of the fisheries resources in the Chehalis basin, a proposed dam, aspects of the analyses that have been presented, and the level of effort that will be needed to safeguard the fisheries resources going into the future, particularly in light of the challenges that climate change brings.

Before I move to these topics, I first provide some background and history regarding my involvement in the Chehalis basin. In 1974, I started work for the Quinault Indian Nation (QIN) as a fisheries biologist and remained employed in that capacity for 16 years. During my early years with QIN, I served as the environmental biologist, having completed my graduate studies on the effects of forest practices on salmon habitat and related fish population performance. In 1978, I performed an extensive review and assessment of fish habitat degradation for the entire Chehalis River basin as part of a potential Phase 2 of the *U.S. v. Washington* case. The report that I prepared, entitled "A survey of fish habitat alterations within WRIA 21, 22, and 23 of Washington State", was submitted to the U.S. Fish and Wildlife Service as part of potential further proceedings of the case. As part of my assessment, I traveled extensively throughout the basin to observe habitat conditions, documenting what I saw with photos and notes. I made an extensive aerial survey of many parts of the basin to identify areas that I then followed up with

[1] / All general references in this document to "salmon" are meant to include steelhead also.

on-the-ground inspection. I also met with various individuals in the basin to better learn of issues that they might be aware of that were adversely affecting salmon habitat. I spent a considerable amount of time in the Chehalis-Centralia area to learn about issues affecting habitat conditions in that vicinity.

Of particular note for my comments here was an interview that I had with a retired fire commissioner who had worked and resided in the Chehalis-Centralia area for many years. I was particularly interested in learning about the history of flooding in that area and the extensive pattern of development and land use within the floodplains. He informed me that he believed that flooding was gradually worsening and that he thought it must be related to the very extensive development of all types that had occurred over the years within the floodplains. As a result of his concerns, he told me that he often attended land use planning meetings where he would express his opinion on the matter. He told me that his concerns were always brushed aside and decisions would then be made following the patterns of the past. My exchange with this person, who struck me as intelligent, articulate, and concerned about the health of the river system, made a deep impression on me. I described this interview in the report that I prepared for the USFWS.

What became readily apparent to me as I made observations around the basin was that significant habitat degradation was extensive and in plain view. It was evident that the conditions of habitat were having adverse effects on the performance of the basin's salmon populations. It also struck me, as I believe I noted in my report, that these patterns were surely known to resource professionals like me who were employed by Washington State. It was evident that other priorities, directives, or a lack of enforceable laws were preventing resource managers from stemming the tide of habitat degradation—a common situation that has long existed in parts of the Pacific Northwest (Lichatowich 1999).

For the rest of my tenure at QIN, I remained involved in issues related to the Chehalis basin, which enabled me to continue to learn about the status of its fish populations and the condition of the fisheries resources in general.

After leaving QIN in 1990, I began working with Lars Mobrand and Jim Lichatowich at Mobrand Biometrics. The work focused largely on salmon recovery planning and included the development of analytical tools to aid in those efforts. The company developed a set of tools, which eventually became known as the Ecosystem Diagnosis and Treatment Method (or model) or EDT (Lichatowich et al. 1995; Lestelle et al. 1996; Mobrand et al. 1997; Mobrand Biometrics; Blair et al. 2009). Those tools have been applied widely to many salmon populations and watersheds throughout the Pacific Northwest and in large parts of California.

In 2001 to 2003, WDFW funded work to apply the EDT method (and model) to all of the rivers and streams within the Chehalis River basin; I served as the lead for that effort and was largely responsible for the overall analysis and report preparation (Mobrand Biometrics 2003). The assessment, diagnosis, and identification of watershed treatment priorities addressed the condition and needs of the habitats and salmon populations, including spring Chinook, fall Chinook, Coho, Chum, and Steelhead. To a very significant extent, aspects of the data inputs and modeling rules used in the 2003 analyses remain a part of the EDT analyses presented in the DPEIS and that are being used to develop the Aquatic Species

Restoration Plan (ASRP) for the basin. ICFI, the company that is responsible for all of the EDT modeling associated with the Chehalis Basin Strategy, is the owner of the EDT model. It is important to recognize that information and data contained in the 2003 analysis were assembled from all of the available sources at that time (including, for example, Wampler et al. [1993] and Smith and Wenger [2001]). Two retired WDFW employees, who had spent their careers working within the Chehalis basin, assisted in assembling and analyzing the available information. For the updated analyses being performed by ICFI, large amounts of newer information and improved data sets have been incorporated.

An abbreviated summary of the conclusions that were presented in the 2003 report for the Chehalis Basin EDT analyses is helpful here:

> "As noted in the previous section, we conclude that salmonid populations have experienced very significant declines in performance—essentially across all populations. Habitat changes have been significant and extensive throughout the basin and along the shorelines of the estuary and harbor. These changes are well documented and thoroughly described in Smith and Wenger (2001).
>
> Whether most of these populations should be considered "healthy" is questionable in our opinion. They should generally be considered as "at risk."[2]
>
> Our overall conclusion on the environmental attribute that should be given the most attention in the basin is riparian condition. Restoration of this single attribute would do more to rehabilitate and restore productive salmonid habitat in the basin than any other actions that might be considered. Very useful discussions of the role of riparian forests to Northwest rivers can be found in Collins et al. (2003) and Berg et al. (2003). We conclude that innovative planning should be undertaken to develop diverse and healthy riparian forests within the river and stream corridors of the basin to the maximum possible extent.
>
> We also advocate taking more innovative measures to increase wood loads in rivers and streams, while riparian corridors are being restored that will, in time, provide for natural wood recruitment. We advocate applying the findings of Abbe et al. (2003) on Engineered Log Jam (ELJ) technology, initially through several pilot projects."

I should point out that the conclusions drawn in the 2003 report are entirely consistent with those of the most recent analyses being used to guide the development of the ASRP, which is linked to whether a dam is built in the upper Chehalis River. It is also notable that the 2003 conclusions foresaw what would be needed to significantly restore parts of the character of the upper Chehalis River, that is, through an effort like the Restorative Flood Protection alternative, both with respect to re-forming suitable salmon habitats, as well as in arresting the increasing frequency of flooding in the upper basin.

---

[2] / The Salmon and Steelhead Stock Inventory (SASSI) of 1992 listed all salmon and steelhead stocks in the Chehalis basin as "healthy" except for Satsop River and Newaukum/Skookumchuck River winter steelhead, which were listed as "depressed" (WDFW and WWTIT 1994).

The remainder of this document is organized around ten topics dealing with or related to items contained within the DPEIS.

1. Chehalis River salmon populations have suffered long-term declines due to major habitat losses and degradation. A dam would add to that legacy. Watershed processes and habitat functions have been severely impaired throughout the basin. This has long been known (e.g., Wendler and Deschamps 1955; Weyerhaeuser 1994; Williams 1975; Hiss and Knudsen 1992; Wampler et al. 1993; Smith and Wenger 2001). Habitat degradation has occurred due to a variety of land and water uses over a long period of time—continuing to the present. The proposed action of building a dam would continue that pattern. As presented in the DPEIS, a dam combined with a very large program for restoration actions elsewhere in the basin would compensate for dam losses and to some extent rebuild salmon populations. The undeniable point, however, is that construction and operation of a dam would significantly further degrade salmon habitat in the upper Chehalis River.

   Approximately six to eight miles of mainstem river habitat, in addition to tributary habitat, would be inundated year-round under the FRFA dam and periodically under the FRO dam. Virtually all of the spawning habitat used by Chinook upstream of the dam site would be lost. Effects on Coho and Steelhead would be somewhat less than for Chinook because those species also spawn in stream reaches upstream of the footprint of inundation zone, but issues of fish passage effectiveness then come into play.

   It needs to be recognized that while an ASRP is being proposed in conjunction with the dam options that there can be no guarantee about the success of such a plan, if in fact a plan of that kind was to be truly and fully implemented. The future is uncertain. Once built, the effects of a dam would be certain. This point is discussed further in another topic below.

   It also bears noting that an increased amount of future development could reasonably be expected to occur in floodplains downstream of a flood-control dam given the past history of Lewis County's approaches to land use within floodplains. Prospects of relieving flood levels as a result of a dam would encourage expanded development of floodplains. In that case, salmon habitat could be expected to be further degraded. (See QIN's review of Appendix L in the DPEIS regarding Build Out Analysis.)

   In considering the extent of degradation of salmon habitat in the Chehalis basin, it is helpful to have some sense of how much has been lost in salmon production as a result. The historic pre-altered Chehalis basin was a huge producer of salmon. The size of the Chehalis basin, combined with what is known with a high level of certainty about the characteristics of its rivers and streams, attest to this conclusion. EDT modeling provides one way of estimating average levels of historic salmon production and percent losses due to habitat degradation, as shown below for both the 2003 and 2016 analyses (Table 1). It is noted that various refinements were made to the 2016 modeling compared to 2003; the most significant refinement was made in the characterization of the historic template (work by NOAA Fisheries and Natural Systems Design), which is the primary reason that the estimates of historic abundance increased substantially.

Table 1. Estimates of current and historic average run sizes (in the absence of harvest impacts) of Coho, fall Chinook, spring Chinook, and winter Steelhead based on EDT modeling for the 2003 and 2016 analyses. Numbers for the 2016 analyses are from ICFI.[3] Chum salmon estimates are not shown.

Species	From 2003 report			2016 analysis		
	Current	Historic	% loss	Current	Historic	% loss
Coho	68,000	211,000	67.8%	41,000	538,000	92.4%
Fall Chinook	35,000	99,000	64.6%	26,000	140,000	81.4%
Spring Chinook	1,800	12,000	85.0%	1,500	70,000	97.9%
W Steelhead	7,000	18,000	61.1%	7,000	30,000	76.7%
Total	111,800	340,000	67.1%	75,500	778,000	90.3%

Percent losses estimated for Coho, fall Chinook, spring Chinook, and winter Steelhead for the two analyses range between 67.8 to 92.4%, 64.6 to 81.4%, 85.0 to 97.9%, and 61.1 to 76.7%, respectively. For all species combined percent loss ranges between 67.1 to 90.3%. Chum salmon results are not shown because the 2016 analysis has not produced a historic estimate. The most significant loss has been estimated for spring Chinook.

2. <u>The relatively modest losses that are projected in the DPEIS from EDT modeling to occur due to dam construction and operation reflect the extremely degraded condition of the upper Chehalis River upstream of Pe Ell.</u> The DPEIS provides projected impacts to the salmon populations of building either the FRFA or FRO dam. The projected numbers of fish that would be adversely affected under either dam option are shown to be modest (DPEIS Table 5.3-4, page 475). For example, under the dam options the estimated loss in adult Coho abundance ranges from 308 to 622 fish. For spring Chinook, estimated loss in adult abundance ranges from 56 to 82 fish. I note that these numbers, based on EDT modeling, are consistent with numbers of adult salmon observed to use the upper Chehalis River upstream of the dam site in recent years. Ashcraft et al. (2016) reported estimated numbers of spawners in years 2013, 2014, and 2015 for this area to range from 174 to 1,460 for Coho and from 34 to 117 for spring Chinook. Also, the DPEIS (DPEIS Table 5.3-4) indicates that percentage losses of the various species of basin-wide adult production would be small, ranging from <1% to about 4% depending on species and dam option.

   Two points about this are important to understand. The first is that the modest numbers of fish that would be lost from this area can be tied directly to the much degraded conditions of the upper Chehalis River as a result of past and on-going logging-related practices. The river upstream of the proposed dam site remains almost entirely depleted of in-stream wood, particularly large wood structure. The importance of large wood in forming and maintaining high quality salmon habitats is well established (Gregory et al. 2003). Wood jams are absent within the reaches used by Chinook spawners. Pools are infrequent and shallow. I observed these conditions on a site visit made in summer of 2016; inspection of Google Earth imagery of the area confirms these observations. These

[3] / The estimates for spring Chinook for the 2016 analysis use the same spawning distribution as applied in the 2003 analysis. See topic number 10 contained in this document for additional information.

conditions have apparently persisted for decades following the period of intensive logging in the 1960s and 1970s. The Weyerhaeuser watershed analysis documented that very little in-channel wood existed at the time of the surveys throughout the upper Chehalis subbasin (upstream of Crim Creek or about where a dam would be built) (Weyerhaeuser 1994). A summary by Smith and Wenger (2001) stated: "The amount of large woody debris, particularly of key pieces greater than 12 inches diameter, is very limited throughout the upper Chehalis sub-basin, and consists mostly of large scattered log jams containing small pieces of logging slash." The authors described the scour potential to be high within the reaches. It is evident from Google Earth that the area today does not even benefit from logging slash accumulations—the mainstem river is nearly completely clear of any wood structure, making this area extremely vulnerable to bed scour. There is no doubt that the historic condition of the upper Chehalis River was far different: extensive splash damming, widespread removal of log jams and wood debris, and young second and third growth streamside trees have all severely depleted the stream channels of wood.

As a comparison to the projected losses under current conditions with dam construction, the EDT model in the 2016 analysis estimated the historic average habitat potential for this area in adult salmon produced to be approximately 2,800 spring Chinook and 12,000 coho (estimates from ICFI).[4]

A second important point about the way the losses of fish from the upper Chehalis River are conveyed in the DPEIS is that the loss in fish performance is described entirely in terms of fish abundance. Moreover, the presentation focuses largely on loss of fish abundance relative to the basin-wide abundance of each species, which dilutes the level of effect. In doing this, it appears that the losses amount to very small percentages of basin-wide production. What is not conveyed nor discussed in any manner is loss in other characteristics of a Viable Salmonid Population (VSP)—in this case, loss to spatial structure and diversity of the populations. Both of these characteristics are deemed to be critical to maintain population viability (McElhany et al. 2000).[5] The significance of the damage to these population performance characteristics for each of the species produced in the upper Chehalis subbasin from dam construction and operation is not known; the analysis presented in the DPEIS provides no consideration of this matter.

3. <u>There is a pressing need for an ASRP regardless of a flood control dam.</u> In several meetings during the course of developing the DPEIS and the related ASRP (or ASHA in the DPEIS), State agency representatives stated that the Chehalis basin has been given very little attention in the past by the State for salmon habitat restoration. The reasons given were that there are no ESA listed salmonid species produced in the basin and that resources have had to be directed at other watersheds in the state. The message has been that the need to address restoration in the basin is long overdue; the condition of the fish populations and their habitats warrant that significant efforts are needed. While this message has been given, another message has also been conveyed, as I understood it, by the State on this matter, though subtly: a significant ASRP would only be implemented if there is a

[4] / These estimates assume that certain waterfalls in the upper Chehalis River would have been passable, as they became after several sites were improved for fish passage in about 1970 (see Williams 1975).
[5] / Parameters of VSPs that are used to determine viability are abundance, productivity, spatial structure, and diversity.

dam. It is clear that these two efforts are always linked, a flood control effort along with a major thrust to address habitat restoration. I ask: Why?

This raises another important question: Does the State have the commitment and resources to stay the course and implement a long-term salmon and habitat restoration plan? The scale of a plan that would truly make a difference in a basin as large and complex as the Chehalis basin would need to necessarily be very large (Roni et al. 2010)—and costly.

The DPEIS presents a bleak outlook for Chehalis basin salmon populations without a major effort to implement an ASRP. This is seen clearly when considering the projections of how the populations will perform as the effects of climate change occur. The University of Washington's Climate Impact Group (CIG) and Portland State University made projections of how peak flows and water temperatures could be expected to change over the next 60 to 80 years. Significant increases were projected for both. These projections were incorporated into the EDT model to estimate how salmon populations might be expected to respond over that period (Table 2) (modeling results from ICFI). Modeling shows that sharp reductions in average abundance of adult runs could be expected. Losses were projected to be greatest for spring Chinook, followed, by Coho, winter Steelhead, then fall Chinook.

Table 2. Estimates of historic, current, and future (with climate change) average run sizes (in the absence of harvest impacts) of Coho, fall Chinook, spring Chinook, and winter Steelhead based on EDT modeling from the 2016 analyses. Numbers are from ICFI.[6] Abundance projections with climate change are shown without any restoration actions and with restoration actions (level of restoration as described in the DPEIS as High Restoration (20% of reaches).

Species	2016 analysis			
	Historic	Current	Climate change & no restore	Climate change & restore
Coho	538,000	41,000	18,000	45,000
Fall Chinook	140,000	26,000	19,000	25,000
Spring Chinook	70,000	1,500	200	1,400
W Steelhead	30,000	7,000	3,100	7,000
Total	778,000	75,500	40,300	78,400

It is important to note that actual reductions as a percentage of current levels of production would likely be greater than those shown in Table 2 for at least two reasons. First, the EDT model projects an average abundance (equilibrium abundance) along with an associated intrinsic productivity. Both of these numbers can become small when habitats are degraded, unrealistically small in some cases suggesting that in reality the population had probably gone extinct. The model does not perform a viability risk analysis, which if done would be based on some form of multi-generational life cycle

[6] / The estimates for spring Chinook for the 2016 analysis use the same spawning distribution as applied in the 2003 analysis. See topic number 10 contained in this document for additional information.

modeling that would take into account inter-annual variation in run sizes. Both the abundance and productivity parameters would come into play together with year-to-year variation. Climate change effects would likely lead to increased inter-annual variation of environmental factors and associated increased variation in salmon population performance, increasing the risk of extinction over the 60-80 year time horizon (Lestelle et al. 2014). Based on what I know about the EDT model's outputs for intrinsic productivity for the Chehalis populations and other characteristics, I would conclude with high confidence that spring Chinook will be extinct sometime within the next several decades. Risk of extinction for both Coho and winter Steelhead may also reach relatively high levels during the 60-80 year time frame. Some form of viability analysis would be needed to assess an expected level of risk. Fall Chinook would likely have the lowest risk of extinction during this period for the species shown in Table 2 because of their life history. Chum results have not been shown in Table 2. My comments here are based on my knowledge of the VSP parameters for these populations from EDT modeling and these species in general, as well as on viability risk analysis. The effects of other factors, such as changes in estuarine and ocean survival condition are not known.

A second reason that the projected abundance levels with climate change and no restoration are likely biased low is that it can be said with near certainty that habitat will continue to decline in the Chehalis basin over the next several decades even in the absence of climate change. The human population will continue to grow, creating greater pressures on various environmental factors that affect salmon—habitat will continue to degrade (NWIFIC 2016). As this happens, and depending on the extent of human population growth, land use patterns, and regulatory oversight, one or more fish populations that are at "risk" currently will likely need to be classified as "high risk." Human population growth can be expected to expand the most along the I-5 corridor. As discussed under the next topic, I am very concerned about the true status of Chehalis spring Chinook. Without significant restoration efforts, I think it is likely they will be extirpated within several decades.

The only way to offset the projected effects of climate change and increased pressures from human population growth on Chehalis basin salmon populations is to implement an aggressive ASRP. Table 2 displays projected abundance levels for the salmon populations with climate change and some form of an ASRP—in this case shown using the results from EDT for the High Restoration (20% of reaches) scenario given in the DPEIS. As modeled in EDT, this restoration scenario is very substantial, even though it is described as "20% of reaches." The projections in Table 2 show that with an aggressive ASRP the effects of climate could largely be negated. I note, however, that there is much uncertainty about how this level of restoration could in reality be implemented, given that the DPEIS states that it would depend on landowner willingness to participate. My point is that only with a very aggressive restoration plan can we protect the Chehalis runs from sharp decline and increased risk of extinction. Innovative planning would be required.

The commitment of the State to implement a well-planned and aggressive ASRP should be made apart from any linkage to a dam being proposed for the upper Chehalis River.

4. <u>A dam would worsen the outlook for sustaining and recovering the Chehalis River spring chinook population. This has ESA implications.</u> Both dam options considered in the DPEIS would likely

eliminate spring Chinook within a historic core spawning area for this species in the upper Chehalis basin (upstream of Pe Ell). The area upstream of the proposed dam site was historically used by spawning spring Chinook (Williams 1975) and remains so to the present day. Under the FRFA dam option, the entirety of the area used by spring Chinook would be permanently inundated. EDT modeling projected that all spring Chinook production in the area would be lost. Under the FRO dam option and as modeled in EDT, the large majority, but not all, of the area assumed to be used by this species was assumed to be periodically inundated. EDT modeling projected a loss of some portion of the production from this area but not complete elimination. However, I note that all of the stream reaches upstream of the dam site documented to have been used by spawning spring Chinook in 2013, 2014, and 2015 were entirely within the periodic inundation zone of the FRO option (Ashcraft et al. 2016). I believe that it is highly likely that even with the FRO option spring Chinook would be eliminated from this area.

Spring Chinook are a race of Chinook that is particularly vulnerable to land use effects, watershed alterations, and climate change because of their much longer association with freshwater habitats than fall Chinook (Busby et al. 1996; Quinn et al. 2015). These fish enter the river in spring and early summer in a sexually immature state, and then move up the river, holding in various locations while they slowly mature sexually. Quinn et al. (2015) referred to this race as premature migrants, in contrast to mature migrating Chinook (fall Chinook) that enter freshwater in a nearly sexually mature state. The consequence of the premature migrating life history is that these fish can suffer considerable mortality prior to spawning if poor habitat conditions exist. They are in special need of cool water to survive the summer period and deep resting pools for evading predation (Moyle 2002). They are unique in that they typically return to areas higher in watersheds than fall Chinook, distributing ocean-derived nutrients to those locales (Lichatowich 1999). Moreover, they are highly coveted by both tribal and non-tribal fishers because of their high fat content (Hearsey and Kinziger 2014). They have special cultural significance to Indian people groups (Netboy 1973), including the Quinault and Chehalis tribes, because these salmon are the first ones to enter the river annually (Quinault River sockeye are a rival for this distinction in that river).

While the Chehalis River spring Chinook population has been considered "healthy" in the past (WDFW and WWTIT 1994), there is growing uncertainty about their true status. I have had serious doubts about their status for many years.

Through my years of working on the Queets River as a tribal biologist, and since then through various projects, I have been puzzled as to why the Chehalis run sizes appeared to be much larger and more stable than those in the Queets River, as well as in the Hoh River, based on spawning escapement and run size estimates. The Queets and Hoh rivers originate in the glaciers of Mt. Olympus and the large majority of habitats used by spring Chinook are within Olympic National Park. The habitats of these populations are in nearly pristine condition. The waters used by the adult salmon in summer are generally cool. Pools are deep, numerous, and associated with complex log jams made of large wood. The mainstem rivers are lined by old growth conifers interspersed with stands of deciduous trees. The riparian corridors are fully intact.

In contrast to the Queets and Hoh rivers, much of the habitat used by spring Chinook in the Chehalis basin is highly degraded. Pool habitat over long stretches of the streams used by this race is shallow and lacks good cover. Log jams are scarce and where they do exist they are generally composed of small trees. Deep pools are rare. The riparian zones lack trees along substantial lengths of channel where agricultural fields or houses exist. Where riparian buffers do exist, the trees are generally small and young. Water temperatures are elevated, often beyond critical levels (Liedtke et al. 2016). An example of the consequence of these conditions was seen in 2009 when about 100 adult spring Chinook were found dead in the river (Kohn et al. 2009). Pre-spawning mortalities have also been found in the Newaukum River during surveys associated with a radio-tagging study of spring Chinook (Liedtke et al. 2016) and it appears that these mortalities were due to natural predation and poaching (M. Zimmerman, WDFW, personal communications).

Figure 1 compares estimates of spring Chinook spawning escapements, averaged (geometric means) in four 7-year periods over the past 28 years for the Queets, Hoh, and Chehalis rivers. All data are from the PFMC data base or from Jim Jorgensen with QIN. The patterns show substantial declines in the Queets and Hoh river run sizes and essentially no decline in the Chehalis River run sizes. I would note that the declines seen in the Queets and Hoh river runs are even more apparent when including data extending back to the 1970s (QIN unpublished). The pattern seen for the Chehalis River population is consistent with the status assigned in SASSI of "healthy" and stable (WDFW and WWTIT 1994). But questions need to be asked: Why would the Queets and Hoh river run sizes be so much smaller than the Chehalis River run size? And why would the Queets and Hoh river runs be in steep decline and the Chehalis River run stable?[7]

These patterns raise uncertainty about the true status of the Chehalis River spring Chinook.

My concerns about this matter were recently given traction as a result of preliminary findings from an analysis of otoliths taken from Chehalis spawners classified by spawning surveyors as either spring or fall Chinook. WDFW is currently engaged in analyzing otolith samples from Chinook classified either as spring or fall race spawners from different spawning areas in the Chehalis basin. Otoliths are hard, calcium carbonate structures located directly behind the brain of bony fishes. The analysis is based on micro-chemistry patterns of the otoliths, which provides a strong signal of whether a female Chinook has sexually matured in freshwater (indicating premature migration of the adult into freshwater—i.e., a spring chinook) or that she has largely sexually matured in saltwater (indicating mature migration into freshwater much closer to end of life—i.e., a fall chinook). Samples were collected from 2015 and 2016 for these analyses. Results from 2015 for samples taken in the upper Chehalis (upstream of the South Fork) show clearly that a major portion (perhaps a majority) of sampled spawners classified that year by surveyors as spring Chinook were instead fall Chinook (M. Zimmerman, WDFW, personal communications). These results are preliminary and the evaluation is currently in progress. It is expected that the analysis will be completed in early winter.

[7] / I note that I do not believe that the declines seen in the Queets and Hoh rivers are due to in-river fisheries as fishery impacts are considered to be negligible to modest in recent decades.

The preliminary results of the otolith analysis suggest that the spawning escapement estimates for the Chehalis River are likely biased high, at least in some years, due to misclassification of spawners between the spring and fall races. This raises uncertainty about the true status of the Chehalis spring Chinook population. WDFW is also engaged in a genetic analysis of samples of Chehalis Chinook and results are expected sometime in 2017. In addition, the agency is expected to receive funding to complete a newer type of genetic analysis (based on procedures in Prince et al. in preparation) that will be much more definitive about the population structure of Chinook salmon in the river basin. I consider this analysis to be critically important for understanding the status of the spring run.

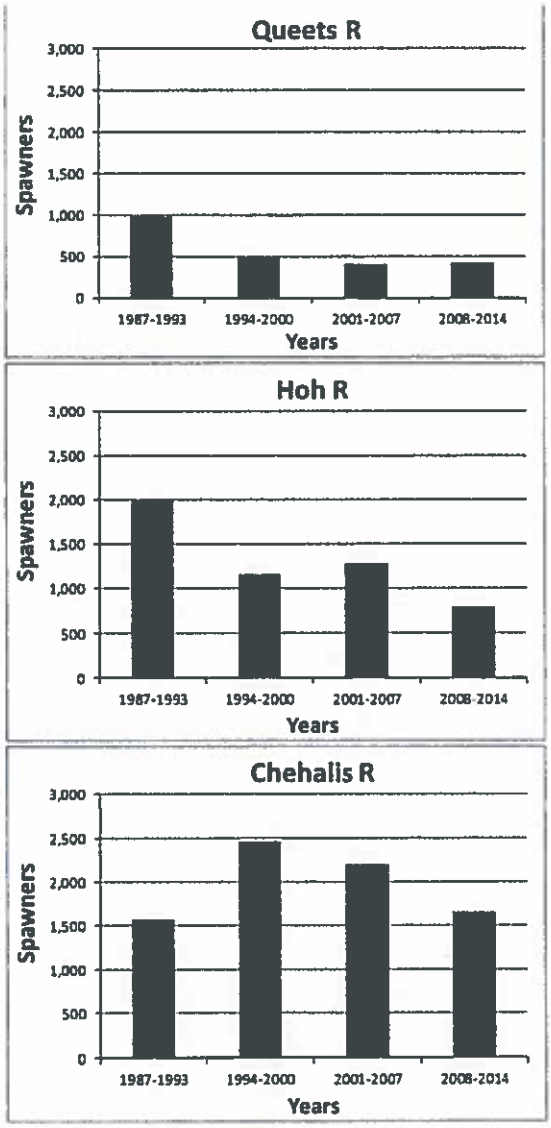

Figure 1. The average number of spring Chinook spawners averaged in four 7-year periods over the past 28 years for the Queets, Hoh, and Chehalis rivers (geometric means). Data from QIN and PFMC.

A soon-to-be published scientific paper (Prince et al. In preparation) by a group of geneticists on the evolutionary biology of spring Chinook has significant implications to this discussion; its findings are summarized briefly here. The genetics lab responsible for the work is located at UC Davis. The paper has been submitted to the prestigious journal Science for publication. Its major conclusion is that premature migration (i.e., spring Chinook) is the result of a single mutational event associated with one allele within the genome of Chinook salmon. That event likely occurred millions of years ago and the allele for premature migration was subsequently spread to distant populations through straying and positive selection. Thus, such a mutational event is so exceptionally rare that if the allele is lost it cannot be expected to readily re-evolve. In other words, if spring Chinook are extirpated, they would be effectively lost forever. Other conclusions of the paper address spring and fall Chinook hybrids (heterozygotes with a recessive premature migration allele) and how these are manifested as intermediate phenotypes.[8] The implication is that if true spring Chinook (homozygotes for the premature migration allele) are extirpated then over time the intermediate phenotypes will also disappear leaving only the mature migration life history type. This explains the continuum of adult migration timing from late winter to fall in rivers like the Queets, Hoh, and Chehalis. It implies that if true spring Chinook are extirpated, the continuum of run timing that now exists would contract back to a pattern associated with only late-timed fall Chinook. Fish that have intermediate run timing (such as July and August) would also be extirpated.

The implications of the Prince paper to Chinook conservation and management are profound, particularly with respect to the delineation of conservation units, such as Evolutionarily Significant Units (ESUs) as applied to Pacific salmon, and the potential need for ESA listing. Delineation of ESUs for Chinook salmon to a large extent has reflected geography as opposed to migration phenotype. Myers et al. (1998) concluded on the basis of genetic work existing at the time that the different migration phenotypes for Chinook (i.e., early and late) were not different enough genetically to group them into separate conservation units. The phenotypes were seen to be more similar genetically within a river system than compared to fish from river systems outside of the region (such as the difference between Washington Coastal Chinook and Puget Sound Chinook). This seemed to imply that premature migration is evolutionarily replaceable over time frames relevant to conservation planning (e.g., tens to hundreds of years; Waples et al. 2004), suggesting it is not an important component in the evolutionary legacy of the species (Williams et al. 2013). If the premature migration life history is lost in a population, it could re-emerge from the abundant mature migrating life history form. As a result of this reasoning, all migration types within the Washington Coastal area were combined into one ESU. Similar reasoning was applied in defining conservation units elsewhere on the coast. Thus, there has been no need to consider ESA listing of spring Chinook within these ESUs because the combined abundance of life history forms are considered sufficiently large and stable (due to the abundance of fall Chinook).

In contrast to this reasoning, the Prince paper strongly suggests there is a need for some form of supplemental framework to safeguard specific adaptive genetic variation such as that associated

[8] / Phenotype is the set of observable characteristics of an individual resulting from the interaction of its genotype with the environment. Migration timing pattern is a distinct phenotype.

with premature migration. This has implications for future potential ESA listing of Washington Coastal spring Chinook if their existence is threatened. The observed declines in this race in some Washington Coastal rivers over the past several decades are alarming. Also, the status of Chehalis spring Chinook appears to be increasingly uncertain.

Both dam options would likely remove the upper Chehalis River upstream of the proposed dam site as part of the spatial structure of Chehalis River spring Chinook. The performance of the overall population could be expected to decline. Given what appears to be increased uncertainty about the size and stability of this population, both options create more uncertainty about the future sustainability of the population. The final PEIS (FPEIS) needs to address this matter to the extent possible.

5. Construction and operation of a dam would have very long-term effects and would effectively foreclose opportunities for restoration in the area upstream of where a dam would be built. Once built, either dam would have long-term consequences—even perhaps permanently—for habitats and salmon production in the upper Chehalis River. As I noted as part of topic two, the DPEIS implies that the magnitudes of losses would be small, even trivial, compared to the numbers of fish produced Chehalis basin-wide. As I also noted elsewhere, this ignores the importance of spatial structure and population diversity for each species.

   Another point that may be critically important to long-term sustainability of some populations in the basin, particularly for spring Chinook, is that either dam would effectively foreclose opportunities for restoring habitats within the area of inundation. Historically, the thermal regime in this area should have been highly suitable for spring Chinook and I suspect that it was a core production area for the Chehalis population. Restoration of large wood jams to the area, together with the maturation of the riparian forest there, could once again provide abundant, high quality habitats for spring Chinook.

6. Fish passage at a dam would be only partially effective, complicated, and costly; the magnitude of these issues would vary by dam option. The DPEIS states on page 282 that both the FRO and FRFA dam options would cause significant adverse impacts on fish survival and migration. On page 284, it states that both dam options would be a barrier to both upstream and downstream juvenile and adult fish movement, impairing ability of fish to forage, find refuge, and, in some cases, complete their life cycles, thereby creating significant adverse impacts on fish performance. For both options, facilities would be required to enable fish passage, but how effective they would be is uncertain. Page 284 states:

   > "Final fish passage designs have not been determined, and passage success would vary considerably depending on the method of passage. Fish passage facilities would be designed according to state and federal fish passage engineering criteria to allow fish to safely pass the dam and access spawning and rearing area above the dam."

   Designing and operating facilities at high dams to "allow fish to safely pass" is notoriously difficult. Fish passage effectiveness levels that can be achieved remains uncertain until actual construction

and evaluation; evaluation of passage effectiveness often takes many years (Cone and Ridlington 1996). Every dam built to enable fish passage has its own unique challenges for design and implementation, and effectiveness is often less than specified objectives, as has been the case frequently for high dams constructed on salmon-bearing rivers. The facilities and methods employed to provide both upstream and downstream passage are often complicated, requiring multiple re-designs and improvements in attempting to achieve passage objectives (Tacoma Power 2012; Beckwith et al. 2013). The costs associated with trying to meet standards for fish passage are usually much higher than initially projected, as demonstrated in recent years for the Baker Lake project (Skagit) and Cushman Dams project (Skokomish) (this observation is based on my personal knowledge of the development of those projects). For example, the redesigned downstream floating surface collector on the Baker Lake system reached $50 million in 2010. Beyond design and construction costs, there are annual operations and maintenance costs that are required for the life of the project; these are not trivial costs.

The two dam options being proposed for the upper Chehalis River would employ very different designs and technologies to achieve passage, as outlined in DPEIS. Based on discussions among the members of the Fish Passage Technical Subcommittee for the DPEIS, passage effectiveness values that might reasonably be expected for upstream and downstream passage were identified (Table 3, reproduced from Table 4.2-5, page 286).[9] The values seen in Table 3 represent estimates of "total survival" through the project, defined as the total estimated percentage of fish that successfully navigate and survive the proposed fish passage facility and contribute to upstream and/or downstream life histories considered in the EDT model. I refer to "total survival" here as passage effectiveness.

Table 3. Projected fish passage survival through the two types of dams described in the DPEIS (from Table 4.2-5, page 286).

Species	Life stage & direction	Type of facility and passage structure			
		FRO	FRFA		FRO or FRFA
		Tunnels	Ladder	Juvenile passage facilities	Trap and transport
Anadromous salmon & steelhead	Adult upstream	94% - 96%	79%		91%
	Juvenile upstream	59% - 79%		64%	54%
	Juvenile downstream	85% - 95%			
Lamprey	Adult upstream	96%	54%		54%
	Juvenile downstream	95%		<1%	

Note: Ranges are based on differing passage survival depending on species.

The types of passage facilities and associated effectiveness values are discussed below. I note here that I consider all of these values to be reasonable initial approximations of what might be

[9] / I note that I was not a member of the Fish Passage Technical Subcommittee and did not attend any of its meetings.

achievable for the sake of the DPEIS exercise—though I emphasize that there is a very high level of uncertainty given the lack of detail and specificity about any passage facilities in the DPEIS. I have employed values similar to these in other EDT analyses on other rivers in the Pacific Northwest. I would note that passage effectiveness acts essentially as a direct scalar on population intrinsic productivity, which is a measure of density-independent survival in the population. Reductions in passage effectiveness directly reduce intrinsic productivity, and this parameter is critical when a population is trying to sustain itself in degraded habitat. Under such conditions, relatively small reductions in intrinsic productivity can result in disproportionate losses in abundance (Mobrand et al. 1997). I would note that I consider the upstream passage effectiveness values for juvenile salmon to be most uncertain, but these values should only have a slight effect on EDT results. I assume that upstream movement of juveniles in this part of the river would be relatively minor compared to other movement patterns, though it is known to occur (Winkowski and Zimmerman, In preparation).

FRO Dam

The FRO dam would employ three 230-foot-long open tunnels installed at the base of the dam to pass river flow and to empty the reservoir following filling. Fish passage would largely be achieved through these tunnels. Flood retention behind the dam is projected to occur on average once every 7 years, though this frequency will likely increase as climate change effects occurs. When flood retention happens, closure of the tunnels to fill the reservoir and retain it is expected to last for 26 to 34 days (based on historic record, page H-33). When the tunnels are closed, no fish passage via the tunnels could occur. During these periods, a collection and transport system (aka trap and haul) located just downstream of the dam could be used to collect salmon, steelhead, and lamprey via a short fish ladder into a trap, from they would then be trucked to release points above the dam.

The DPEIS is not completely clear whether a trap and haul system would in fact be employed during periods when the reservoir is filling during a storm event. Page 31 states "During flood retention operations, a collection and transport system located below the dam would collect salmon..." However, page H-37 (Appendix H) states "During a major flood when tunnels would be closed, a trap and transport system is under consideration for providing upstream fish passage past the FRO." These conflicting statements raise uncertainty about what the passage system would in fact include. It is not known what assumptions about a potential trap and haul system are contained within the 94% to 96% values for upstream adult passage for the FRO. Based on these values, it would seem that the assumption behind the table is that trap and haul would be employed; otherwise in any given year passage effectiveness could be much less if a flood event occurs.

But, this seems to be contradicted by this statement on page 286 in the DPEIS:

> "Though inundation or blockages to fish passage could be temporary, a loss of productivity for several weeks in a single year due to temporary inundation or blockage of fish passage would lead to reduced productivity in the subsequent generation. For salmon, the operation of the FRO facility could impair a single group of spawners, and reduce the productivity of their offspring 2 to 4 years later. In this way, the impact of a

> single flood could become protracted and cause fewer adult salmon and steelhead to return to the upper Chehalis Basin in future years."

These contradictory statements need to be addressed in the FPEIS. The consequences seen in the quote from page 286 immediately above make it clear to me that a trap and haul system is needed should the FRO option be selected. Otherwise the values of 94% to 96% for upstream adult passage are unrealistically high in my view. If no trap and haul provision is provided, a flood event that causes the tunnels to be closed for a month in November or December could effectively block most or all of the upstream migration of adult Coho. If such an event were to happen in one year, the result would be that one of the three brood lines[10] of Coho produced in the river above the dam could be effectively eliminated until the area could be subsequently recolonized from fish produced downstream.

It bears noting that uncertainties exist in the how the tunnels would perform for upstream fish passage during high water events (but not high enough to cause the tunnels to be closed). The DPEIS states that no known conduits for upstream passage of the design envisioned to be needed are known to exist, aside from long culverts under highways. The engineers involved in the DPEIS assumed that information from culverts was applicable in this situation (Garello and Ferguson 2016). The uncertainties associated with tunnel passage in these situations need to be more clearly described and evaluated in the FPEIS.

Downstream passage of juveniles would be disrupted during periods when the reservoir is either filling or emptying. Juvenile Coho undergo very significant downstream redistributions in fall and winter coinciding with major freshets during that period (Lestelle 2007; Soto et al. 2016). These movements would be particularly affected by the FRO reservoir being filled during those times. While I believe the range of 85% to 95% is a reasonable one to apply to a model like EDT, it needs to be recognized that there could be considerable variability as to when changes in passage occur within a year and between years. I would note that this kind of variability within a year and between years, as mentioned above with respect to upstream passage, can potentially have a significant effect on the performance of any single brood year's production. EDT does not handle this kind of variability. For future analysis, consideration might be given to developing a multi-generational life cycle model to improve understanding about the effects of variability (EDT can be used in conjunction with those types of models).

FRFA Dam

The FRFA dam presents greater challenges for fish passage than the FRO dam because of the permanent reservoir and the greater height of the dam. Details about potential passage facilities in the DPEIS are scant, making evaluation here particularly difficult.

[10] / Female Coho in Washington streams are effectively all 3-year olds when they spawn, meaning that there are three separate brood lines within the population.

For upstream passage, two options are presented in the DPEIS, a fish ladder and a trap and haul system. Both systems would be particularly problematic for the upstream passage of juvenile salmon and adult lamprey.

A fish ladder poses particular design challenges given the height of the proposed dam and the type of reservoir. The FRFA dam would be approximately 285 ft high, making use of a fish ladder extremely difficult in this situation. The Faraday-North Fork Fishway on the Clackamas River in Oregon, considered to the longest operational fish ladder in the world (Beckwith et al. 2013) is nearly 2 miles in length and ascends a height of 240 ft, according to Garello and Ferguson (2016). (Beckwith et al. [2013] lists the height ascended as 196 ft) Also, the highly variable reservoir elevation during the salmon migration season due to filling and flow releases to achieve prescribed flow regimes would make operation of a fish ladder difficult. Moreover, juvenile salmon would not be able to ascend such a ladder. For these reasons, it is highly unlikely that a fish ladder would be advanced for further design work. I do not believe a fish ladder was modeled as part of the EDT analysis; I do not consider it any further here.

If the FRFA dam were to be selected, upstream passage would very likely need to be achieved by a trap and haul system. This technology has a long history of use. It is often used at high head dams (such as the FRFA) where it may be the only feasible way of moving fish. It also has a much lower initial cost compared to the construction of fish ways, like extremely long ladders (Beckwith et al. 2013). A trap and haul system is the adult passage method used at the Wynoochee Dam in the lower Chehalis basin.

The upstream passage effectiveness value assumed for the DPEIS for adult salmon of 91% (Table 3) is reasonable and consistent with values applied in analyses elsewhere. The passage effectiveness values for juvenile salmon and adult lamprey were assumed to be 54% but there is a very high level of uncertainty associated with these. I note that both of these values are somewhat higher than values presented by Garello and Ferguson (2016) to the Fish Passage Technical Subcommittee. There is very little available data to support any value that might be applied; it is recognized that there is high uncertainty for upstream passage of juvenile salmon and lamprey in a situation like that on the upper Chehalis River (Garello and Ferguson 2016). I would note that I do not expect there would be substantial upstream movement of juvenile salmon in this vicinity though it is known that juvenile steelhead demonstrate such movements here (Winkowski and Zimmerman, In preparation). My level of concern at not being able to accommodate a higher effectiveness of upstream passage of juvenile salmon for this option is low compared to other issues associated with passage.

For downstream passage of adult steelhead (kelts) and juvenile salmon, two options are considered in the PDEIS: a floating surface collector (FSC) and a multi-port system. The FSC system would be located in the dam forebay (the area just upstream of the dam). This method of collection has been successfully employed on several reservoirs in the Pacific Northwest, most notably on Baker Lake in the Skagit River system (Beckwith et al. 2013). It is expensive to build, operate, and maintain. It is still considered experimental because it needs to be adapted to each reservoir where it is employed.

A new version of the system has recently been designed and built at Cushman Reservoir (Skokomish) by Tacoma Power. The specified target effectiveness of these systems is normally set at 90% but it is difficult to achieve this target. Garello and Ferguson (2016) state that initial test results for Cushman Reservoir show an effectiveness value much lower than 90%. The Fish Passage Technical Subcommittee assumed a value of 64% for downstream passage for the FRFA dam (Table 3).

The multi-port passage option would be built into the dam. The DPEIS states that a total of four dewatering screen systems would be installed and operated one at a time to accommodate the approximately 40-foot fluctuation in forebay elevation. Adult and juvenile salmonids would enter and pass through the dewatering screen system, and be conveyed to a release point below the dam via specially designed transportation conduits. Information given to the Fish Passage Technical Subcommittee by the contractor HDR suggested that this method has particular design challenges for the FRFA reservoir.

My conclusions about the FRFA downstream passage options are that there is a very high level of uncertainty about what level of effectiveness can be achieved. Design, construction, and testing of the facilities needed would be expensive. Evaluations and refinements would likely take years to complete. Annual operations and maintenance costs would be high, given that this facility would not be a hydroelectric project that could generate revenue to provide O&M budget.

EDT modeling results for fish abundance produced upstream of the dam site (model results provided by ICFI) show that all salmon species would drop sharply from current levels of production under both the FRO and FRFA dam options. While these results are due to both habitat inundation as well as fish passage issues, it appears to me that the combination of upstream and downstream passage factors would have a significant effect on fish performance. Under the climate change scenario, it is my opinion that it is likely the production of all species from upstream of the dam would be eliminated (in part because intrinsic productivity could be expected to dangerously low levels).

Regarding lamprey, I would repeat what the DPEIS states: Based on the available information, construction of the FRO dam would not be expected to significantly affect passage of lamprey, but it is unknown how changes in the reservoir area would affect lamprey. Construction of the FRFA dam would have a significant effect on the upper mainstem population of lamprey in the Chehalis Basin; the species could be expected to be eliminated from upstream of the dam.

7. <u>There is a mismatch in the DPEIS with time horizons for adverse effects and potential benefits from an ASRP.</u> Time horizons that were evaluated in the DPEIS for adverse effects of the dam options combined with potential benefits from restoration actions are not comparable and do not align. Adverse effects of creating and operating a dam would result in nearly immediate effects, whereas benefits of ASHA would be accrued over a very long period of time, spanning many decades. The modeling results in the DPEIS make no distinctions about differences in time horizons. This needs to be corrected in the FPEIS by modeling different time horizons for the different elements of the alternatives.

8. Dam effects combined with expected climate change effects would either compound adverse effects of climate change or, to an extremely limited degree act to buffer certain aspects of climate change. Projected effects of climate-change pose a severe threat to the production and sustainability of many of the basin's salmon sub-populations; dam options either compound those threats or, in the case of some potential cool water releases with the FRFA, provide insufficient benefit to avoid extinction or significant losses.

   The adverse effects of inundation and passage issues on salmon population performance were discussed in topics above. I have not addressed how in-channel and off-channel habitats would be adversely affected downstream of either dam option as a result of changes in flow regime characteristics, sediment routing, and wood transport. Those issues have been addressed by other individuals providing review comments to QIN and I will not discuss them here.

   Two additional points, however, need to be made about the dam options being considered. The FRO option has been generally cast as a more benign option than the FRFA option; while that may be true in some ways, it needs to be recognized that such a dam would compound adverse temperature effects expected from climate change. Because the area of inundation footprint would become more susceptible to heating due to solar radiation under this option, summer water temperatures through this area would be expected to be increase compared to current conditions. Climate change would exacerbate this condition.

   The FRFA option would provide for both increased flows downstream of the dam during summer by releasing stored water in the reservoir and by releasing cooler water than occurs there under current conditions. While this would be expected to partially mitigate for the various adverse effects of the dam, the level of benefits would be small given the magnitude of potential losses that would otherwise accrue. Moreover, in considering the foreclosure of future opportunities to restore habitats both upstream downstream of the dam, the relative benefits of releasing cool water in greater abundance would be expected to be small in comparison (as mentioned in topic two).

9. The alternatives should be compared to a future baseline condition. The DPEIS compares modeling results for each alternative to what is considered the current condition or the No Action Alternative. The manner in which this is explained in the document is very confusing and inconsistent. Moreover, the authors of the document appear to have changed how they defined the No Action Alternative between the initial release of the document at the end of September and a supplement released in mid-October. In particular, how the effects of managed forests were handled in the analysis appears to have been inconsistent between these two released documents, which created much confusion. I am still uncertain how the analysis was intended to be done and presented.

   The analysis should be conducted by comparing the projected outcome of each alternative to a future baseline representing the No Action Alternative. This would be the only fair way to make an "apples to apples" comparison. For reference, these results should also be compared to the current condition (current baseline). The future baseline (No Action) would include climate effects as well as

any potential benefits projected to come from managed forests under existing HCPs, the Forest Practices Act, and management in federal forests. Differences in management between jurisdictions and land ownership within the managed forests would need to be taken into account.

10. Issues associated with the EDT modeling need to be recognized. The EDT model provides an extremely useful tool for comparing alternatives and scenarios with respect to potential salmon population performance. But full disclosure on my part is needed: I am biased since I was one of the principal architects of the basic model. That being said, there are issues and limitations related to the model, including the Chehalis River version that should be recognized and addressed.

    First, it is important to recognize the purpose of which the model was designed and some of its intended applications. The EDT model is a habitat model that assesses environmental constraints on salmon production. It is not a fish population model, even though it provides outputs expressed as VSP population parameters; as such it is meant to convey information about the condition of the environment "through the eyes of salmon" (Mobrand et al. 1997). The outputs are meant to characterize habitat potential for salmon performance under a given set of assumptions about habitat conditions. It allows managers to explore alternative habitat restoration strategies and potential future land use decisions (in this case, decisions related to building a dam or using a restorative approach) (Blair et al. 2009). The modeling results represent hypotheses about how habitat potential for salmon performance is predicted to change under given sets of assumptions about future habitat conditions resulting from different scenarios. The results are not meant to predict how many fish would actually be produced if certain alternatives or strategies are implemented. Those scenarios typically represent habitat conditions that might be expected in some future time period, perhaps roughly 20 or 100 years (or longer) in the future. No model can predict how many fish would actually be produced in distant time periods under various scenarios—too many uncertainties exist about the future. Furthermore, salmon populations can fluctuate greatly from year to year—to a large extent due to variability in ocean survival conditions. Ocean conditions are extremely unpredictable as a result of broad-scale and global ocean and climate patterns.

    In the same way that the model looks at future conditions, it is also used to assess habitat potential both for current conditions and for a set of assumptions that could reasonably represent conditions prior to watershed alterations. A comparison between these two scenarios is the basis of formulating a watershed/species diagnosis. This provides a quantitative limiting factors analysis to help identify constraints on habitat potential resulting from watershed alterations. The diagnostic outputs are then used to rank stream reaches for restoration and/or protection benefits and to identify limiting factors that should be addressed. These results are being used to inform prioritization for developing the ASRP for the Chehalis basin.

    Certain limitations of the model need to be recognized. Because the model is not a fish population model, it does not follow generations of a salmon population through time, nor does it incorporate interannual variability in survival that occurs due to environmental variation. For example, a drought or a flood can have disastrous effects on the production of salmon in a given year. Those effects can keep a salmon population depressed for multiple generations (the rate of rebound will be

influenced by the condition of the habitat). Similarly, as noted in topic 6 (Fish Passage), periodic flood retention events under the FRO dam option could have a severe effect on a given cohort of fish. How such an event would affect the population over subsequent generations cannot be assessed by EDT except in only a very crude manner that likely does not reflect the level of real effect.

Also, the EDT model does not provide any kind of a population viability analysis (PVA) to quantitatively assess risk of extinction. Different types of models exist for performing PVAs (Morris and Doak 2002; LCWTRT 2003; Sands et al. 2009). An approach for incorporating climate change effects on summer Chum viability in Hood Canal was recently used to provide guidance in recovery planning in that region (Lestelle et al. 2014). There may be a need to perform a PVA on some Chehalis populations, particularly spring Chinook. The results of assessment work aimed at better understanding the status of spring Chinook in the basin by WDFW will help inform whether a PVA could be useful.

I also would note that the EDT abundance values reported for spring Chinook throughout the DPEIS are biased high due to what I believe is a mistake in how the model was run for this species. For the 2016 model runs, ICFI assumed that spring Chinook spawners would use the entire mainstem Chehalis River upstream of Porter Creek, which enters the mainstem river at RM 33.3, in addition to the Skookumchuck, Newaukum, and South Fork Chehalis rivers. For the 2003 analysis (Mobrand Biometrics 2003), the spawning distribution was limited to the mainstem Chehalis River upstream of the Newaukum River, entering at RM 75.4, a difference of about 42 miles of river assumed to be used for spawning by this race. In my opinion, it is unreasonable to believe that spring Chinook, either historically or in the present time, spawn in the mainstem river downstream of the Newaukum River due to exceptionally warm conditions of the river. It is also highly likely that this section of river was quite warm prior to watershed alterations due to the size of the basin and its large channel width through this area.

The matter of what spawning distribution to apply for the 2016 analysis was a topic of considerable discussion among the technical representatives engaged in some way in the DPEIS process. (There were also significant differences in the spawning distributions between the 2003 and 2016 analyses for the other species. The differences between the 2003 and 2016 analyses existed for several reasons, which do not need to be explained here.) The differences in spawning distributions had a very important bearing on modeling outputs and how these might be applied and interpreted. For spring Chinook, the expanded distribution that extended to Porter Creek would result in significantly greater habitat potential for both the historic and current periods (expressed as fish abundance). A special meeting for the participants was convened on March 16 to address this matter, at which time a recommendation was requested from WDFW on how this matter should be handled. Following the meeting, Mara Zimmerman, a lead scientist with WDFW, sent an email (dated April 29) to Chip McConnaha with ICFI advising: "Use the 2004 distributions for analyses conducted this

biennium."[11] She went on to say that this matter would be addressed further in the upcoming biennium.

In September of this year, after the EDT modeling for the DPEIS had been completed and the draft document distributed, I discovered in the course of reviewing modeling results that the 2003 spawning distribution had not been applied for spring Chinook. Instead, the expanded distribution that extended to Porter Creek had been used. The effect was to produce much larger habitat potential values (i.e., fish abundance) than would have been produced with the smaller distribution. My conclusion is that this was done by mistake. This matter needs to be addressed in the FPEIS. I would also note that the effect of this is to produce what I believe is a false impression about the actual size of the spring Chinook population in the Chehalis basin (discussed under topic 4 in this letter).

In closing this letter, I come back to the first topic discussed (topic one). It is agreed on by all parties who have been engaged in some way with the PEIS that the salmon resources of the Chehalis basin have been greatly diminished by alterations to the watershed. Salmon habitat has been severely degraded and wild salmon runs have declined significantly.

Page 473 in the DPEIS states:

> "Alternative 1, when implemented as a comprehensive strategy, could substantially increase abundance of native aquatic species, reduce the potential for future ESA listings, and enhance tribal and non-tribal fisheries as compared to the No Action Alternative."

I agree with the statement, assuming that a large, comprehensive habitat restoration plan were to be truly implemented. But it would be true only because the adverse effects of building a dam could be offset by a large enough restoration plan conducted elsewhere in the basin. Such a restoration plan could be implemented, and should be implemented, without building a dam. A dam would add to the legacy of habitat loss in the basin.

Thank you for the opportunity to comment on this very important matter.

Sincerely,

Larry Lestelle

[11] / Reference to "2004 distributions" actually refers to the distributions applied in the 2003 analyses that were the basis of the report by Mobrand Biometrics issued in December 2003.

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ATTACHMENT 3

dkcarlton & associates

MEMORANDUM

TO: Mr. Larry (Junior) Goodell
Quinault Indian Nation Chairman of Off-Reservation River and Ocean Fisheries Committees
FROM: Dave Carlton, PE, CFM
DATE: October 21, 2016
SUBJECT: Draft Chehalis Basin Strategy Programmatic EIS

I have completed my review of the alternatives contained in the Draft PEIS and the actions contained in the alternatives to determine if the requirements of the National Flood Insurance Program (NFIP) would impact their implementation. Several of the alternatives would result in changes to the extent of the Special Flood Hazard Area (SFHA) and the Base Flood Elevation (BFE) which would result in a change to the existing Flood Insurance Rate Maps (FIRMs) upon completion. Other projects, such as the Restorative Alternative would not change the SFHA initially, but over time as more of it is implemented and the habitat improves, changes may result in the SFHA as part of the normal updating of the maps that FEMA does. The SFHA is the area of the FIRM where the minimum building standards of the NFIP are required to be enforced and insurance is required to be purchased by holders of federally backed mortgages. Areas outside of the SFHA are not subject to these minimum standards.

Four alternatives were analyzed in the Draft PEIS. Each alternative includes the full suite of aquatic species habitat actions and local-scale flood damage reduction actions.

Alternative 1 also includes the Flood retention facility, the Airport improvement levees and the Aberdeen/Hoquiam north shore levee elements. Alternative 2 also includes the Airport improvement levees, the I-5 projects and the Aberdeen/Hoquiam north shore levee elements. Alternative 3 is a non-structural flood protection alternative that includes none of the Large-scale flood damage reduction actions. Alternative 4 includes only the Restorative flood protection element in addition to the Local-scale and Aquatic Species actions.

Large-Scale Flood Damage Reduction Actions

Flood Retention Facility: The flood retention dam proposed on the mainstem of the Chehalis River, with or without a permanent reservoir, is intended to substantially reduce damages during a major flood. The dam is proposed to operate only during major flood events, 38,800 cfs or more at Grand Mound, which is currently predicted to be a 7-year event. Once the dam is completed and properly functioning, it is anticipated to reduce the extent of the Special Flood Hazard Area and the Base Flood Elevation downstream as mapped by FEMA. It is likely that if the dam is constructed the federal government will pay for a portion of the cost of construction. If so, the project will need to go through the NEPA process.

- NFIP Impacts: Because the impacts of this project on the SFHA are significant, prior to final design of the facility a Conditional Letter of Map Revision (CLOMR) should be

submitted to FEMA to ensure that FEMA agrees with the analysis and the proposed changes to the FIRM downstream of the dam and impacted property owners are properly notified of the potential changes. Obtaining a CLOMR will ensure the proponents what the changes to the FIRM will be once the dam is functioning as proposed. All applicants for a CLOMR are required to perform an Environmental Assessment and show there is no negative impact.

- When the dam is in place and functioning, a Letter of Map Revision (LOMR) should be pursued to revise the effective FIRMs. Once the FIRMs are revised and become effective the flood insurance rates for property owners benefited by the dam should be reduced and because the SFHA will be smaller less property will be subject to the minimum standards of the NFIP.

Airport Levee Improvements: This project would increase the height of the existing levee by four to seven feet and 1700 feet of Airport Road would be raised for a total of 11,221 feet of increased protection. The intent is to protect the airport, local businesses and part of I-5 from flooding during events up to the 1% chance event. Each element of this project would require a local permit to ensure its impacts on the SFHA and adjoining property owners are properly mitigated.

- NFIP Impacts: Once implemented this option would result in changes to the FIRM that show a reduction of the SFHA in some portions of the floodplain, higher flood elevations in other locations because of the loss of flow area (up to 0.9' upstream of the project) and may result in a change to the existing floodway. Therefore close coordination with FEMA through the CLOMR process should be pursued to ensure the levees can be properly accredited and shown on the FIRMs as providing protection. This process should begin prior to final design in order to make any required modifications to the project in order to obtain concurrence by FEMA on the predicted changes to the FIRM and identification of property owners impacted.
- Once the project is complete a Letter of Map Revision should be pursued in order to modify the FIRMs impacted by the maps. Either at this time, or during the CLOMR process, all impacted property owners will need to be notified of the potential changes to the FIRMs and given a chance to comment on those changes. As part of the project it might become necessary to provide some sort of mitigation to all property owners where the BFE is predicted to increase. This project, while protecting the airport and other properties, will add properties to the SFHA and require any new structures or floodproofing projects in the nearby area to be built to a higher elevation once completed

I-5 Projects: The I-5 Projects action is designed to protect I-5 and the airport with levees and floodwalls. It may provide some flood additional flood protection to homes and businesses in Chehalis and Centralia but there is also an anticipated increase in flood elevations both upstream and downstream of the project. As part of the project bridges over both Dillenbaugh and Salzer Creeks will be replaced and will result in local changes to the flood elevations.

- This set of projects will also require close coordination with FEMA due to the desire to have the levees and flood walls shown on the FIRM as providing protection, and the replacement of bridges over both Dillenbaugh and Salzer Creek. This option would

require changes to the FIRM through a public process as portions of the community should expect to see higher BFEs. It may also require a change to the floodway depending on the impacts. All impacted property owners would need to be notified and given a chance to comment on the project as it may increase not only their risk of flooding but also their premiums for flood insurance. It might become necessary to provide them some sort of protection from this increased risk.

Aberdeen/Hoquiam North Shore Levee: This element consists of approximately 5.8 miles of levee improvements and is designed for the current conditions 100-year flood event, but may also accommodate some future sea level rise. The improved levee will provide additional flood protection for the cities of Hoquiam and Aberdeen from both riverine and coastal flooding. The project would also result in upstream increases in flood elevation. The extent of which is currently unknown.

- NFIP Impacts: Because of the desire to ensure that significant portions of Aberdeen and Hoquiam are removed from the SFHA the project should be closely coordinated with FEMA through the CLOMR process. This will ensure that any changes needed to the preliminary design are included to allow the levee to be accredited by FEMA once the project is built. In addition, owners of properties that will see an increase in their predicted BFEs will need to be notified of the impacts and have a chance to comment on the changes. Once the new FIRM becomes effective with an increase in flood elevations any projects within those areas would need to meet the new elevation requirements, and current holders of flood insurance policies may face increased premiums in the future due to the increased risk. These impacts should be acknowledged and mitigation provided when necessary.

Restorative Flood Protection: The intent of the project is to rebuild the natural flood storage capacity of the Chehalis Basin by reversing landscape changes that contribute to downstream flooding through a series of individual actions. It would increase instream flood storage, reconnect channels to floodplain storage, and increase storage in the floodplain. The actions would be upstream of the confluence of the Chehalis River with the Newaukum River in order to reduce flood peaks downstream of the confluence.

- NFIP Impacts: When fully implemented the project may result in changes to the FIRMS as shown in Table 4.3-1 of the Draft PEIS. The communities could choose to regulate to the predicted map prior to full implementation of the projects to ensure that any structure built in the future would be relatively safe. Because the project is anticipated to be completed with the cooperation of willing land owners it is anticipated to take many years to fully implement. Therefore, any changes to the FIRMs due to the project should be caught in the normal FEMA mapping update process. While it might be possible to obtain a CLOMR for the project, the actual changes to the flood risk will not occur for many years and by that time climate change may be impacting the actual risk also. It is not recommended to pursue a CLOMR for this project.

Local-Scale Flood Damage Reduction Actions

Floodproofing: This action includes the elevation or demolition of structures, construction of individual floodwalls, or other floodproofing measures as appropriate. This element also includes the construction of critter pads and the elevation of evacuation routes. This action would be implemented with willing property owners and is expected to be a long-term project pursued as there is funding and interest.

- NFIP Impacts: When fill is placed in the SFHA, but outside of the floodway, no analysis of the impacts is necessary and only a local permit is required. If fill is placed in a floodway, say for elevating an existing road, an analysis of the impacts is required and a CLOMR should be pursued prior to final design to ensure FEMA agrees with the analysis and the resulting map change is agreeable. Local agencies would be required to permit each elevation or floodproofing project to ensure structures are properly elevated or protection is provided to the proper level. Once a structure is elevated, or if a commercial structure is floodproofed, the building owners should see a significant reduction in the flood insurance premiums and less damage in the future.

Local Projects: These are a series of local projects designed to protect critical infrastructure, frequently damaged properties and priority areas. These projects may also include actions to restore floodplain function.

- NFIP Impacts: Each project will be required to analyze its impact on the BFE should there be any fill placed with the floodway or in the SFHA where there is no floodway. In such cases a CLOMR should be pursued to ensure that if the project causes any change to the BFE or SHFA it is properly analyzed, and if mitigation is not possible then the impacts are known before the project is constructed. If a levee that is not currently accredited becomes accredited the impact on neighboring properties, not protected by the levee, must be analyzed and any impacts on them will need to be shown on a revised FIRM, the owners must be notified of the change and given an opportunity to comment. A CLOMR should be applied for early in the process to ensure that FEMA agrees with the analysis of the impacts, the proposed changes to the maps and that impacted properties are all properly notified of the potential change to the maps.

Land Use Management: This element involves local governments revising their land use regulations and practices to better protect remaining floodplain functions and prevent future flood damages by minimizing floodplain development.

- NFIP Impacts: This regulatory approach to minimize new development and require new development to build more safely is encouraged by the NFIP and could receive significant credit under FEMAs Community Rating System (CRS) for each participating community.

Flood Warning Improvements: This element would improve and expand the existing flood warning system to expand the system and improve the timeliness and validity of the forecasts.

- NFIP Impacts: The improvements should result in a higher score when the program is rated under FEMAs CRS program and more credit for participating communities.

Aquatic Species Habitat Actions

This Action consists of seven elements all designed to increase the habitat available to aquatic species within the basin. These are:

1. Restoration of riparian habitat,
2. Removal of fish passage barriers,
3. Restoration of off-channel habitat,
4. Add wood to streams for habitat,
5. Restore bank erosion to naturally occurring rates,
6. Reconnect the floodplain, and
7. Create, restore and enhance wetlands.

- NFIP Impacts: Each individual project will need to be reviewed and its impacts determined. In general the removal of fish passage barriers may increase downstream flood peaks because the storage upstream of the barrier is eliminated. However, this impact may be mitigated by the enhanced storage capability of wetlands, the channel due to increased woody debris and floodplains due to the increased roughness caused by improved habitat. While the planting of trees and shrubs does not require a permit, any fill or excavation within the SFHA associated with a restoration project would need to be permitted by the local agency and the impacts reviewed. If the fill is outside of the floodway, no analysis is required by the NFIP, only the local permit. All projects involving fill, excavation or the placement of large woody debris in the channel should analyze the impacts to determine if a CLOMR recognizing the impacts should be pursued. As FEMA completes future updates the maps, FIRMS, for the basin, the combined impact of these projects may result in some localized increases in the extent of the SFHA and the BFE and decreases downstream of the projects. It is recommended to pursue a CLOMR for all projects involving the removal of a fish passage barrier within the mapped SFHA to ensure FEMA agrees with the impacts. A CLOMR would only be required for other projects when there is an immediate change in the BFE or SFHA upon completion of an individual project.

ATTACHMENT 4

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November 14, 2016

Department of Ecology
Shorelands & Environmental Assessment Program
PO Box 47600
Olympia, WA 98504-7600

Re: Chehalis Basin Strategy Draft Programmatic EIS

To the Washington Department of Ecology:

This letter addresses itself to the Draft PEIS Alternative 1 proposal to construct a flood retention dam and reservoir on the upper Chehalis River, and its relationship with Washington's Public Trust Doctrine. This letter is submitted on behalf of the Quinault Indian Nation, signatory to the Treaty of Olympia (1856), by which it reserved, among other things, the right of "taking fish, at all usual and accustomed fishing grounds and stations," and the privilege of hunting and gathering, among other rights, in exchange for ceding lands and waters it historically possessed.

The construction of a dam and reservoir as proposed in the draft PEIS will destroy public values in the six-plus mile reach of river in the upper Chehalis River, including fisheries habitat, navigation, recreational, and environmental uses. The dam and reservoir will also cause harm to public resources downstream of the dam, through the full extent of the river, to Grays Harbor and the Pacific coast. The dam and reservoir will also generate greenhouse gas emissions that contribute to climate change, and therefore contribute to damage to public resources within the Quinault Indian Nation's ceded territories. These adverse and substantial impacts to public resources are prohibited by Washington's Public Trust Doctrine.

There are 1,189 dams in Washington, none of which has ever been analyzed for impact on public trust resources.[1] It is time for that approach to change, and for the State of Washington through its resource agencies, to exert Public Trust authority over its rivers, including the upper Chehalis River.

I. Chehalis Basin Strategy Flood Retention Proposal and Its Impacts

A. The dam/reservoir proposals

One of two configurations of a dam/reservoir project is proposed to be built on the upper Chehalis River. DPEIS, Section 2.3.3.1, p. 26 *et seq*. The Flood Retention Only (FRO) dam would create a 5.3 to 6.2 mile reservoir that would retain water only during floods (averaging once every 7 years), then release it over a 32-day period. The FRO would otherwise operate as a flow-through facility. The alternative proposal, the Flood Retention and Flow Augmentation (FRFA) dam, would create a

[1] Washington Dept. of Ecology, Washington State Inventory of Dams, Publ. No. 94-16 (rev. Nov. 2015, current as of 10-6-16), at https://fortress.wa.gov/ecy/publications/documents/94016.pdf.

permanent 6.3 to 7.6 mile reservoir, and inundate up to 1,264 acres. The FRFA reservoir would retain both floodwaters and a 65,000 acre-foot "conservation pool" that would be released during the months of June through September to maintain higher flows in the mainstem of the Chehalis River. The reservoir pool would fluctuate with inflow and outflow.[2]

B. On-site impacts of the dam/reservoir proposals.

The dam and reservoir would effectively destroy the public values of 6-plus miles of the inundated upper Chehalis River. The following impacts were identified in the draft PEIS.

Water Quality. The reservoir would not meet water quality standards for dissolved oxygen, temperature and core salmonid habitat some or all of the time. DPEIS Section 4.2, p. 255. The DPEIS acknowledges that it is unknown whether a dam could be authorized per the Clean Water Act Section 401, in that it would completely eliminate a designated use, i.e., salmon spawning, under state water quality standards. DPEIS Section 4.2.1.3.1.

Wetlands. Inundation would cause loss of up to 68 or 89 acres of wetlands. DPEIS Section 4.2.3, p. 274.

Fish & Wildlife. The FRFA dam/reservoir will have significant adverse impacts on fisheries. Salmon spawning and rearing habitat will be lost and destroyed in the reservoir area, and the dams will create passage problems. Loss of vegetation on the shoreline adjacent to the reservoirs would reduce or eliminate shading and nutrient inputs. Water quality will be degraded, including temperature stratification and exceedances of water quality standards, affecting foraging, rearing and predation. The settling of fine sediments would clog spawning beds. DPEIS, Section 4.2.4.2.1, pp. 281-96. The FRFA facility would cause substantial loss (31%) of downstream migrating juvenile salmon, and almost complete loss of downstream migrating juvenile lamprey. DPEIS, pp. 285-86 and Table 4.2-5. Construction of the damsite would disrupt salmon spawning for 2-3 years, causing generational impacts to returning salmon that would last for multiple years thereafter. DPEIS, p. 306.

Tribal Resources. The treaty rights of the Quinault Indian Nation extend throughout the Chehalis River Basin, and include property interests in treaty fish and shellfish, along with rights of access to fishing grounds. The Quinault Nation is, historically and presently, dependent on salmon as a food, economic and cultural resource.[3] DPEIS, Section 4.2.5.

Recreation. The reach of the Chehalis River proposed for inundation provides Class III-IV whitewater opportunities for recreational boaters. Both dam configurations would prohibit recreational use of the reservoir. Recreational-navigational use of the river would be destroyed. DPEIS, Section 4.2.11, pp. 322-23.

Impacts from Climate Change. The DPEIS recognizes that climate change will alter stream hydrology in the future, and notes that it may exacerbate the impacts to fish and wildlife and other tribal resources described above. DPEIS, Section 3.7 and p. H-50.

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[2] See DPEIS, Table 4.2.1 at p. 260 for summary of water quantity impacts.

[3] Letter, Quinault Indian Nation to Maia Bellon, Director, Washington Dept. of Ecology (5-13-16) (hereafter "QIN Letter"); see also Washington Dept. of Fish & Wildlife, Upper Chehalis Instream Fish Study 2015 (2016).

C. Downstream impacts of the dam/reservoir proposal.

Fisheries. Salmon, steelhead and lamprey are migratory species and move throughout the Chehalis River watershed for spawning and rearing. Damage to the species in the headwaters of the upper Chehalis will, perforce, cause damage to the species and reduce their harvestable numbers throughout the riverine system, including in the tributaries and Grays Harbor estuary.[4]

Overall, as reported in the Ruckelshaus Center's 2014 Report for the Chehalis Basin Strategy, spring and fall chinook, coho and steelhead runs have already been reduced from 78, 45, 69 and 44%, respectively. Causes of reductions are due to physical processes within the watershed, several of which will be exacerbated by the dam/reservoir project.[5]

Large Woody Debris and Flood Flows. Large woody debris (LWD) and mature riparian structure are important elements of salmon habitat and are identified as limiting factors for ESA salmon recovery in the basin. Flood flows provide energy to define channels, move LWD, move bedload, create avulsion and erosion and other maintain riverine processes that are important for salmon life stages. Large wood moving from the Chehalis River headwaters is also important to maintain a productive marine environment in Grays Harbor and along the coast. The proposed dam/reservoir project will interfere with these natural processes of wood recruitment.[6]

Geology & Geomorphology. There are potential unmitigable adverse impacts related to landslides within the reservoir and LWD and gravel deprivation downstream of the dam. DPEIS Section 4.2.2, p. 273. Maintenance of mud and sand flats is dependent upon sediment deposition in the Grays Harbor estuary. The dam and reservoir project will contribute to loss of these habitats due to reduced downstream transport of sediment into the estuary.[7] Sediment loss could affect beach sand recruitment and habitat for razor clams on the Pacific Coast outside of Grays Harbor.[8] The dam is expected to cause changes to habitat forming processes from damsite to Elk Creek, causing losses of salmon spawning habitat and affecting production of salmon and steelhead throughout the basin. DPEIS, p. 291 and Tables 4.2-8 and 4.2-9a, b, c.

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[4] QIN Letter, pp. 4-5.

[5] QIN Letter, citing Ruckelhaus Center, Chehalis Basin Strategy, Governor's Chehalis Basin Work Group, 2014 Recommendations Report (Nov. 25, 2014) and Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species, Aquatic Species Enhancement Plan (Aug. 29, 2014).

[6] QIN Letter, pp. 5-6.

[7] Wild Fish Conservancy, Climate Change/Sea Level Rise in Chehalis Basin & Grays Harbor at pp. 36-37 (2012), http://wildfishconservancy.org/projects/grays-harbor-juvenile-salmon-fish-community-study/WFC.ClimateChangeintheChehalisRiverandGraysHarborEstuary2012final.pdf.

[8] QIN Letter, p. 10.

II. Climate Change Impacts Caused by the Flood Retention Dam/Reservoir Proposal.

A. New Study Reports GHG Emissions from Reservoirs.

The DPEIS identifies the contribution to greenhouse gasses (GHGs) of the dam and reservoir as (1) short term construction impacts, and (2) loss of carbon-sequestering vegetation within the reservoir footprint. The FRO proposal would result in emission of 49,731 metric tons (MT) of carbon dioxide or equivalents (CO_2e). The FRFA would result in emission of 107,569 MT of CO_2e. The analysis concludes that "adverse impacts contributing to climate change are not anticipated from operation and maintenance of the Flood Retention Facility, as these activities would generate relatively few greenhouse gas emissions." DPEIS, p. H-50. Elsewhere, the document asserts that contribution to GHG emissions are too small to be significant. DPEIS, Section 4.2.7.

These conclusions are likely incorrect. In an October 2016 study published in BioScience, researchers found significantly higher GHG emissions from reservoirs than have been estimated in previous reports.[9] Methane in particular is a greenhouse gas present in many reservoirs. Methane is 34 times more potent than carbon dioxide (over a 100-year time scale), and is responsible for about 25% of the human-caused global warming that is occurring today.[10] Importantly for this project, contrary to the earlier belief that GHG emissions are only significant for reservoirs in tropical climates, "midlatitude reservoirs can emit as much CH_4 [methane] as tropical systems."[11] The study found that GHG emission quantities are tied to primary productivity and nutrient loading and eutrophication within a reservoir; overall, GHG emissions estimates were 25% higher than previously reported.

The BioScience study reported that pathways and mechanisms for methane emissions from reservoirs include decomposing organic materials within the reservoir, periodic inundation of reservoir shorelines, outlet structures and water discharges, and downstream flux. All of these mechanisms would be present in the proposed dam/reservoir. The DPEIS does not calculate or project any GHG/methane emissions for the dam/reservoir proposals. New methods must be developed to accurately assess how a dam and reservoir in the upper Chehalis River will contribute to GHGs.

B. GHG Emissions from the Flood Retention Dam/Reservoir Will Harm Public Trust Resources.

Climate change is having and will continue to have a major impact on the Chehalis River, Grays Harbor, and associated coastal resources.[12] As described below, the impacts of climate change on freshwater

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[9] Deemer, B.R., et al, "Greenhouse Gas Emissions from Reservoir Water Surfaces: A New Global Synthesis," (BioScience, Advanced access edition 10/5/16); Deemer, B.R., et al., Supplementary Information for "Greenhouse Gas Emissions from Reservoir Water Surfaces" at http://bioscience.oxfordjournals.org/content/early/2016/10/02/biosci.biw117.

[10] Ibid.; see also Environmental Defense Fund, "Methane: the other important greenhouse gas" at https://www.edf.org/methane-other-important-greenhouse-gas.

[11] Deemer, supra at p.4.

[12] Sandell, Todd, et al., Climate Change in the Chehalis River and Grays Harbor Estuary (WFC 2013) at http://wildfishconservancy.org/projects/grays-harbor-juvenile-salmon-fish-community-study/WFC.ClimateChangeintheChehalisRiverandGraysHarborEstuary2012final.pdf and "Workshop offers look at

and coastal resources include increases in sea level rise, saltwater intrusion into freshwater resources (surface and ground), extreme weather events and coastal flooding and erosion, and ocean acidification.[13] In addition, changes in precipitation amounts and timing, and loss of glaciers is affecting and will continue to affect the Chehalis and other rivers that flow into and nourish Grays Harbor and its fish and wildlife habitat.

PDEIS Discussion. The draft PEIS identifies multiple climate impacts to the environment of the Chehalis River basin and its environmental resources, ranging from changes in stream flow and temperature to sea level rise and inundation of coastal marshes and low elevation mud and sand flats. DPEIS, Section 3.7, pp. 178-81. What the DPEIS does not do is connect the climate impacts of the dam/reservoir proposals with the climate change that is already evident and projected to intensify.

Sea Level Rise. Sea level rise on the Washington coast is expected to increase by 10 to 143 centimeters by 2100.[14] In a new study of the effects of sea level rise on tidal marshes in eleven estuaries in the Pacific Northwest, including Grays Harbor, the U.S. Geological Survey cited Grays Harbor as one of the more resilient tidal estuaries, but even so, concluded that it will convert to high marsh, dramatically converting and limiting diverse estuarine habitat, by 2110.[15] The Department of Ecology is directing shoreline planners to prepare for sea level rise in development of shoreline master programs.[16]

Saltwater Intrusion. "Changes in climate and sea level will drive changes to the coastal groundwater system that will impact both human populations and coastal ecosystems. Increases in sea-level will raise the fresh water table in many coastal regions . . . Impacts to humans may include an increase in the potential for basement or septic system failure. Sea-level rise can also contaminate groundwater supplies due to landward and upward movement of sea-water in coastal aquifers,"[17] thus causing saltwater intrusion.

Grays Harbor of the future" (Daily World, 4-10-14) at http://thedailyworld.com/news/local/workshop-offers-look-grays-harbor-future.

[13] Sandell, supra; Huppert, D., et al., Impacts of Climate Change on the Coasts of Washington State, Ch. 8 in the Washington Climate Change Impacts and Adaptation Report (CSES 2009) at http://cses.washington.edu/db/pdf/wacciach8coasts651.pdf; WA Dept. of Ecology, Oceans and Coastlines, Ch. 6 (2012) at https://fortress.wa.gov/ecy/publications/publications/1201004h.pdf

[14] Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future, Report in Brief (NAS 2012) at http://www.ecy.wa.gov/climatechange/docs/ipa_slr_nrcbrief.pdf and Full Report at http://dels.nas.edu/Report/Level-Rise-Coasts/13389?bname=besr.

[15] USGS, Thorne, K. and B. Dugger, Marshes to Mudflats: Climate Change Effects along a Latitudinal Gradient in the Pacific Northwest (2015) at https://nccwsc.usgs.gov/display-project/4f8c64d2e4b0546c0c397b46/5006e99ee4b0abf7ce733f58.

[16] Dept. of Ecology, Shoreline Master Plan Handbook, Appendix A, "Addressing Sea Level Rise in Shoreline Master Programs," (7-1-10) at http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/appendixA.pdf.

[17] U.S. Geologic Survey, Sea-level rise hazards and decision support: Coastal Groundwater Systems, at http://wh.er.usgs.gov/slr/coastalgroundwater.html; see also Dept. of Ecology, Rising Sea Level, at http://www.ecy.wa.gov/climatechange/risingsealevel_more.htm.

Extreme Weather, Coastal Flooding, and Erosion. Grays Harbor County is Washington's second most vulnerable to coastal flooding, and ranks first for the number of homes at risk due to enhanced coastal flooding.[18] There have been several severe storms of note in the Grays Harbor area in the past few years, including the January 5, 2015 rainstorm that dropped 7 inches of precipitation on Hoquiam in 24 hours, flooding urban areas and causing massive mudslides.[19] Nonetheless, scientists do not have sufficient trend data to say that extreme weather events on the Pacific Northwest coast are increasing in frequency, and are attributable to climate change.[20] What is known is that a combination of very high ("king") tides, storm surges, and heavy precipitation can cause substantial flood and slide damage. Sea level rise will magnify the effects of storm surges and high tides on coastal environments.[21] Inland marshes and wetlands, such as those found in Grays Harbor can ameliorate coastal flooding impacts, but sea level rise is predicted to eliminate this resilience. Erosion has been a longstanding problem at the South Jetty/Half Moon Bay area near Westport and the entrance to Grays Harbor.[22]

Ocean Acidification. Ocean acidification or OA is a long-term progressive change in ocean water chemistry due to the uptake of CO_2 from the atmosphere. It is changing seawater carbonate chemistry, with substantial negative biological impacts on coastal marine organisms. Coastal areas with large freshwater inputs, such as Grays Harbor, are particularly vulnerable to these changes. Shellfish in particular are at risk of exceeding tolerances for ocean pH.[23]

Precipitation Changes and Glacial Loss. One well-known harbinger of climate change is the change in precipitation that will occur as a result of a warming atmosphere. Scientists project that the amount of precipitation falling will not change much for Washington's coast range, but that it will fall as rain, rather than snow. This will radically change the timing of run-off of rivers and their suitability as habitat for

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[18] Climate Central, Sea level rise and coastal flood exposure: Summary for Grays Harbor County, WA (2014) at http://ssrf.climatecentral.org.s3-website-us-east-1.amazonaws.com/Buffer2/states/WA/downloads/pdf_reports/County/WA_Grays_Harbor_County-report.pdf.

[19] The Daily World, "Flooding, Landslides Hit the Harbor" (1-5-15) at http://thedailyworld.com/news/local/flooding-landslides-hit-harbors; The News Tribune, "Rain Event Hits Grays Harbor County" (n.d.) at http://www.thenewstribune.com/news/local/article25852570.html.

[20] Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future, Report in Brief (NRC 2012) at http://www.ecy.wa.gov/climatechange/docs/ipa_slr_nrcbrief.pdf

[21] Dalrymple, Robert A., Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future, Powerpoint Presentation (NRC 6-20-12) at http://www.ecy.wa.gov/climatechange/docs/ipa_slr_nrcpresentation.pdf.

[22] WA Dept. of Ecology, Westport South Jetty shoreline changes, webpage at http://www.ecy.wa.gov/programs/sea/coast/erosion/westport.html.

[23] NANOOS, et al, Ocean Acidification in the Pacific Northwest (May 2014); Washington State Blue Ribbon Panel on Ocean Acidification, "From Knowledge to Action," (Nov. 2012); see also extensive materials set forth at Wash. Dept of Ecology website on "Ocean Acidification and Washington State" at http://www.ecy.wa.gov/water/marine/oceanacidification.html.

salmon and other aquatic species.[24] Similarly, the loss of glacial mass in Olympic National Park is a striking indicator of how global change is causing very local impacts.[25]

C. Greenhouse gas emissions are a direct cause of climate change and its consequent harm to the Chehalis River Watershed.

Climate change is a direct consequence of atmospheric warming caused by greenhouse gas emissions, particularly carbon dioxide, methane, and nitrous oxide. GHG emissions remain largely uncontrolled in the United States, with atmospheric concentrations of all three GHGs still on the rise.[26] Climate scientists urge that radical reductions in GHG emissions are needed, perhaps even near-zero emissions, in order to stabilize the planet's climate. Washington explicitly recognizes the need to control GHG emissions and has set targets for future reductions.[27]

Atmospheric warming (caused by GHGs) is, in turn, the major cause of the melting polar ice cap, as well as the glacial melt experienced locally in Washington State and on the Olympic Peninsula.[28] Melting glaciers and ice sheets are and will continue as the major contributors to sea level rise, followed by increases in ocean mass as water temperatures increase.[29]

Emission of GHGs as part of the construction and operation of the flood retention dam/reservoir project is a matter of consequence and importance to the public. Ecology must re-calculate total project emissions to account for GHG contributions of the dam and reservoir over time. Ecology must also recognize that it is the very nature of the climate crisis, that is it incremental and cumulative, that makes it difficult and yet absolutely essential to eliminate and control all sources, and to avoid further contribution to the problem of GHG concentrations.

These consequences are not hypothetical. Climate change is changing freshwater, coastal, and estuarine environments. The science is clear that climate change is causing and will continue to cause harm to the Chehalis River watershed, along with Grays Harbor and the Pacific coastline in southwest

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[24] Mote, P.A., et al., National Climate Assessment, Pacific Northwest Region (2014), at http://nca2014.globalchange.gov/report/regions/northwest.

[25] See National Park Service, Glaciers & Climate Change, Olympic National Park, http://www.nps.gov/olym/learn/nature/glaciers.htm.

[26] US Environmental Protection Agency, Climate Change Indicators: Overview of Greenhouse Gas Emissions, at https://www.epa.gov/climate-indicators/climate-change-indicators-atmospheric-concentrations-greenhouse-gases.

[27] RCW Ch. 70.235, WAC Chs. 173-441, -442.

[28] Vinas, M. and C. Rasmussen, Warming Seas and Melting Ice Sheets (NASA, 8-26-15) at http://climate.nasa.gov/news/2328/. A 2009 inventory of Olympic National Park glaciers found a reduction in the number of glaciers from 266 to 184 during the period 1982 to 2009, a 34% loss in glacial surface area from the period 1970 to 2009, and a decrease in ice volume of at least 15% between 1987 and 2009. See National Park Service, Glaciers & Climate Change, Olympic National Park, http://www.nps.gov/olym/learn/nature/glaciers.htm.

[29] Vinas & Rasmussen, supra; Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future, Report in Brief (NRC 2012) at http://www.ecy.wa.gov/climatechange/docs/ipa_slr_nrcbrief.pdf.

Washington. These places are public trust resources of Washington State and, as discussed below, the state has a duty to invoke the Public Trust Doctrine to protect them from long-term harm.

III. Navigability

The application of the public trust doctrine to the upper Chehalis River requires a determination of the river's navigability under federal law. Navigability of the upper Chehalis River has not been determined by state or federal court.[30] The Washington Department of Natural Resources (DNR) apparently has made an informal determination that the river is not navigable upstream of Pe Ell,[31] but that decision has been neither publicly vetted nor reviewed by courts.

Under the federal test for navigability, courts look to the condition of the river at the time of statehood. The test is whether the river, under its ordinary condition, was used, or was susceptible of being used, for commercial purposes.[32] Factors include the depth, breadth, and length of the river (or segment thereof), and the speed of current. Rivers are navigable "when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water."[33] Short or temporary periods of use based on high water would not support navigability, but the use (or potential for use) does not have to be year-round or continuous to demonstrate navigability.[34] Washington DNR rules track the federal test, stating that a body of water is navigable if it is "capable or susceptible of having been or is being used for the transport of useful commerce." WAC 332-30-106(41).

Very recently, an Oregon court found the Rogue River to be navigable under the federal test, based on its susceptibility of use for commercial purposes at the time of statehood.[35] That case is relevant to the question of navigability of the upper Chehalis River.

Several factors weigh in favor of a determination of federal navigability of the upper Chehalis River. While evidence of usage in 1889 may be hard to come by, as in the Rogue River case, it is not necessary under the federal test to show actual usage. The question is whether it was possible to use the river for commerce at the time of statehood. Evidence informing that question may include physical characteristics and evidence of modern-day use that is comparable to usage that would have supported trade and travel 130 years ago.

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[30] Navigability is "unknown" per WDNR Navigable Waters Map (WDNR Aquatic Resources, Dec. 2004). See also WDNR, Boundaries of State-Owned Aquatic Lands, Brochure (n.d.).

[31] Personal communication with Mike Rechner, Washington DNR Aquatic Lands Program (10-13-16).

[32] *PPL Montana, LLC v. Montana*, 132 S.Ct. 1215 (2012); *Hardy v. State Land Board*, 360 P.3d 647 (2015), cert. denied, __ S.Ct. __ (10-31-16).

[33] *The Daniel Ball*, 77 U.S. 557 (1870).

[34] See for example, *The Daniel Ball, supra; Stewart v. U.S. ex rel. Department of Agriculture*, 639 F.Supp.2d 1190, 1195 (2009); *United States v. Utah*, 283 U.S. 64, 87 (1931).

[35] *Hardy, supra.*

For this latter inquiry, the Oregon court relied on evidence of post-statehood log drives and recreational boating and fishing to show the capability of the Rogue River to support trade and travel in 1859 (the year of Oregon statehood).[36] Present-day recreational use is relevant if the craft used today are meaningfully similar to that used for trade and travel at statehood, and if the river's condition now is not meaningfully different than that at statehood. Present-day recreational watercraft (e.g., rafts, kayaks, driftboats) are meaningfully similar to historic watercraft that would be used in trade and travel (e.g., dugout canoes). Historic conditions are determined using stream gage data and other information.[37]

The DPEIS shows that median flows for the upper Chehalis River range from 20 to 700 cfs, with the river at or above 100 cfs for 8 months out of the year. DPEIS, App. K, Table 1 at p.2. American Whitewater reports an average gradient of 42 feet per mile.[38] As acknowledged in the DPEIS, the upper Chehalis River is used by recreational boaters. DPEIS Section 4.2.1.1. American Whitewater, a national river recreation advocacy group, describes the upper Chehalis as an "outstanding class III whitewater run, one of the longer stretches of continuous whitewater in the state . . ."[39] Rafts, kayaks and canoes can navigate the upper Chehalis River throughout the year.

It is plausible that the upper Chehalis River was navigable at statehood according to the federal test for navigability.

The question of navigability of the upper Chehalis River is important, but has not received formal consideration by agency or court. In assessing the viability of the DPEIS dam/reservoir proposal, decision agencies must not simply assume non-navigability based on private ownership of adjacent lands, but affirmatively assess and determine whether the upper Chehalis is navigable under federal law.

In the discussion below, we assume the upper Chehalis River to be navigable and therefore subject to Washington's public trust protections.

IV. The Public Trust Doctrine Prohibits Alienation or Impairment of the Upper Chehalis River as a Trust Resource.

Inundation of the upper Chehalis River will cause impairment of public uses of a navigable river traditionally protected by the Public Trust Doctrine, including navigation, fish and wildlife, recreation, and environmental uses.

A. Background of the Public Trust Doctrine.

The Public Trust Doctrine is an ancient law that protects public interests in navigation, commerce and fisheries relating to shorelines and navigable water bodies. It is used regularly, including by Washington

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[36] *Id.* at 658-61; see also *Puget Sound Power & Light v. FERC*, 644 F.2d 785 (9th Cir. 1981) (Washington's White River is navigable under the federal test, based on evidence of shingle bolt drives); *Monroe Mill Co. v. Menzel*, 35 Wash. 487 (1904) (Washington's Elochoman Creek is navigable based on evidence of shingle bolt drives).

[37] *Hardy* at 661-63, citing *PPL Montana*, 132 S.Ct. at 1233.

[38] https://www.americanwhitewater.org/content/River/detail/id/2081/.

[39] https://www.americanwhitewater.org/content/Article/view/articleid/30452/display/full/.

courts, to protect modern public values in these resources, including recreation and environmental quality.

The Public Trust Doctrine has existed in Washington since statehood in 1889. In 1987, the Washington Supreme Court explicitly recognized that the Public Trust Doctrine applies to Washington's navigable waters, and has so applied since statehood.[40] The "doctrine reserves a public property interest, the jus publicum, in tidelands and the waters flowing over them, despite the sale of these lands into private ownership." The state cannot give away or abdicate this public property interest.[41] Further, government may not make use of public trust resources in a way that substantially impairs the public's interest in those resources.[42] As discussed below, the Public Trust Doctrine imposes a duty on state governments and their agencies to protect specific public resources.

In Washington, the Public Trust Doctrine protects multiple public uses of navigable waters. "Historically, the trust developed out of the public's need for access to navigable waters and shorelands, and thus the trust encompassed the right of navigation and fishery. . . . Recognizing modern science's ability to identify the public need, state courts have extended the doctrine beyond . . . navigational and commercial fishing rights to include 'incidental rights of fishing, boating, swimming, water skiing, and other related recreational purposes...'"[43]

The Public Trust Doctrine also functions to protect wildlife and habitat. In Washington, the courts have utilized the Public Trust Doctrine to prevent tidelands development in Padilla Bay in Skagit County, and found that a San Juan County ban on jet skis was consistent with the public trust duty to protect wildlife in the waters of the San Juan Islands.[44]

The Public Trust Doctrine is a flexible legal tool and Washington courts have expanded its scope and application over time to meet evolving public needs.

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[40] *Caminiti v. Boyle*, 107 Wn.2d 662 (1987)

[41] *Esplanade Properties LLC v. City of Seattle*, 307 F.3d 978 (2002).

[42] *Orion Corp.*, 109 Wn.2d 621 (1987); *Esplanade Properties, supra*.

[43] *Orion Corp.* (citations and footnotes omitted).

[44] In other states, wildlife has also been a focus of public trust protections. In a case involving proposed fill of tidelands in the Tomales Bay estuary in northern California, the Court held that "one of the most important public uses of the tidelands—a use encompassed within the tidelands trust—*is the preservation of those lands in their natural state,* so that they may serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life, and which favorably affect the scenery and climate of the area." *Marks v. Whitney*, 491 P.2d 374, 380 (1970). When Virginia sought damages for an oil spill cleanup in Chesapeake Bay, a federal court held that "[u]nder the Public Trust Doctrine, the State of Virginia and the United States have the right and duty to protect and preserve the public's interest in natural wildlife resources. Such right does not derive from ownership of the resources but from a duty owing to the people." *In re Steuart Transportation Co.*, 495 F.Supp. 38 (U.S.D.C. E. VA, 1980). The California courts utilized the public trust to prevent impairment of Mono Lake because of its importance as a stop on the Pacific Flyway for millions of migratory birds. *National Audubon Soc'y v. Superior Court*, 658 P.2d 709 (CA 1983).

Washington's Public Trust Doctrine is "partially encapsulated" in the Washington State Constitution.[45] Article XVII, Section 1, asserts public ownership over all navigable waters of the state, including harbors, rivers and lakes.[46] This public ownership is the source of the public right to utilize navigable waters, including bedlands, tidelands, shorelands, and navigable inland waterways.[47] The Chehalis River, along with Grays Harbor and Washington's outer Pacific coast, are navigable waterways and protected for the public under Washington's Constitution.

B. The Departments of Ecology and Natural Resources Each Possess a Duty to Protect Washington's Public Trust Resources.

a. DNR Duties Under the Public Trust Doctrine.

The Washington Department of Natural Resources (DNR) is the delegated manager of the beds of Washington's navigable rivers, including the upper Chehalis River, which the state owns in fee. RCW 79.105.010. The state and DNR hold and manage the bed of the Chehalis riverbed in trust on behalf of the public. Courts have held, and DNR itself recognizes, that the public trust doctrine applies to the state's ownership and management of all navigable waters in the state.[48] Under DNR rules, "public trust" means that state-owned tidelands, shorelands and all beds of navigable waters are held in trust by the state for all citizens with each citizen having an equal and undivided interest in the land. The department has the responsibility to manage these lands in the best interest of the general public.[49]

b. Department of Ecology Duties Under the Public Trust Doctrine.

The Department of Ecology's enabling statute and the State Environmental Policy Act (SEPA) contain statutory language that embodies and reflects public trust principles. A Washington Court recently held that Ecology's enabling statute, while not establishing a statutory duty, does provide evidence of the State Legislature's view of the people's rights retained under the State Constitution. SEPA policies provide similar evidence of the retained rights of Washington's citizens to have a healthful environment.

Washington courts do not lightly invoke the Public Trust Doctrine, but will do so when threats to public resources are clear. Courts have expressly used the Public Trust Doctrine to reject development permits, or support local legislation, to eliminate threats to Lake Chelan, Padilla Bay, Elliott Bay, the waters surrounding the San Juan Islands, and Eagle Harbor.

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[45] *Rettkowski*, 122 Wn.2d 219 (1993); *Caminiti*, at 669, citing *Wilbour v. Gallagher,* 77 Wn.2d 306, 316 (1969); Utter, Robert F. and H.D. Spitzer, The Washington State Constitution: A Reference Guide, at pp. 212-17 (2002).

[46] WA Const. Art. XVII, Sec. 1. The Public Trust Doctrine derives also from the Equal Footing Doctrine, which vested ownership and sovereign authority over navigable waterways in the state in 1889, when Washington entered the union of the United States. *Orion Corp.*, 109 Wn.2d at 639.

[47] *Wilbour v. Gallagher*; *Caminiti v. Boyle*.

[48] *Caminiti v. Boyle, supra*; *Lake Union Drydock v. State Dept. of Natural Resources*, 143 Wn.App. 644, 658-59 (2008); Johnson, Ralph W., et al., "The Public Trust Doctrine and Coastal Zone Management in Washington State," 67 Wash. L. Rev. 521 (1992).

[49] WAC 332-30-106(55).

While the Washington judiciary has just begun to link the Public Trust Doctrine with the cumulative impacts associated with climate change, the doctrine's qualities of protecting public interests (including intergenerational interests) make it a particularly useful tool where statutory authorities may be limited.

c. When addressing a conflict between public trust uses, Washington courts protect environmental values.

When confronted with conflicts between public trust uses, Washington courts focus on protection of public and environmental values. Here, the proposal to inundate the upper Chehalis River ostensibly presents a public benefit of flood control, although the DPEIS is clear that options exist to address floods other than the dam/reservoir proposal. When confronted with a conflict between multiple public uses, Washington courts choose in favor of protection of larger public interests, particularly protection of wildlife.

In *Weden v. San Juan County*, the Washington Supreme Court found that a local ban on operation of motorized personal watercraft in the waters surrounding the San Juan Islands did not conflict with and was consistent with the Public Trust Doctrine, stating that "it would be an odd use of the Public Trust Doctrine to sanction an activity that actually harms and damages the waters and wildlife of this state."[50] In *Samson v. City of Bainbridge*, the Court of Appeals found that the city's ban on private docks promoted public trust interests in navigation and recreational use of the harbor.[51]

Navigation interests, i.e., boating and private docks, were alleged as uses requiring public trust protection in these cases. The courts found that where there was a conflict, interests in navigation did not eclipse the larger public need for environmental protection.

V. The Public Trust Doctrine Mandates Protection of Chehalis Basin Trust Resources from the Impacts of Climate Change

The CBS flood retention facility must also be rejected because it will contribute greenhouse gas emissions to the atmosphere, exacerbating climate change that is harming and will continue to harm public trust resources. As discussed above, coastal, estuarine and river resources, and dependent fish and wildlife, are and will continue to be harmed by increasing concentrations of atmospheric GHGs. These impacts will exacerbate over the coming decades, with potentially devastating consequences for the environment and future generations of Washingtonians.

Washington's agencies, including Ecology, have a duty to prevent activities that will contribute to GHG emissions and otherwise destroy trust resources.

The Public Trust Doctrine operates as authority to deny the dam/reservoir proposal based on its contribution to GHG emissions that will cause climate change impacts to the Chehalis River watershed and its traditional public trust resources.

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[50] *Weden v. San Juan County*, 135 Wn.2d 678 (1998).

[51] *Samson v. City of Bainbridge*, 149 Wn.App. 33 (2009).

The scope of Washington's public trust application is not fixed and may expand according to public need.[52] Courts are using the Public Trust Doctrine to protect trust resources from the impacts of climate change. As recognized in a recent court decision of the King County (WA) Superior Court, there is no question that greenhouse gas emissions are causing climate change, and climate change is causing adverse impacts to coastal resources such as Grays Harbor.

> [C]urrent science makes clear that global warming is impacting the acidification of the oceans to alarming and dangerous levels, thus endangering the bounty of our navigable waters. . . . The navigable waters and the atmosphere are intertwined and to argue a separation of the two, or to argue that GHG emissions do not affect navigable waters is nonsensical. Therefore, the Public Trust Doctrine mandates that the State act through its designated agency to protect what it holds in trust. The Department of Ecology is the agency authorized both to recommend changes in [] standards and to establish limits that are responsible.[53]

The Pennsylvania Court recently expounded on the natural resources to which the Public Trust applies:

> At present, the concept of public natural resources includes not only state-owned lands, waterways, and mineral reserves, but also resources that implicate the public interest, such as ambient air, surface and ground water, wild flora, and fauna (including fish) that are outside the scope of purely private property.[54]

In Oregon, a federal court has very recently held that the Public Trust Doctrine provides a basis for suit against federal agencies for failure to control and limit greenhouse gas emissions and contributing actions, policies and activities. Enforcement of the Public Trust by agencies is appropriate and necessary to protect inalienable rights of life and liberty, i.e., a healthful planet, for present and future beneficiaries.[55]

As in *Foster*, the Department of Ecology is the agency authorized to implement SEPA and other statutes that are designed to protect public trust resources. Along with its statutory authorities, the Public Trust Doctrine provides Ecology with the basis to address the cumulative, long-term scope of damage caused by GHG-emitting reservoirs.

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[52] *Orion Corp., supra; Weden, supra.*

[53] *Foster v. State of Washington*, King Cty. Sup'r. Ct. Dckt. No. 14-2-25295-1, Slip Op. at p. 8 (11-19-16); see also, Wood, Mary C. and Charles W. Woodward, "Atmospheric Trust Litigation and the Constitutional Right to a Healthy Climate System: Judicial Recognition at Last," Wash. J. of Env'tal L. & Pol., Vol. 6, p. 633 (2016).

[54] *Robinson Township v. Pennsylvania*, 83 A.3d 901, 955 (2013).

[55] *Juliana v. United States*, Dckt. No. 6:15-cv-01517-TC, Opinion and Order (U.S.D.C. OR, 11-20-16).

VI. Conclusion

The Department of Ecology is duty-bound to reject the proposal to build a dam and reservoir on the upper Chehalis River, because the project will impair public trust resources, in three ways. First, it will eliminate the public's ability to utilize the inundated portion of the River. Second, it will cause damage to downstream public resources. Third, it will emit an as-yet unknown quantity of GHGs that will exacerbate damage to all resources held in trust by the state for the public.

The Public Trust Doctrine provides the flexibility to not just consider, but also to substantively address the full scope of the issues and concerns associated with this project, including:

- The totality of GHG emissions in Washington that are affecting the Chehalis River watershed and its resources.
- The multiplicity of present and reasonably foreseeable proposed projects that would contribute to GHG emissions, cause climate change, and ultimate harm the Chehalis River watershed.
- The duty as co-tenant and joint manager with the Quinault Indian Nation to not waste shared public trust resources, i.e., Chehalis River and Grays Harbor fisheries.
- The intergenerational impacts to trust resources that will have devastating effects on future Washington citizens if not halted.
- The specific impact of climate change on resources that are traditionally protected by the Public Trust Doctrine, including navigation, commerce and especially fisheries and wildlife resources.
- The specific impact of climate change on corollary resources that have not been traditionally called out by the Washington courts, when applying the Public Trust Doctrine, but which out of public necessity require protection. These include coastal stability, glacial stability, marine water quality, freshwater quality, and others.

The scope of the State's public trust authority and duties clearly extend to the affected waters and associated resources of the Chehalis River watershed, including Grays Harbor and the southwestern Washington coast. In addition to statutory authorities, Washington's Public Trust Doctrine protects navigable waterways, as well as the fisheries, wildlife and water quality within those waterways.

Sincerely,

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ATTACHMENT 5

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Flow Augmentation and Water Rights

I. Introduction

Throughout the PEIS and its appendices, the augmentation of flows is identified as a benefit to the Chehalis River, supporting the development of a flood retention reservoir. Flow augmentation is also identified as mitigation for impacts of the flood retention facility. These assertions of benefit and mitigation are not adequately defined or supported. Other than in the immediate reach downstream of the FRFA dam, the PEIS does not quantify the extent to which release of water will increase flows in the mainstem or contribute to fisheries health and recovery in the Chehalis River basin. What science is presented in the PEIS does not support an assertion that fish benefits will result, as studies show that augmented flows will not lead to an increase in the number of chinook migrating in the river, and with the exception of a short reach of the river directly below the dam, will not lower water temperatures to the state standards required for migrating, spawning and rearing salmon habitat.

The Draft PEIS is also inadequate for its failure to consider the impacts of the water storage proposal on existing water rights and, conversely, the impacts of existing rights on the proposal to store water and augment instream flows. Potential impacts could include:

(1) Impairment of existing senior rights,
(2) Impairment of existing groundwater rights, and
(3) Difficulty in protecting augmented instream flows from impairment by existing and future rights.

Impairment of water rights is a significant impact of the proposed action, and must be considered as part of the PEIS.[1] As discussed below, the dam and reservoir proposals would require issuance of water right permits by the Department of Ecology. New water rights may not be issued if they would result in impairment of an existing water right. RCW 90.03.290(3). A decision to go forward with one of the flood retention proposals, resulting in impairment, would then require mitigation to offset the impairment. These impacts and mitigation requirements must be identified in the PEIS.

In addition, because of impacts from existing and future water rights, more water would be required for effective flow augmentation than that projected in the PEIS. Underestimating the amount of water needed for FRFA conservation storage is a significant deficiency in the PEIS.

[1] Appendix I, p. I-4 recognizes that impacts on current allocations of water rights that extend beyond the immediate footprint of the flood retention facility would be significant. Appendix I also states that "largescale disruption of groundwater flow regime" would be a significant impact. This is incorrect. Any impacts that prevent an existing water right holder from accessing their rights would be significant.

II. Augmentation flows will not benefit migrating salmon.

1. The PEIS does not provide adequate description of the augmentation flows.

The PEIS description of the FRFA alternative is vague and inadequate. PEIS, Section 2.3.3.1. Elsewhere in the EIS, we learn that the proposed augmentation flows range from 95 to either 80 or 160 cfs between June and September, and that these flows are intended to improve habitat for chinook salmon (although analysis indicates it will not do so, see Section IV(c) below). PEIS, App. H, Fig. H-3 and App. K, Table 1. For example, the PEIS does not disclose:

- The quantity of water that will flow in the middle and lower reaches of the Chehalis River as a result of augmentation flows. For example, are there losing reaches of the Chehalis River and how will they impact augmentation flows?
- The variability of augmentation flows and how they are affected by differing temperature regimes and climate change.
- The relationship of augmentation flows with the instream flows set by rule.
- The relationship of augmentation flows to fisheries recovery goals.

2. PEIS analysis indicates that flow augmentation will <u>not</u> benefit fisheries.

The PEIS analyzes the effects of flow augmentation and water temperature reductions, ostensibly resulting from flow releases, on spring-run chinook. PEIS, App. K. The analysis concludes that chinook rearing habitat improves with decreases in water temperatures. PEIS, App. K, Fig. 3. What the analysis shows in graphs, but does not discuss, is that modeled temperatures associated with augmented flows will decrease to a level that is tolerable for chinook salmon for only (approximately) three miles below the dam, at which point temperatures climb sharply to levels that the report itself identifies as a "migration block." Granted, there is a modeled reduction from current flows, but it is too small to be of benefit. Instead of providing straightforward analysis, the PEIS several times states that temperatures will decrease for 30-plus miles downstream, erroneously implying that the temperatures will be sufficiently cool for fish. This is not what the modeled results show. The analysis also acknowledges that it is unknown how chinook would behaviorally adapt to changes in flow.

In other words, what analysis is provided in the PEIS indicates that flow augmentation will do little to improve conditions for chinook, that there is significant uncertainty around chinook adaptation, and that models indicate a net decrease in the numbers of chinook returning to the upper Chehalis River.

3. The PEIS improperly identifies the augmentation flows as appropriate mitigation.

Despite the general lack of analysis of the impacts of flow augmentation downstream of the dam, and despite the negative conclusions buried in Appendices H and K, the PEIS is replete with statements indicating that the goal of the FRFA facility is to increase flows and decrease temperatures. The PEIS also identifies flow augmentation as a benefit to fish, and as a

mitigation measure, PEIS at p. 264, stating that it will "optimize" flow and temperature. Appendix H claims that reduction in stream temperatures will address increased temperatures caused by climate change. PEIS, pp. H-41, H-50.

All references in the PEIS text to reduced water temperatures deriving from flow augmentation should disclose that, below (approximately) River Mile 105, temperature reductions will be substantially in excess of what the state water quality standard requires for salmonids.

All references in the PEIS to flow augmentation should disclose that EDT analysis indicates that there will be a net loss of chinook salmon to the basin as a result of the FRFA reservoir, and that flow augmentation will contribute to that net loss.

Overall the PEIS needs to be re-drafted to ensure the reader understands that flow augmentation will do virtually nothing for migrating salmon. This is not a problem that can be deferred on the basis that this is a programmatic EIS. The purpose of the PEIS is to evaluate broad-scale impacts of the alternatives. The inability of the FRFA alternative to produce benefits for the Chehalis River is something that must be addressed in this round of environmental analysis. Implications that flow augmentation is a benefit, an appropriate mitigation measure, or otherwise will offset the impacts of the FRFA facility must be revised to indicate the actual results of analysis as described above.

III. Status of Water Rights in the Chehalis River basin.

1. The flood retention facility will require acquisition of new water rights.

As acknowledged in the PEIS (Fact Sheet, p. ii) the reservoir alternatives for the Chehalis Basin Strategy (CBS) will require both a water right permit and a reservoir permit. These water rights will be issued with a priority date junior to the many other water rights in the basin, including the instream flows established by rule at WAC Ch. 173-522.

A. Reservoir permit

To impound water in a new reservoir, the CBS authority would be required to obtain a reservoir permit.[2] RCW 90.03.370(1). This requirement would apply to both the FRO and FRFA alternatives. The reservoir permit would have a priority date as of the date of application for the water permit (which would require certainty that the reservoir is to be built).

B. Instream flow water right(s)

In order to use water from the FRFA reservoir to augment instream flows, the FRFA owner would be required to obtain a "secondary permit" for a water right.[3] RCW 90.03.370(1). This

[2] See Dept. of Ecology, "Apply for a Permit to Store Water," at http://www.ecy.wa.gov/programs/wr/rights/reservoir_storage.html and Governor's Office for Regulatory Assistance, "Reservoir Permit," at http://apps.oria.wa.gov/permithandbook/permitdetail/13.

[3] The FRO alternative would not require a secondary permit because the proposal would not beneficially use water from the reservoir, instead simply releasing captured water over a 32-day period without intent to augment instream flows downstream.

permit would have a priority date as of the date of application (also requiring certainty that the reservoir will be built.)

The FRFA secondary permit could be issued for instream flow purposes, but it would be difficult (if not impossible) to protect and enforce instream flows without transfer into the state Trust Water Right program.[4] The further difficulty in protecting a TWR from out-of-stream users is discussed below.

A Trust Water Right or TWR can only be created from an existing water right. RCW 90.42.080. Assuming the Department of Ecology could issue a new water right for the FRFA (i.e., that it would not cause impairment to senior water users), the FRFA authority would be required to release augmentation water for at least a year (in order to perfect it) before it could transfer its secondary permit into the Trust Water Right program.

2. Existing state-based water rights in the Chehalis River basin.

A. Chehalis River instream flows[5]

The Chehalis River basin instream flow rule, WAC Ch. 173-522, was adopted on March 10, 1976.[6] Rule-based flows for the mainstem Chehalis River are established at five control points, and vary geographically and seasonally. For example, the rule-based flows for the Chehalis River at Elk Creek range between a low of 31 cfs for the time period August 15 to September 30, and a high of 260 cfs for the time period December 1 to April 30. Flows established for the Chehalis River at Satsop range from a low of 550 cfs between August 15 and September 30, to a high of 3800 cfs between December 1 and April 30.

It is important to note that the flows established by rule are "paper" water rights with a priority date of their adoption and do not always reflect the amount of water actually flowing in the river. Chehalis River instream flows established in the rule are frequently not met, especially between May and September. The PEIS cites the example that flows in the Chehalis River at the Grand Mound control point are not met 42% of the days in a year. PEIS at p. 86. See also CBP 2004 at Table 3, p. IV-26.

B. Chehalis River out-of-stream water rights[7]

a. Pre-1976 water rights

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[4] See Dept. of Ecology, Trust Water Rights Program website at http://www.ecy.wa.gov/programs/wr/market/trust.html, and Dept. of Ecology, "Focus on Trust Water Rights Program," Publ. No. 12-11-054 (Dec. 2011) at https://fortress.wa.gov/ecy/publications/documents/1211054.pdf.

[5] See DPEIS Section 3.1.2.2 (Minimum Instream Flows).

[6] See *Swinomish Indian Tribal Community v. WA Dep't of Ecology*, 178 Wn.2d 571 (2013), for discussion of Washington's instream flow rules.

[7] See DPEIS Section 3.1.4 (Water Use and Water Rights).

The PEIS lists 2,500 water right permits and certificates in the Chehalis Basin, and another 8,400 water right claims. 2,100 of the permits and certificates and all of the claims are senior to the minimum instream flow rule, WAC 173-522-020(2). The PEIS also states that there are approximately 17,000 wells in the Chehalis basin, but does not indicate how many are senior to the instream flow rule. PEIS pp. 109-110. A new report from the Northwest Indian Fisheries Commission indicates that, since 1980, about 10,500 wells have been drilled in the Quinault Nation area of interest, although a small percent of those wells are in the Queets River watershed. (NWIFC 2016, p. 200)

b. Post-1976 water rights

The PEIS indicates that, of the 2,500 water right permits and certificates in the Chehalis Basin, approximately 400 are junior to the Chehalis instream flow rule, WAC 173-522-020(2), adopted in 1976. None of the water right claims are junior to the rule since, per se, they represent water use that commenced before 1917 (surface water) or 1945 (groundwater). PEIS pp. 109-110. The PEIS does not indicate how many of the approximate 17,000 wells are junior to the instream flow rule, but the NWIFC report indicates about 10,500 wells have been drilled since the rule was adopted. A large number of these wells are in the mainstem of the Chehalis River. (NWIFC 2016) Groundwater recharges surface waters, so it may be presumed that most wells in the basin are intercepting water that is hydraulically connected to the Chehalis River. (CBP 2004, Section IV-11)

3. Tribal water rights

As a signatory of the Quinault Treaty, the Quinault Indian Nation holds water rights for instream flows in the Chehalis River and its tributaries sufficient to support treaty fisheries. These rights are the most senior rights in the basin, with a priority date of "time immemorial," however, they are not quantified.[8] See PEIS Section 3.1.4, p. 110.

The Confederated Tribes of the Chehalis Reservation hold unquantified Winters Doctrine water rights for the reservation, with a priority date of the establishing of the reservation.

IV. Chehalis River Basin water right management.

1. Relationship of Flood Retention Waters to Existing Water Rights.

Under the FRO alternative, the impoundment and timed release of water over a 32-day period is expected to occur during the winter (rainy) season. It is possible that impoundment of floodwaters every seven years (on average) could impact groundwater levels and water available to existing groundwater rights in the Chehalis floodplain. PEIS Section 4.2.1.2.3. It is also possible that winter impoundment could affect senior water right holders in the basin; it is not

[8] See Osborn, R.P. "Native American Winters Doctrine and Stevens Treaty Water Rights: Recognition, Quantification, Management," American Indian Law Journal, Vol. II, Issue 1, p. 76, available at https://law.seattleu.edu/Documents/ailj/Fall%202013/AILJ-Volume%20II-Issue%201.pdf.

possible to know until the impairment analysis is done. The PEIS does not acknowledge this possibility.

Under the FRFA alternative, the situation is more complex.[9] As noted above, the permanent impoundment of 65,000 acre-feet of water in the FRFA reservoir will have a priority date as of the date of application for the reservoir and secondary permits (2017 or thereafter). Thus these water rights will be junior to the thousands of existing permits, certificates, claims and permit-exempt wells, as well as the Chehalis instream flow rule and tribal water rights.

As with the FRO, the impoundment of FRFA water could impact senior rights in the Chehalis River. Actual impairment analysis is needed to assess this potential. The release of water for flow augmentation, which will have a priority date of 2017 or later, will occur during summer months, when irrigation demand is highest. To the extent flows in the Chehalis River are insufficient to fulfill existing water rights, the FRFA conservation impoundment water will be difficult to protect from diversion by senior water right holders and hydraulically connected wells (whether senior or junior).

Further, as discussed in the next section, to the extent the conservation impoundment water does have seniority, enforcement problems may be a barrier to successful augmentation. The PEIS is silent on these issues.

2. Impacts of pre-existing and future rights on augmentation flows.

The PEIS is deficient in its failure to analyze how future water usage will affect instream flows in the basin, and therefore impact the ability of the dam operators to protect FRFA instream flows.

a. Existing, unused rights.

There are tens of thousands of surface and groundwater rights in the Chehalis basin, and it is believed that many of these rights are not being used. However, because the Chehalis River basin has not been adjudicated, it is impossible to know which rights are validly using water and which have relinquished. (CBP n.d.) Because relinquishment is not automatic and requires agency or judicial action to enforce, it is possible that any number of existing rights not presently in use will be brought back into use in the future. Looking at paper rights, the basin is over-allocated. For example, the Chehalis Basin Watershed Plan reports that "during an average August at the Porter Washington stream flow gage, the amount of water allocated under existing upstream rights and claims is greater than the amount of water actually flowing in the Chehalis River by 275 percent (nearly three times)." (CBP n.d.)

The revival of unused water rights is plausible under conditions of water scarcity caused by drought, climate change, market forces and other factors. The PEIS does not discuss how increased use of presently unused and unadjudicated water rights would affect augmentation flows.

[9] See DPEIS Section 2 and Appendix H, p. H-2 (and Tables H-1, H-2 and H-3) and pp. H-24 to H-25 for discussion of proposed FRFA operations.

The revival of unused surface water rights will have a direct impact on Chehalis River instream flows. The revival of presently unused groundwater rights within the mainstem Chehalis River flood plain will also deplete Chehalis River flows. The flow augmentation plan must anticipate that, to be effective, thousands of acre-feet water may be needed to insulate augmentation flows against increased consumption by pre-existing senior water rights. This will be a problem for instream flows until such time as these rights are adjudicated and the specific quantity of use associated with those rights (and their impact on river flows) can be known.

b. Existing water rights junior to the instream flow.

When instream flows drop below levels mandated in the Chehalis Basin rule, the Department of Ecology notifies for Chehalis basin water right holders with post-1976 priority dates that they must curtail. (Ecology 2016a, 2016b). Most recently, curtailments have occurred in 2016, 2015 and 2006. In 2015, 93 rights were curtailed (and 2,400 water rights pre-dating the rule were not affected). (CBP 2016, 2015). If the goal of augmentation flows are to maintain the rule-based instream flows, then during drought years the augmentation flows will effectively insulate junior rights from curtailment. Compounding the problem would be the relative priorities of the augmentation flow and 1976-2017 water rights. Further, the Department of Ecology recommends that curtailed surface water users convert to groundwater to avoid curtailment. Each of these scenarios could require significantly more augmentation water.

To ensure instream flows are not diminished, the PEIS should calculate the quantity of water associated with junior rights to be included in the augmentation plan.

c. Municipal inchoate water rights.

One subset of unused senior water rights that have been deemed valid and will definitely affect instream flows are municipal inchoate rights. The Cities of Chehalis and Hoquiam hold the largest inchoate water rights in the basin, with about 20,000 acre-feet of unused water. (CBP 2004, at Table 1, p. IV-46) The PEIS does not analyze how future development of these rights will affect instream flows.

d. Future groundwater use.

PEIS Appendix L, which projects build-out potential for flood plain areas, discusses future population growth in the basin along with increased development of land. All such growth will require water, likely groundwater, but the PEIS contains no discussion of future water needs. Increased future use of water may affect instream flows, including augmentation flows, in the Chehalis River mainstem.

e. Climate Change and Water.

The PEIS includes analysis that climate change is likely to lead to reduced instream flows in the Chehalis River. PEIS, Section 3.7. The PEIS states:

- "Climate change predictions suggest changes in quantity, timing, and intensity of precipitation that will translate into changes in streamflow magnitude, and perhaps changes in the frequency of floods. Projections for the Chehalis Basin anticipate less

change in streamflow than in snow-dominated systems. However, by mid-century, rainfall events are projected to become more severe, *summer streamflows are projected to decrease*, and annual variability will continue to cause some periods that are abnormally wet, and others that are abnormally dry." PEIS, p. 179, see also PEIS, p. 522.

- "During the summer months, models consistently predict that summer precipitation would decrease by as much as 30% in the Pacific Northwest." PEIS, p. 179.
- ". . . mean monthly runoff could increase slightly (up to 7%) from October to March and decrease very slightly (3%) during the summer months." PEIS, p. 180.
- "Water temperatures in streams are expected to increase due to climate change because of increases in air temperatures and lower streamflows. The increase in stream water temperatures would reduce the quality and quantity of freshwater habitat, especially for salmonid species that become stressed from high water temperatures. Increasing temperatures during heat waves, during summer afternoons, and in the mid-channels of rivers and streams would increase the importance of protecting thermal refugia for aquatic life, such as cool tributaries and shaded off-channel areas with cool groundwater inflows." PEIS, p. 181.
- Regionally downscaled climate models project increases in annual temperature of 3.3 to 9.7°F by 2070 to 2099 (compared to the period 1970 to 1999), depending on total global emissions of heat-trapping gases. These increases are projected to be the largest in the summer." PEIS, p. 179.

While the PEIS does indicate that ambient temperature increases will lead to impacts on water quantity and quality, it does not discuss how those impacts will affect human and environmental use of water resources in the future, and commensurate impacts on instream flows. This is a deficiency that must be corrected.

3. Groundwater Impacts

PEIS Section 4.2.1.2.3 and Appendix H discuss potential reductions to groundwater recharge. Appendix H states, for example, "Flood control operations would reduce floodplain inundation by 10% (4,480 acres) . . ." PEIS, p. H-40. Table H-2 also notes that, under the FRFA alternative, for the river reaches between the dam and the South Fork Chehalis River, there will be "changes in floodplain inundation." This could result in reduction of recharge to the flood plain and shallow aquifers, and could interfere with the ability of existing groundwater rights to obtain their water. Ultimately the PEIS states that it has not analyzed the impacts on groundwater because it is presenting a "programmatic analysis."

Currently there are approximately 15,000 wells in the Chehalis basin, with about 180 new wells being drilled each year. (NWIFC 2016) USGS reports hydraulic connectivity between ground and surface water. (USGS 2011, 2016) If the FRO or FRFA operations reduce the groundwater available to wells, that is an impact that must be evaluated and mitigated. The PEIS is incorrect in stating that all impacts to surface and groundwater will be beneficial and therefore need not be mitigated. PEIS, Section 4.2.1.3.2 and 4.2.1.3.3.

4. Enforcement of water right priorities in the Chehalis Basin

As the foregoing analysis suggests, it is very difficult to protect instream flows from depletion by existing and future water rights, permitted and permit-exempt. In addition, illegal water diversions are a matter of concern in the Chehalis Basin. (Ecology 1995; CBP 2015; CBP 2004) Although the Department of Ecology does engage in some water rights enforcement in the basin, its resources are limited. (Ecology 2016c, CBP 2016)

The PEIS does not discuss how augmentation flows would be protected from illegal water diversions or, when flows drop below regulatory minimums, uses by junior water users, or expansion of senior rights in the Chehalis River basin.

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ATTACHMENT 6

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Chehalis Basin Strategy

Draft Programmatic EIS

Appendix L: Build Out Analysis

A Critical Review by Larry Goodell, Jr.

November 14, 2016

THIS IS MY LAND

This is my land
From the time of the first moon
Till the time of the last sun
It was given to my people.
Wha-neh Wha-neh, the great giver of life
Made me out to the earth of this land
He said, "You are the land, and the land is you."
I take good care of this land,
For I am part of it.
I take good care of the animals,
For they are my brothers and sisters.
I take care of the streams and rivers,
For they clean my land.
I honor the Ocean as my father,
For he gives me food and a means of Travel.
Ocean knows everything, for he is everywhere.
Ocean is wise, for he is old.
Listen to Ocean, for he speaks wisdom.
He sees much, and knows more.
He says, "Take care of my sister, Earth,
She is young and has little wisdom, but much kindness."
"When she smiles, it is springtime."
Scar not her beauty, for she is beautiful beyond all things."
"Her face looks eternally upward to the beauty of sky and stars,
Where once she lived with her father, Sky."
I am forever grateful for this beautiful and bountiful earth.
God gave it to me
This is my land.

CLARENCE PICKERNELL
Quinault, Taholah

Appendix L, Build-Out Analysis (Analysis), of the Washington State Department of Ecology (Ecology) Draft Programmatic Environmental Impact Statement (PEIS) attempts to analyze future development potential in the modeled 100-year Chehalis Basin floodplain. However, due to numerous flaws, the Analysis inappropriately diminishes the likelihood of future development potential in the Chehalis Basin (Basin). The true causes and effects that this Analysis should have considered are remarkably absent from the document, thus the shortfalls explained herein shall serve to inform the Analysis of the extraordinary significance of this PEIS.

This topic is one of paramount significance to the fundamental goals of the Chehalis Basin Strategy (Strategy) to, [maximize] the benefits of flood damage reduction and aquatic species habitat restoration over both the short and long term[1]. The PEIS however, widely underestimates future development potential in the Basin by, among numerous other shortfalls, utilizing Washington State Office of Financial Management's (OFM) 2012 population growth projections as a fundamental data point to inform the long-term impacts on *Land Use* from the PEIS No-Action Alternative, the Governor's Workgroup Recommendation; Alternative 1, as well as Alternative 2. Further, continued or increased development within the FEMA floodplain, the modeled 100-year floodplain or any area of the Basin that is susceptible to flooding is outright contrary to the goals of the Strategy where the risk of flood damage will actually intensify given such a scenario. Development is also proven to harm natural ecosystem processes which is also contrary to the Strategy. In total, the Analysis fails entirely to reasonably inform the public and decision makers on a component that is key to the Strategy itself; the risk of future flood damage.

The Analysis fundamentally relies on the 2012 methods and conclusions of the *OFM, 2012 Projections, County Growth Management Population Projections by Age and Sex: 2010-2040* (OFM Projection), to forecast future population growth for the State and various counties in the State – including Grays Harbor, Lewis and Thurston. Accordingly, the PEIS concludes, among other findings that, "[d]uring the next 100 years, population growth in the Chehalis River floodplain could result in development similar to that expected for the No Action Alternative, approximately 4 to 9 structures per year (total of 407 to 914 structures during the next 100 years). PEIS, Section 5.3.2, p. 473, at 5th paragraph. Further, "[b]ased on population estimates…[t]he total development potential of 5,592 available parcels far exceeds the highest estimated number of new structures (914) that could be located in the modeled 100-year floodplain per the projections." PEIS, Appendix L; *Build Out Analysis,* p. 32, at 4th paragraph.

The OFM Projection is an inappropriate tool to form conclusions regarding potential development and population growth in the Basin because the projections do not account for any current or future flood control or flood attenuation to occur in the Basin (how could it?). Moreover, the 2012 OFM Projection predates the PEIS by 4 years thus it cannot be assumed that any future growth arising from hypothetical reductions in flooding extents from any of the PEIS Action Alternatives was accounted for.

Section II of the OFM Projection provides explanations behind the County Projection Assumptions that are evidently devoid of any details regarding flood control whereas, "[t]hree sets of county population projections are provided…[that] reflect assumptions…based on the historical high and low decade migration patterns for each county and on current factors affecting the economic base and attractiveness of specific areas in the state." OMF Projection, p. 6, at 1st paragraph. Further, "[c]ounty populations and components of population change were compared and reconciled to the statewide age-sex, birth, death and net migration projections for each five-year interval from 2010 to 2040." *Id*, p. 9, at 2nd paragraph. And, future *migration* projections are based on, "1980-2010 trends in relative population growth and a set of assumptions that is both grounded in past experience and that seems reasonable, given what is known about the economic, demographic, and social character of each of the 39 counties." *Id,* p. 11, at 3rd paragraph.

The OFM Projection assumes nothing with regard to flood attenuation or flood control when projecting county population growth. For this reason, the use of OFM's 2012 population growth projections as a fundamental data point to inform the question of future development potential disregards the question entirely, and thus, results in erroneous conclusions.

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[1] PEIS, Executive Summary, p. 1

Surge of Flood Damage

Further shortfalls of the Analysis extend to the current land-use regulations within the Basin floodplain coupled with the various *Goals* and *Policies* of Lewis County and the cities of Centralia and Chehalis.

The PEIS acknowledges that, "[m]any of the Chehalis Basin communities…do not currently have regulations that prohibit development in the floodplain." The Lewis County code on *Flood Damage Prevention, Chapter 15.35,* provides rules where its *Purpose* is:

"[T]o promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

(1) To protect human life and health;
(2) To minimize expenditure of public money and costly flood control projects; to minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
(3) To minimize prolonged business interruptions;
(4) To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;
(5) To help stabilize the tax base by providing for the sound use and development of the areas of special flood hazard so as to minimize future blight areas;
(6) To ensure that potential buyers are notified that property is in an area of special flood hazard; and
(7) To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions." Lewis County Code, 15.35.020.

As provided in *Chapter 15.35, special flood hazard area* is defined as: "Special flood hazard area means an area subject to a base or 100-year flood; areas of special flood hazard are shown on a flood hazard boundary map or flood insurance rate map as zone A, AO, AI-30, AE, A99, AH, VO, V1-30, VE, or V." *Id,* 15.35.040.

Additionally, *Chapter 15.35* mandates a standard for *flood protection elevation*: "In order to account for the impacts of future developments on flood depths, and in order to ensure the least expensive insurance rates for floodplain occupants, all development within special flood hazard areas which requires elevation or floodproofing shall be elevated or floodproofed to or above the flood protection elevation (base flood elevation plus one foot of freeboard)." *Id,* 15.35.260.

The *Purpose* of *Chapter 15.35* is clear however, subsequent Sections of the ordinance stray from Lewis County's mandate to "promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions…" by authorizing development within *special flood hazard areas.* This is particularly troublesome as the current standard for *flood protection elevation* is solely contingent on the **current** *base flood elevation.* The UW Climate Impacts Group predicts a substantial change in the magnitude of peak flows where: at the confluence of the Newaukum and Chehalis Rivers, the current peak flows are projected to increase by an average of 63% by year 2080 with a maximum predicted increase of 228% (depending on which model and greenhouse gas assumptions are used).[2] Under current regulations, development within the 100-year floodplain falls short of the stated *Purposes* of *Chapter 15.35.* Moreover, application of the current standard for *flood protection elevation* puts *public health, safety and general welfare* at risk and exacerbates *public and private losses due to flood conditions.* Despite best available science, Lewis County permits residential construction, nonresidential construction, construction of critical facilities as well as placement of manufactured homes all within the *special flood hazard area* of Lewis County:

Lewis County permits residential construction:

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[2] *Effect of Climate Change on the Hydrology of the Chehalis Basin*, July 8, 2016, pg. 45, at Table 9.

> "New construction on existing parcels, additions, and substantial improvement of any residential structure shall have the lowest floor, including basement, elevated to the flood protection elevation." *Id,* 15.35.270

Lewis County permits nonresidential construction:

> "New construction, additions, and substantial improvement of any commercial, industrial, or other nonresidential structure requiring a building permit shall either have the lowest floor, including basement, elevated to the flood protection elevation…" *Id*, 15.35.280

Lewis County permits placement of manufactured homes:

> "All manufactured homes to be placed or substantially improved within zones A1-30, AH, and AE shall be elevated on a permanent foundation such that the lowest floor of the manufactured home is at the flood protection elevation and be securely anchored to an adequately anchored foundation system in accordance with the provisions of LCC 15.35.200(2)." *Id,* 15.35.290

Lewis County permits construction of critical facilities:

> "Critical facilities should be afforded additional flood protection due to their nature. Construction of new critical facilities shall be located outside the limits of the 100-year floodplain as identified on the community's FIRM, or as identified by Lewis County as being an area of high flood risk whether or not the location is identified on the FIRM, unless no alternative location is feasible. Substantial modification of existing critical facilities shall include an analysis of whether relocation is feasible. Construction of new critical facilities permitted within the 100-year frequency floodplain shall have the lowest floor elevated to three or more feet above the level of the 100-year frequency flood. Floodproofing and sealing measures must be taken to ensure that toxic substances will not be displaced by or released into floodwaters. Access routes elevated to or above the level of the 100-year frequency flood shall be provided to all critical facilities to the extent possible." *Id,* 15.35.300

With environmental uncertainties, prohibiting development within flood hazard areas seems commonsensical. However, instead of prohibiting development in the modeled 100-year floodplain, Lewis County and local governments within the County encourage it.

Lewis County encourages development:

> "Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner." *Lewis County Countywide Planning Policies,* December 16, 2013, 1 Urban Growth.

> "Based on growth management population projections made for the county by the Office of Financial Management, the county and each city within the county shall include areas and densities sufficient to permit the urban growth that is projected to occur in the county or city for the succeeding twenty-year period…" *Id*, 1.12.1

> "The provision of an adequate supply of land available for urban intensities of development shall be available to accommodate the population and economic growth of Lewis County." *Id,* 1.12.3

> "Encourage economic development throughout Lewis County that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens, especially for unemployed and for disadvantaged persons, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the Lewis County's natural resources, public services and public facilities." *Id,* 5 Economic Development.

"The County and cities should designate adequate land within the UGAs to provide for future industrial and commercial needs." *Id*, 5.3.

"Comprehensive plans shall designate adequate land within Lewis County to provide for future industrial and commercial needs. The County and cities will work together employing innovative tools, such as subarea plans, to meet these needs." *Id,* 5.5.

"Lewis County should encourage commercial/industrial development along major transportation corridors and where the potential for expansion of water and sewer development exists consistent with the County Comprehensive Plan and state regulations." *Id,* 5.9.

"Lewis County's location on the I-5 Corridor is an extremely valuable asset as it provides access and visibility to the County from much of the region. This attribute is particularly important, as much of the development pressure in the Puget Sound region is expanding north, south and east along the interstate corridors. Lewis County is centrally located between Seattle and Portland. The state highways are also important as they provide access to the county from surrounding areas. US Highway 12 is one of only three Washington highways that cross the Cascades and are open year-round." *Lewis County Comprehensive Plan; Economic Development Element*, p. 4.

"Local governments offer strong permitting systems for industrial uses that can provide timely permit approvals for priority projects." *Id,* p. 5.

"The local governments in Lewis County do not impose local business and occupation taxes." *Id*, p. 6.

"The Lewis County Economic Development Council leverages the strengths of the County, cities, ports, schools, and other partners in developing programs for a wide range of economic development activities." *Id*, p. 7.

"Assure that adequate lands are available to support industrial and commercial development." *Id,* p. 19.

"The County will promote commercial and industrial infill development of vacant and underutilized lands within incorporated places, urban growth areas, and limited areas of more intense rural development." *Id*, p. 19.

The City of Chehalis encourages development:

"To promote the continued expansion of a healthy commercial sector." LU.14

"To promote industrial and economic development." LU.16

"Locate warehouse and distribution facilities near or adjacent to appropriate transportation networks." LU.16.05

"Assist and encourage the expansion of existing industry, as well as the location of new industry where appropriate." LU.16.10

"Support the efforts of the Lewis County Economic Development Council, Port of Chehalis, Chehalis Industrial Commission, the Chamber of Centralia, Chehalis and Greater Lewis County, the Chehalis-Centralia Airport Board and other groups to promote the success and growth of existing businesses, and to facilitate the recruitment of new business to the community." LU.16.11

"Locate industrial areas in a manner which takes advantage of the air, freeway and rail transportation systems." LU.16.12

"To encourage the expansion of existing businesses and the recruitment of new enterprises by providing a business-friendly environment." *City of Chehalis Comprehensive Plan; Chapter 8 Economic Development Element,* p. 14, Goal ED 1.

"Provide a timely and certain permitting process." *Id,* Policy ED 1.3.

"Ensure that development regulations are balanced so that they nurture economic activity, maintain jobs, encourage new employment, and promote a high quality of life in Chehalis." *Id*, p. 15, Policy ED 1.5.

"To provide a supply of prime industrial sites sufficient to meet market demands for industrial development." *Id*, Policy ED 4.

"Maintain a minimum 10-year supply of prime or potentially prime industrial land." *Id,* p. 16, Policy ED 4.2.

"To provide commercial sites sufficient to meet a diversity of needs for retail, service, and institutional development within the City." *Id*, Goal ED 5.

"Review and adjust economic development goals as needed during the planning period to ensure a minimum 10-year supply of commercial land to preserve services that support the community." *Id*, Policy ED 5.1.

The Port of Chehalis (Port) industrial park is located adjacent to the southeast edge of the corporate city limits of Chehalis. "The Port of Chehalis provides sites for industrial, warehousing, distribution, commercial and small business incubator uses. The Port's *(sic)* acts as a major focal point for enhancement and diversification of the City's and county's economy and employment basis." *City of Chehalis Comprehensive Plan; Chapter 8 Economic Development Element,* p. 9. The mission of the Port is to be, "a catalyst for economic growth and diversification by recruiting new business and industry and supporting the retention and expansion of existing ones." *Port of Chehalis Comprehensive Scheme of Harbor Improvements; UPDATE; February 2012,* p.2, Mission. "The [Port's] master planned area is entirely outside the Chehalis city limits but lies within the City's Urban Growth Area (UGA), and is therefore under the jurisdiction of the City due to an agreement with Lewis County. In 2009, the City of Chehalis updated the City's development regulations to adopt the Port's development standards & guidelines by reference to allow more flexibility by the City of Chehalis in permitting projects when the Port is the applicant." *Id,* p. 36.

The Port advertises that, "[i]t is very important that the Port have as many options as possible for land development. The greater the number of options, the faster a sustainable momentum can be established[3]." "The issuance of the wetland regional general permit is an extraordinary accomplishment…[4]" "The Regional General Permit provides the Port the opportunity to fill low quality wetlands... As a result, the Port is better positioned than ever to take advantage of new business opportunities that become available as the state and the nation emerge from the recession.[5]" Among the various local governments within Lewis County, the Port of Chehalis is arguably the purveyor of development where, in addition to the foregoing pro-development displays, "[t]he Port's goal is to be the development opportunity of least resistance[6]."

By the foregoing statutes, policies, goals and strategies, Lewis County is poised to find the development and expansion of the upper Chehalis Basin that the County and City officials are planning for.

Land Deficit

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[3] *Id,* p. 10.
[4] *Id,* p. 14.
[5] *Id,* p. 10.
[6] *Id,* p. 10.

"Housing demand is a function of population growth and the demographic characteristics of the population[7]." "Development of population projections for [Growth Management Act] is a shared responsibility. As directed by statute RCW 43.62.035, the Office of Financial Management (OFM) prepares a range of possible population growth for Washington's counties to use as they plan for future growth und GMA…[L]ocal officials are responsible for selecting a 20-year GMA planning target that is within the high and low growth projections prepared by OFM. County officials select the county planning target[8]."

As of December 27th, 2010, Lewis County has adopted a growth rate that is within the bounds of the OFM projections for the County:

> "The Planned Growth Committee of elected officials in the county has adopted population allocations for all jurisdictions that total 99,746 by 2030, within the bounds of the OFM intermediate and high projections.[9]"

The U.S. Census Bureau estimates the 2010 population of Lewis County to be 75,455[10]. Therefore Lewis County projects an increase of 24,291 people by year 2030.

OFM projects the following intercensal estimates of population and housing in Lewis County for the year 2010:

- Total population: 75,455
- Total Household population: 74,514[11]
- Total housing units: 34,050[12]
- Total occupied housing units: 29,743[13]
- Occupancy rate: 87%[14]
- Persons per household: 2.50[15]

To calculate the corresponding future housing demand, a function of the population growth divided by the estimated *persons per household* is used. For Lewis County, the OFM estimates the *persons per household* in 2010 to be 2.50[16]. Based on this estimate, Lewis County's adopted population increase of 24,291 people equates to a future housing demand of 9,716 units. The OFM also estimates the occupancy/vacancy rate of residential dwellings. The vacancy rate for 2010 was estimated at 13%[17]. This additional factor ultimately equates to a future estimated housing demand for Lewis County of 10,979 units by year 2030.

Again, OFM population growth projections for Lewis County are completely devoid of any assumptions associated with future flood attenuation attributable to any proposed flood control measures.

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[7] *Lewis County Comprehensive Plan;* Appendix B, December 22, 2008, p. B 1 -7

[8] *Growth Management Act (GMA) Population Projections Final 2007 County Projection Update Office of Financial Management;* November 2007, p.1.

[9] *Lewis County Comprehensive Plan; Appendix A*; *Amended December 27, 2010,* p. A 3-32

[10] U.S. Census Bureau, 2016. Quick Facts for Lewis County. Available from: http://www.census.gov/quickfacts/table/PST045215/53041,00

[11] Office of Financial Management (OFM), 2016; Historical Estimates of April 1 Population and Housing for the State, Counties and Cities. Available from: http://www.ofm.wa.gov/pop/april1/hseries/ofm_april1_intercensal_estimates_methodology_2000-2010.pdf

[12] *Id*

[13] *Id*

[14] *Id*

[15] *Id.*

[16] *Id.*

[17] *Id.*

As of 2010, there were an estimated 4,307 vacant housing units out of an estimated total 34,050 housing units – in Lewis County. Accounting for these vacancies yields a future housing deficit of 6,672 units – by year 2030.

City of Chehalis Case Study

An example of development constraints in the County are those of the City of Chehalis where, "[t]he [city] is virtually built out [and] almost all of the most easily developable land has already been developed. [T]he need to expand beyond the existing corporate boundaries of the city, especially to accommodate needed economic expansion, will become clear[18]." The Housing Element of the City of Chehalis Comprehensive Plan (City of Chehalis Housing Element) "calculates a 2025 need of 1134 single family and 510 multi-family dwelling units (d/u)[19]" totaling a future housing need of 1,644 units. "Based upon calculations made by the city's Department of Community Services, there are not more than 100 vacant lots platted within the city. Of these platted lots, there are none available for new housing construction…[And] currently there is a trend of single-family dwelling units supporting 69% of the housing in the City of Chehalis and 31% of housing is comprised of multi-family dwelling units.[20]" These development constraints within the Chehalis city limits, result in a residential land deficit of 230.87 net acres[21] for single-family d/us and a 2.375 acre net surplus of multi-family d/us.

"On May 4, 1998, the Lewis County Board of County Commissioners adopted Ordinance 11-59, approving the Interim Urban Growth Area (IUGA) for the city of Chehalis…In determining the size and composition of the IUGA, the city and the county reviewed the following:

- The twenty-year population projections provided by the state's Office of Financial Management (OFM);
- The limited amount of vacant land that exists within the city;
- The amount of land within the city that includes critical areas and other significant constraints to development…[22]"

The City of Chehalis Housing Element acknowledges the Urban Growth Area (UGA) which totals 3,184 acres[23]. "The bulk of that land (1,205 acres)…is intended for industrial use…Of the remaining land, 1,242 acres is intended for residential use, while 709 acres is set aside for commercial use.[24]" Of the 1,242 acres of residential UGA land, there is a current total of 882 acres of residential land-use. The remaining 360 gross acres is vacant and would be available for residential development within the UGA. There is an additional 179 net acres of undeveloped residential land located within the Chehalis city limits.

The intent of *Chapter 17.42; R-1 – Single-Family, Low Density* as provided in the *Chehalis Municipal Code* is as follows:

> "The intent of the R-1 zone is to provide an area for development of low density single-family residences with relatively larger lot sizes and adequate public facilities, and with zoning controls designed to protect the residential living environment.[25]"

The minimum *permitted* dwelling unit (d/u) density, as provided in *Chapter 17.42* is 4 units per acre.[26] As stated above, the current available acreage for residential development within the UGA is 360 gross acres.

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18 City of Chehalis Comprehensive Plan, Chapter 3, Land Use; p. 35.
19 *Id.* p. 37.
20 *Id.*
21 *Id.*
22 *Id.* p. 28.
23 *Id.* p. 29.
24 *Id.*
25 Chehalis Municipal Code, 17.42.001.

Additionally, there exists 179 net acres within the city limits. Adding these together (539 acres) and using a function of the City of Chehalis' minimum d/u density standard for R-1 zoned development multiplied by the available acreage equates to 2,156 parcels of developable residential land that could legally accommodate single-family d/us.

If the current trend of single-family and multi-family housing is followed, then 69% of the available 539 gross residential acres equates to just 371.91 acres which, using the same function just mentioned, further equates to 1,487.64 parcels of available single-family housing developable land. With 1 (one) d/u per parcel, the 2025 single-family housing need will be met with a surplus of 353.64 parcels remaining.

OFM estimates there to be a current housing inventory of 3,131 dwellings[27] in the city of Chehalis; compared to 2,871 dwellings one decade before (2000). This increase represents a 0.9% average annual increase between 2000 and 2010. Applying this rate (which does not assume any flood attenuation attributable to any future flood control projects) to the future 2025 projected housing inventory of 4,265 equates to a one year increase of 338.85 dwellings which exceeds the projected 2025 surplus of 353.64 parcels within the UGA.

Within the city limits of Chehalis, the estimated acreage of residential land that is currently available to accommodate the projected 2025 housing need lies at a significant deficit. As provided earlier, in 1998 Lewis County and the City of Chehalis predicted this scenario where they reviewed – among other situations – *the twenty-year population projections* and the *limited amount of vacant land that exists within the city* to approve the *Urban Growth Area* which added over 3,000 acres to the City's developable land-base. Nearly 20-years later, the city limits are now *virtually built out* where the City asserts, "special attention should be awarded [to the] residential land in the UGA as it is key to overcoming the residential single family dwelling unit deficit…[28]" The exact crossroads that confronted the City and County nearly 20-years ago has now came full-circle where within the current 20-year planning horizon, the City of Chehalis will effectively completely find itself "built-out."

The Rivers that Nobody Wanted

"Could urban development and population increase in the floodplain after a flood retention facility is constructed?[29]"

The PEIS examines this question in comparison to the historic flood control measure of the Howard Hanson Dam on the Green River. After analysis of Howard Hanson Dam, the PEIS categorically denies the notion that a reduction of flooding extents – directly attributable to the construction of a dam – is likely to result in similar influxes of population, development or economic growth as historically witnessed in the Green River Valley. This conclusion is not well substantiated and stands at odds with the cause and effect of historic flood control in Washington State.

The PEIS acknowledges that, "[r]educed flooding extents may increase the development pressure in localized areas where the reduction is large enough to substantially reduce the risk of being flooded.[30]" This assertion is further emphasized within discussions regarding Alternative 1 where, "[t]he largest reduction in flood extents as a result of constructing the Flood Retention Facility and the Airport Levee Improvements would be seen in the upper Chehalis Basin, close to the facility and near Chehalis and Centralia…[31]" Despite these conclusions, the PEIS contends that although substantial reductions in flood risk "has been

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[26] Chehalis Municipal Code, 17.42.020 Bulk regulations (R-1 zone).

[27] Office of Financial Management (OFM), 2016; Historical Estimates of April 1 Population and Housing for the State, Counties and Cities. Available from: http://www.ofm.wa.gov/pop/april1/hseries/ofm_april1_intercensal_estimates_methodology_2000-2010.pdf

[28] City of Chehalis Comprehensive Plan, Chapter 3, Land Use, p. 38.

[29] PEIS; Appendix L; Sub-Appendix A; *Howard Hanson Dam Case Study*, p. A-1.

[30] PEIS; Appendix L, p. 1.

[31] *Id*, p. 22.

seen in other river basins in Washington, such as the Green River Valley after installation of the Howard Hanson Dam,[32]" the subsequent growth of such river basins "cannot be singularly attributed to the installation of [a] dam…[33]"

To substantiate these claims the PEIS inadequately examines the circumstances of the Green River Valley by evaluating the changes in communities downstream of the Howard Hanson Dam in a case study entitled: *Howard Hanson Dam Case Study*[34] (Case Study). The Case Study concludes the following regarding the Howard Hanson Dam:

> "[T]he circumstances surrounding that facility are such that they cannot be compared to the Chehalis Basin Strategy.[35]"
>
> "[T]he specific causes of increased growth in the Green River Valley cannot be singularly attributed to the installation of the dam, and other factors should be considered when comparing the potential land use impacts of the proposed dam in the Chehalis Basin to the circumstances of Howard Hanson Dam in the Green River Valley.[36]"

To solely consider Howard Hanson Dam for this exercise fails to provide an apples-to-apples comparison between the overall historic flood control measures of the Green River Valley and the proposed measures in the Chehalis Basin. Doing so inappropriately limits the scope of the Case Study and allows the PEIS to sidestep the question of growth potential. The *Build Out Analysis* compares development potential to the No-Action Alternative, Alternative 1 and Alternative 2. None of these Alternatives exclusively introduce a dam but rather encompass a combination of flood control action elements such as a dam and the I-5 & Airport Levees – elements that are strikingly similar to the overall flood control of the Green River Valley.

Since the turn of the 20th century, the Green River Valley has suffered extensive natural and man made changes to the conveyance of flows from the Duwamish, White, Green and Cedar Rivers. Prior to 1906, the Green, Cedar and White Rivers all drained into the Duwamish, which then emptied into Puget Sound at Elliot Bay. Additionally, up until 1916 Lake Washington also drained into the Duwamish River by way of the Black River near present day downtown Renton[37].

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32 PEIS; Appendix L, p.1

33 PEIS; Appendix L; Sub-Appendix A; *Howard Hanson Dam Case Study*, p. A-1.

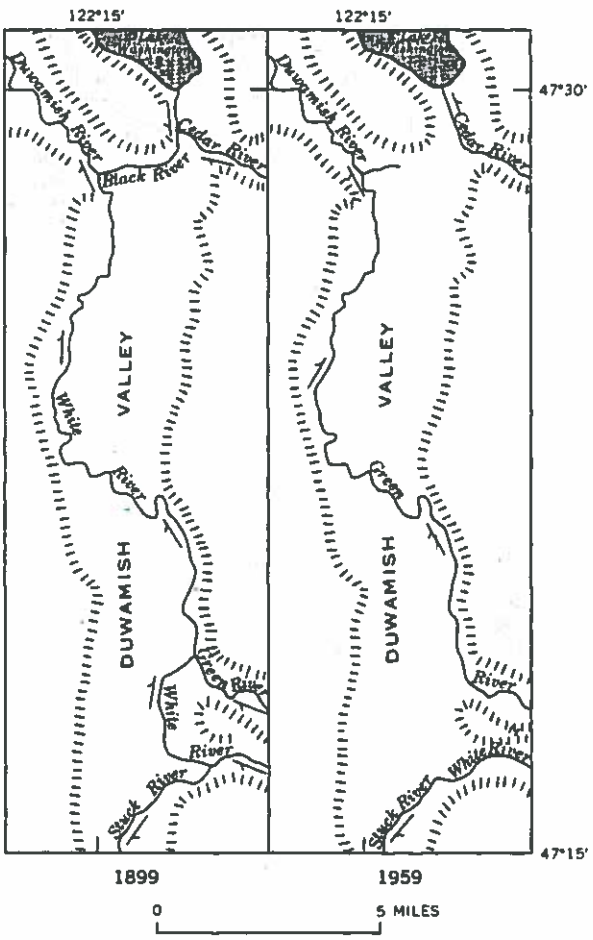
34 *Id.*

35 EIS; Appendix L, p. 1.

36 *Id.*

37 Donald R. Mullineaux, Geological Survey Professional Paper 672, *Geology of the Renton, Auburn, and Black Diamond Quadrangles, King County, Washington*, United States Government Printing Office, Washington, 1970, p. 8, at Figure 5.

To examine the geographical changes of the Green River Valley, one has to start with the White River. Prior to 1906, what is known today as the Green River was actually the White River where the Green drained into the White as it flowed north and emptied into Elliot Bay[38]. Five and a half miles upriver from the mouth of the Green River, the channel of the White River ran very close and nearly parallel to the Stuck River which drained into the Puyallup and then emptied into Commencement Bay at Tacoma. The November flood of 1906 forever changed the course of the White River when a logjam backed up the high flows of the White. "The backflow from the [logjam] poured across the narrow neck of land that had separated the Stuck and White rivers and obliterated it completely. In their fury, the waters swept away a heavy growth of timber and poured down the Puyallup…[39]" After flood waters receded, Major Hiram M. Chittenden of the U.S. Engineers Corps was called upon to study remedial measures. Major Chittenden ultimately recommended that the White River be permanently channeled south to the Puyallup River stating, "[n]ature has transferred the course and it will be simpler to perpetuate it then to change it again [40]." Subsequent flood control measures including dredging, bank armoring, diking and ultimately the construction of the Mud Mountain Dam has eternalized the century old guidance of Major Chittenden for the White to stay its course thus permanently diverging the White from the Green, Cedar and Duwamish Rivers.



"The magnitude of the [1906] disaster stirred both counties to action and a joint commission was appointed to consider remedial measures. The advice of engineers was sought and recommendations for flood control were made by Major. H. M. Chittenden. Chittenden in his report recommended the construction of sheer booms for catching drifting timbers, the protection of banks on the concave side of the streams, and a concrete dam for directing the course of the flowing water in a way to do the least damage.[41]" "Operation of this plan began January 23, 1914. The first step was construction by King County of the 1,600-foot Auburn diversion dam and a 2,000-foot drift barrier composed of 30 heavy concrete piers laced together with ten wire cables a foot apart. Levees were built, the channel was dredged sufficiently, it was supposed to carry floods, and stream banks were strengthened to prevent erosion.[42]" In the 1930s, "the War Department approved of construction of a dam in White River's box canyon…[43]" "The project, named Mud Mountain dam…was authorized by an act of Congress on June 22, 1936…[b]ut World War II interfered, and the dam was not completed until 1948.[44]"

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38 *Id.*

39 Clarence B. Bagley, *History of King County Washington*, Vol. 1 (Chicago: S.J. Clarke Publishing Co, 1929), p. 710.

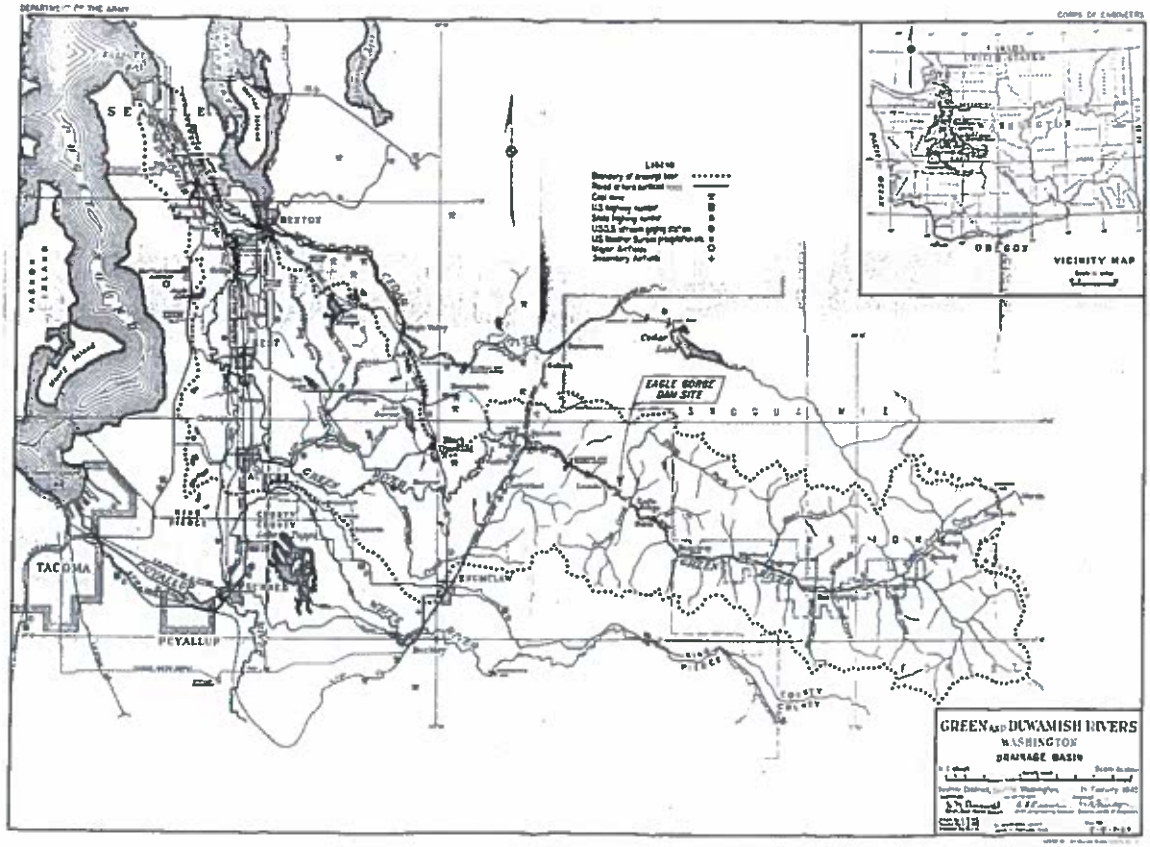
40 "The River Nobody Wanted," *The Seattle Times*, January 27, 1957, p. 2

41 Clarence B. Bagley, *History of King County Washington*, Vol. 1 (Chicago: S.J. Clarke Publishing Co, 1929), p. 711.

42 "The River Nobody Wanted," *The Seattle Times*, January 27, 1957, p. 2

43 *Id.*

44 Alan J. Stein, *Mud Mountain Dam*, (HistoryLink.org Essay 3584, September 23, 2001)



Source: Chief of Engineers, U.S. Army, Report on Green and Duwamish River, and Duwamish Waterway, H.R. Rep. No. 81-271, p. 50., (1st Sess., 1949).

Diversion of the Cedar River and the simultaneous elimination of the Black River was next, however these changes were hardly occasions of natural phenomenon. The diversion of the Cedar served to link Lake Washington to the Puget Sound by way of canals and locks between Lake Washington, Lake Union and the Salish Sea. Lake Union was aptly named by Thomas Mercer "as at some future time, it would be part of the union between Lake Washington and the Sound.[45]"

"In accordance with the provisions of the...Rivers and Harbors Act of June 13, 1913, two locks, a larger and a smaller, side by side, connecting Shilshole Bay with Salmon Bay have been constructed by the Government.[46]" Two canals, one termed the *Fremont Cut* connecting Salmon Bay to Lake Union and the *Montlake Cut* connecting Lake Union to Lake Washington were completed in the spring of 1916. Proper operation of the locks required a steady supply of water which called for an augmentation of inflow to the lake. In 1912 the Cedar River was diverted where "a channel 80 feet long *(sic)* and 2,000 feet wide *(sic)* carried the river to [Lake Washington][47]." Because the average elevation of Lake Washington "was almost eight feet above that of Lake Union...[t]he level of Lake Union was taken for the canal project, thus lowering that of Lake Washington [and] removing the flood menace of Lake Washington[48]" by effectively drying up the drainage of the Lake – the Black River. Joseph Moses, a Duwamish Indian recalled the death of the Black, "That was quite a day for the white people at least. The waters just went down, down, until our landing and canoes stood dry and there was no Black River at all. There were pools, of course, and the

45 Clarence B. Bagley, *History of King County Washington*, Vol. 1 (Chicago: S.J. Clarke Publishing Co, 1929), p. 388.

46 Clarence B. Bagley, *History of King County Washington*, Vol. 1 (Chicago: S.J. Clarke Publishing Co, 1929), p. 394.

47 David M. Buerge, *Renton, Where the Water Took Wing*, (Windsor Publications, Inc., 1989), p. 42.

48 Howard A. Hanson, *More Land for Industry: The Story of Flood Control in the Green River Valley*. The Pacific Northwest Quarterly, Vol. 48, No. 1, (University of Washington, 1957), p. 3

struggling fish trapped in them. People came from miles around, laughing and hollering and stuffing fish into gunny sacks.[49]"

With the diversion of the White and Cedar Rivers, as well as the outright elimination of the Black River, the Green River became completely disjoined from any major tributaries and flowed unimpeded to the Salish Sea. Despite these drastic geographical changes, flooding persisted in the Green River Valley and remained an obstacle to King County's industrial growth "[f]or one deterrent of industrial growth in [Seattle] has been the lack of sites suitable for establishment of large manufacturing plants. Land remaining adapted for such use lies to the south in the Green-Duwamish River valley, where the danger of repeated floods and the winding course of the river hitherto have discouraged development.[50]"

In a letter dated July 20, 1949, the Secretary of the Army, Gordon Gray transmitted a report, dated February 28, 1949, from the Chief of Engineers, United States Army, to The Speaker of the House of Representatives regarding "a preliminary examination and survey of Green and Duwamish Rivers, Wash., and a review of reports on Duwamish waterway, Seattle Harbor, Wash.[51]" The report "consider[s] methods for control of floods in the entire Green and Duwamish river valleys and modifications of existing navigation for Duwamish waterway.[52]" L. H. Hewitt, Colonel, Corps of Engineers, District Engineer, concluded in the report that, "[t]he district engineer finds that recurring floods in the Green River Valley cause substantial flood damage and retard the agricultural and industrial development of the area.[53]" Also, "Green River no longer has any important tributaries, and therefore the flood problem is confined to controlling the floods in a single major valley.[54]"

Col. Hewitt goes on to state, "[i]f the lands in the Green River Valley were freed from the threat of recurrent flooding, it is probable that they would be converted at a rapid rate from their present use to the production of higher-value crops and to sites for industrial plants…The effect of freedom from flooding on land use, and hence on land values, is exemplified in the adjacent Puyallup Valley where climatic and soil conditions are similar to these in the Green Valley, but which is protected from flooding by Mud Mountain Dam. Land values in the Puyallup Valley are generally about 165 percent of those in the Green River Valley.[55]"

February 27, 1947, a public hearing about the report was held in Seattle where "[c]onsiderable discussion…was devoted to the need for additional industrial sites in the Seattle area. Data were presented showing that the only unoccupied sites were in vicinity of the Duwamish waterway; that at the present rate of industrial expansion these sites would be utilized within the next 3 to 5 years; and that the need for additional industrial land would be acute." The report addresses these concerns providing, "[t]he conversion of the lower Duwamish River Valley from its present use for farms, residential communities and a golf course to industrial use will require prevention of periodic flooding and the straightening of the river channel so that an adequate system of roads, railroad spurs and utilities can be provided. The flood control project as set forth herein will, if constructed, prevent this periodic flooding.[56]"

Col. Hewitt ultimately concludes that, "[t]he construction of a multiple-purpose reservoir project at Eagle Gorge…will provide the best plan of development of the Green River Basin in the interest of flood-control,

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[49] Mike Sato, *The Price of Taming a River: The Decline of Puget Sound's Duwamish/Green Waterway* (Seattle: The Mountaineers, 1997), 51-57

[50] "City's Industrial Growth Faces One Less Barrier," *The Seattle Times*, March 14, 1948, p. 6.

[51] Chief of Engineers, U.S. Army, Report on Green and Duwamish River, and Duwamish Waterway, H.R. Rep. No. 81-271, p. 1., (1st Sess., 1949).

[52] *Id.*, p. 22.

[53] *Id.*, p. 21.

[54] *Id.*, p. 36.

[55] *Id.*, p. 43.

[56] *Id.*, p. 45.

fish conservation, pollution abatement, domestic water supply, irrigation, and industrial expansion…[and Col. Hewitt] therefore recommend[s] adoption of the Eagle Gorge project…[57]"

Three years later, "[i]n March, 1952, the Bureau of the Budget recommended a certificate of necessity for the Eagle Gorge project and an allotment for planning. On May 14th, 1952, the President approved certification and $75,000 for planning… In 1955, $1,000,000 was appropriated to start construction[58]" and by "1956, $6,300,000 were appropriated to continue construction work.[59]" The Eagle Gorge project was completed in May of 1963 and was renamed by an act of Congress for the dam's visionary, Howard A. Hanson, who passed away in 1957. Before his death, Howard Hanson wrote, "[w]hether it be for a home, a city or an expanding metropolitan area, there must be a site, a locale, suited to the purpose by nature or made so by man's efforts.[60]"

"The dedication of the Howard Hanson Dam in May 1963 heralded the onset of industrial conversion. For the first time in history, development in the Valley could proceed without risk of destruction by annual flood waters. As Colonel Hanson himself predicted, 'Old Man River, from Elliot Bay to Auburn, will be under control and the entire valley available for its highest and best uses.[61]"

"The dam was widely heralded as a boon to agriculture, and valley farmers supported it en masse. But there were many – businessmen, developers, industrialists, and farmers alike – who from an early date perceived the broader implications of transforming a flood-prone valley into prime real estate. A promotional brochure put out by the Corps of Engineers made no bones about this potential benefit:

The Green-Duwamish River valley is also a natural area for industrial development…Freedom from flooding in the valley opens more than 10,000 acres of level land for homes, shopping centers, commercial enterprises, and both light and heavy industry. This means more economic growth which in turns means more employment and better communities in which to live.[62]"

Alice Staples, a real estate editor for the Seattle Times published the article in 1962 entitled, "*Kent Reaps Planning Dividends as Population Doubles in 5 Years*" where she writes, "In the past five years, the city has doubled in population [and] new building last year exceeded $3,000,000. [City] officials said that probably one of the best things ever to happen to Kent and the Valley was the Howard A. Hanson Dam at Eagle Creek. Our people worked hard with others in the Valley for that project…It will free land for industrial development, which if the dam were not there, would be underwater.[63]" Growth in the Green River Valley also yielded a surge of new critical facilities where the once tiny town of Kent has grown "to include 16 square miles of land…expand[ing] to take ni *(sic)* all of County Fire District 37, including six stations, 11 fire trucks, and 110 volunteer firemen. Schools in the Kent district are growing 8 per cent a year with 400 new pupils entering school last year.[64]"

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57 *Id.*, p. 48.

58 Howard A. Hanson, *More Land for Industry: The Story of Flood Control in the Green River Valley,* The Pacific Northwest Quarterly, Vol. 48, No. 1, (University of Washington, 1957), p. 6.

59 *Id.*

60 *Id.*, p. 1.

61 Florence K. Lentz, *Kent, Valley of Opportunity, An Illustrated History,* (Windsor Publications, Inc. 1990), p. 75.

62 *Id.*, p. 68.

63 "Kent Reaps Planning Dividends as Population Doubles in 5 Years," *The Seattle Times,* February 4, 1962, p. 42.

64 *Id.*

Kent Reaps Planning Dividends as Population Doubles in 5 Years

Dreams Of '40's Turn To Reality

By ALICE STAPLES
Real-Estate Editor, The Times

Back in the late 1940's, after the Second World War, when Kent got its first City Planning Commission, some of the city councilmen believed the new commission was "too visionary."

The planners wanted a comprehensive plan for the city. It would cost money.

"THOSE THINGS could happen, but we won't live to see it," a councilman said when he was warned of a possible impending population explosion. The councilman had something to go on, too. Kent had for some 15 years, remained a city of static population, with 2,000 to 4,000 persons.

E. A. Sipe, chairman, and a member of the Planning Commission since its inception, recalled these hectic days.

Sometimes in those days I wondered if I was a dreamer," he said. "But sometimes today I wonder if we were visionary enough."

IN THE PAST five years, the city has doubled in population. It is believed that the April census will reach 16,000

From left—MAYOR ALEXANDER THORNTON, E. A. SIPE, GLEN SHERWOOD

for the incorporated area. It is estimated that more than 20,000 people are residing in the immediate Kent area.

City Engineer Glen Sherwood estimated there will be an additional 1,200 homes built within the city limits this year. Herb Wilka, the city's building inspector, said new building last year exceeded $2,000,000.

"WE ARE much better prepared than most cities our size to meet the problems of

NEW BANK BUILDING UNDER CONSTRUCTION

that project." Thomas S. Bailey, president of the Kent Chamber of Commerce, said: "It will lure land for industrial development, which, if the dams were not there, would be under water."

"The parking lots, which will

THE NEW Bank of Kent, a state-chartered institution with 177 local stockholders, will be open for business April 24. The bank will be housed in a handsome new building now under construction. It will be managed by Ernest Vogel, vice president. Howard A. Edlin, Kent undertaker is president.

Two other banks, the National Bank of Washington, and the Peoples National Bank of Washington have offices in Kent.

Charles Bridges, who for 20 years has been fire chief, city clerk and purchasing agent, has seen a tiny town grow to

"OUR PEOPLE worked hard with others in the Valley for

industrial development and population coming our way," Mayor Alexander Thornton said. "We had our first comprehensive plan made in 1947, and, other numerous occasions, the plan was brought up to date in 1956."

The officials said that probably one of the best things ever to happen to Kent and the Valley was the Howard A. Hanson Dam at Eagle Gorge

THIS BUILDING, IN KENT, WILL HOUSE DUCOMMUN METALS & SUPPLY CO.

and industrial chairman for the Chamber of Commerce, said great strides are being made in Kent for the future of industry there. He listed among the new arrivals in the past several years, the Graystone plant, Pioneer Sand & Gravel Co., Heath Tecna-Plastics, Inc., and the Western Processing Co.

THE HEATH company board of directors announced yesterday it has negotiated the first phase of a multi-million dollar building program for the company. The Multnau Development Co., a national developer of commercial and industrial plants, will construct a 60,000-square-foot plant and 6,000 square feet of office space at the company's Kent site on a lease-back basis. Construction will begin next week.

G. J. Nieuwenhuis, president of Western Processing, said his company is preparing to begin production in one of five buildings planned for a 13-acre site north of the business district. The company, which moved from Seattle, makes edible products from waste acids and other materials including blood. The buildings will cost more than $500,000.

A $200,000 building to house

CHARLES BRIDGES

BARNEY WILSON

CARL POZZI

the interests of Ducommun Metals & Supply Co. and the Bardoe Steel Co. is nearing completion in a 45-acre leased tract park north of Kent.

INDUSTRIAL SITES are owned by other companies, including the Esco Corp., of Seattle, and the Durell Products, Inc., a company manufacturing aluminum door and window frame displaced by the freeway.

Zoning for commercial centers on the perimeter of Kent and development of ten acres, platted for residences, will get under way this year.

South 240th Street and the Benson Highway in a combination housing and commercial venture by a group of Renton and Seattle investors known as the General Investment Co. Lewis Perotti, vice president, said ten acres, platted for residences, will get under way this year.

Carl Pozzi, city councilman in charge of streets, said traffic in the business district will be improved with the completion of the Valley Freeway, east of the existing highway. The right-of-way is now being purchased, he said.

"[In] 1965…the Boeing Company opened the Kent Aerospace Center in a pasture north of the heart of town… Boeing Aerospace was Kent's first big new plant, and for a time it remained physically isolated in a sea of farmland. But other new developments soon filled in the fallow fields to the north, south and west of town in quick succession. Tradewell Stores, Inc., arrived in 1965, Cam Industries and Northwest Steel Rolling Mills in 1966, Western Electric in 1967, and Tally Corporation in 1968. New industries continue to locate in Kent through the 1970s, creating a major industrial center of considerable scope and influence.[65]"

Returning to the PEIS, the significance of the geographic change to the waterways of the historic *White River Valley,* beginning at the turn of the 19th Century, is historically monumental where southern King County and northern Pierce County widely proliferated as a result. It is this history – the change from the anabranching channels of the historic *White River Valley* to the divergent flows of the White, Green and Cedar rivers of today – that serves to better inform the question of, "Could urban development and population increase in the floodplain after a flood retention facility is constructed?[66]"

When we review OFM records for historic population estimates of Kent and Tukwila, we find momentous population growth during the 1910, 1960 and 1970 decennial census counts. To examine these 3 particular decades, the preceding instruction shall serve to inform the 152.7%, 175.1% and the 138.5% increases in population growth for the decennial census' of 1910, 1960 and 1970 respectively for the city of Kent; found in Table 1.0 below.

Table 1.0

City/Town Name	**OFM Population, 1910**	*% Change, from 1900*	**OFM Population, 1960**	*% Change, from 1950*	**OFM Population, 1970**	*% Change, from 1960*
Kent	1,908	*152.72%*	9,017	*175.08%*	16,596	*84.05%*
Tukwila	361	*N/A*	1,804	*55.65%*	3,509	*94.51%*
City/Town Name	**U.S. Census Bureau Population, 1910**	*% Change, from 1900*	**U.S. Census Bureau Population, 1960**	*% Change, from 1950*	**U.S. Census Bureau Population, 1970**	*% Change, from 1960*
Kent	1,908	*152.72%*	9,017	*175.08%*	21,510	*138.55%*
Tukwila	361	*N/A*	1,804	*55.65%*	3,496	*94.51%*

65 Florence K. Lentz, *Kent, Valley of Opportunity, An Illustrated History,* (Windsor Publications, Inc. 1990), p. 75.

66 PEIS; Appendix L; Sub-Appendix A; *Howard Hanson Dam Case Study,* p. A-1.

Source: Office of Financial Management (OFM), 2016; Historical Estimates of April 1 Population and Housing for the State, Counties and Cities; Bureau of the Census, Characteristics of the Population, Vol. 1, Part 49, Washington, 1970.

As explained, during the flood of 1906, the mainstem White River was completely diverted from its northerly course through the "Green River Valley" to a southerly route that now joins the Puyallup River – before emptying into Commencement Bay at Tacoma. This phenomenon conveyed White River flows into the Puyallup River Valley and as a result, the episode completely disengaged the White River from the "Green River Valley," attenuating flooding in the Auburn, Kent and Tukwila areas. With the flow of the Green River "cut in half, the new stream was slower, tamer, and less prone to regular destructive flooding.[67]" Accordingly, between year 1900 and 1910, a 152.72% population increase was observed for the city of Kent.

In 1947, Congress authorized the proposed construction of the Howard A. Hanson Dam and in 1955, funding was appropriated for construction. "The dedication of the Howard Hanson Dam in May 1963 heralded the onset of industrial conversion. For the first time in history, development in the Valley could proceed without risk of destruction by annual flood waters.[68]" Development mushroomed as a result and, "[e]ager to expand its tax base and sphere of influence, the City of Kent moved forward [and] a rush of annexations began in 1954 and peaked in the years between 1957 and 1960 [where] the city had spread from one square mile in 1953 to 12.7 square miles in 1960.[69]" As development expanded, so did population. In 1960, the U.S. Census Bureau estimated the population of Kent to be 9,017[70] constituting a 175% increase from the previous decennial census. The trend continued where in 1970, Kent's population grew another 135.5% with 21,510 people living in the City.

The history of engineered flood attenuation in the Green River Valley encompasses a timeframe spanning from the turn of the 19th century; with the anomalous diversion of the White River and the man-made diversion of the Cedar River for the Lake Washington Ship Canal, among other feats; to the late 1960s when the flows of the White and Green rivers were controlled by Mud Mountain and Howard Hanson Dams. Accordingly, from 1910[71]to 1970, as provided below in Table 1.5, the city of Tukwila grew in population by over 868%. More striking is the growth of Kent where, during the 70-year history of Green River Valley flood control, the City's population inflated by over 2749%.

Table 1.5

	% Change from 1900-1970 (OFM)	*% Change from 1900-1970 (U.S. Census)*		*% Change from 1910-1970 (OFM)*	*% Change from 1910-1970 (U.S. Census)*
Kent	2098.15%	2749.01%	Tukwila	872.02%	868.42%

By the foregoing material, it is clear that the history of man-made flood control in the Green River Valley has systematically resulted in the historic expansion and development of the Green River Valley – from the turn of the 19th Century to the present. Conversely, it is reasonable to infer that such development would not be feasible or even conceivable without the historic flood control infrastructure of the Green River Valley.

The PEIS dismisses the history of the Green River Valley where it states, "Seattle and Tacoma, two of the largest city centers in Western Washington…have seen large and rapid growth between 1960 and 2010

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67 Florence K. Lentz, *Kent, Valley of Opportunity, An Illustrated History,* (Windsor Publications, Inc. 1990), p. 41

68 *Id.*, p. 75.

69 Florence K. Lentz, *Kent, Valley of Opportunity, An Illustrated History,* (Windsor Publications, Inc. 1990), p. 68-69

70 Bureau of the Census, Characteristics of the Population, Vol. 1, Part 49, Washington, 1970, p. 49-13.

71 The earliest census data for the city of Tukwila begins during the 1910 decennial census. See: Department of Commerce, Bureau of the Census, *Thirteenth Census of the United States Taken in the Year 1910*, Vol. 3, p. 986.

which has resulted in increases in population and density within surrounding areas, including Kent (925% growth) and Tukwila (1004% growth; U.S. Census Bureau 1961, 2016). In contrast, the Chehalis Basin is removed from major metropolitan areas, and the largest city in proximity to Centralia and Chehalis is Olympia…[72]"

The distinction that is asserted here, between the Chehalis Basin, as it stands today, and the *major metropolitan areas* that currently exist, once again sidesteps the question of future development potential. The Chehalis Basin is not so far removed from a major metropolitan area as the city of Kent was at the turn of the 19th Century. Over time, flood control of the Green River Valley affected changes of monumental proportions to the metropolitan areas of Seattle and Tacoma where, as a result, expansion of south King and north Pierce Counties exploded. To compare the results of this expansion, to the current profile of the Chehalis Basin is to compare apples-to-pineapples.

The location of the Chehalis Basin however is inherently centric to both inter and intrastate commerce. Lewis County's Comprehensive Plan declares its competitive position regarding economic development:

> "Lewis County's location on the I-5 Corridor is an extremely valuable asset as it provides access and visibility to the County from much of the region. This attribute is particularly important, as much of the development pressure in the Puget Sound region is expanding north, south and east along the interstate corridors. Lewis County is centrally located between Seattle and Portland. The state highways are also important as they provide access to the county from surrounding areas. US Highway 12 is one of only three Washington highways that cross the Cascades and are open year-round.[73]"

The Chehalis Basin has never before seen the flood control that is proposed in the PEIS thus the foregoing history of the Green River Valley is most certainly congruous to the question: "Could urban development and population increase in the floodplain after a flood retention facility is constructed?[74]"

Growth: A Folly of Reciprocity

Growth management, natural resource land conversion, and critical areas protection share problems related to governmental costs and efficiency. The unwise development of natural resource lands or areas susceptible to natural hazards may lead to inefficient use of limited public resources, jeopardize environmental resource functions and values, subject persons and property to unsafe conditions, and affect the perceived quality of life. It is more costly to remedy the loss of natural resource lands or critical areas than to conserve and protect them from loss or degradation. The inherent economic, ecological, social and cultural values of natural resource lands and critical areas should be considered in the development of strategies designed to conserve and protect these lands.[75] When classifying and designating natural resource lands and critical areas, counties and cities should integrate regulatory and nonregulatory approaches together in a comprehensive program that relates to existing local, state, and federal efforts. An integrated approach should also consider other applicable planning requirements, including… the need to include the best available science in policies and regulations protecting critical areas.[76]

That provision of the Washington Administrative Code is congruous with the Legislative Declaration of State Policy on Environment and Utilization of Natural Resources [77] where: "The legislature recognized and declares it to be the policy of this state, that it is a fundamental and inalienable right of the people of the state of Washington to live in a healthful and pleasant environment and to benefit from the proper

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[72] PEIS; Appendix L; Sub-Appendix A; *Howard Hanson Dam Case Study*, p. A-1.

[73] *Lewis County Comprehensive Plan; Economic Development Element*, December 27, 2010, p. 3-4

[74] PEIS; Appendix L; Sub-Appendix A; *Howard Hanson Dam Case Study*, p. A-1.

[75] WAC 365-190-020

[76] *Id.*

[77] RCW 43.21A.010

development and use of its natural resources. The legislature further recognizes that as the population of our state grows, the need to provide for our increasing industrial, agricultural, residential, social, recreational, economic and other needs will place an increasing responsibility on all segments of our society to plan, coordinate, restore and regulate the utilization of our natural resources in a manner that will protect and conserve our clean air, our pure and abundant waters, and the natural beauty of the state.[78]

Because the PEIS evaluates large-scale flood damage reduction actions, the importance of the foregoing provisions are paramount to the Chehalis Basin Strategy. As detailed later on, potential ramifications stemming from the proposed Actions within the PEIS are likely to affect social, economic and environmental harm by precipitating the inefficient uses of limited public resources, jeopardizing environmental resource functions and values, subjecting persons and property to unsafe conditions, and or affect the perceived quality of life.

Watersheds in the Pacific Northwest coastal ecoregion play a vital role in shaping and supporting diverse cultures and professions. Specific characteristics of streams and rivers reflect an integration of countless physical and biological processes, providing a long-term memory of environmental conditions. Streams and adjacent riparian forests provide clean water, habitat for fish and wildlife, recreational opportunities, raw materials, and spiritual values for many American and Canadian cultures (Salo and Cundy 1987, Raedeke 1988, Naiman and Decamps 1990, Gregory et al. 1991). In combination, these features have enormous value but represent substantial managerial difficulties, especially when competing interests vie for limited resources. Difficult issues are magnified when natural ecological processes and their variability in space and time are poorly understood (Decamps and Naiman 1989). For over a century, human alteration of the Pacific Northwest has proceeded without a basic understanding of watershed dynamics, especially for the stream corridors, or of the long-term consequences of land use alterations.[79]

In common with the citizens of the State, the effected environment of the PEIS includes the traditional lands and waters of two federally recognized Indian tribes – the Quinault Indian Nation and the Confederated Tribes of the Chehalis Reservation. What may be uncommon, is that the *perceived quality of life* for the Quinault Indian does not hinge so much on a life of tangible economic prosperity but more so on the quality of the intangible; that is, our way-of-life. Pursuing wildlife resources through hunting and fishing has always been vitally important to many Native American tribes. Many tribes still depend on hunting and fishing as a source of food, income, and employment. Yet, for many tribal members hunting and fishing represents not only a livelihood, but a way of life. Often, these practices are fundamental to maintaining a tribe's culture, traditions, and sense of community.[80] In 1905, the intrinsic value of the "Indian-way" was most poetically memorialized by U.S. Supreme Court Justice Joseph McKenna; writing for the majority in the landmark treaty rights case United States v. Winans (Winans Decision):

> The right to resort to the fishing places in controversy was part of larger rights possessed by the Indians, upon the exercise of which there was not a shadow of impediment, and which were not much less necessary to the existence of the Indians than the atmosphere they breathed...In other words, the treaty was not a grant of rights to the Indians but a grant of rights from them – a reservation of those not granted.[81]

The importance of hunting and fishing to Native American culture cannot be overestimated. To fully understand the importance of these rights, it is essential to first understand the Native American worldview. Native Americans believe that they are part of the earth, and that the earth is part of them. They believe the

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78 *Id.*

79 Robert J. Naiman, Timothy J. Beechie, Lee E. Benda, Dean R. Berg, Peter A. Bison, Lee H. Macdonald, Matthew D. O'Connor, Patricia L. Olson, and E. Ashley Steel, *Fundamental Elements of Ecologically Healthy Watersheds in the Pacific Northwest Coastal Ecoregion*, 1992, p. 128.

80 Sarah A. Garrott, *New Ways to Fulfill Old Promises: Native American Hunting and Fishing Rights as Intangible Cultural Property*, Oregon Law Review, Vol. 92, 2014, p. 572.

81 United States v. Winans, 198 U.S. 371, 381 (1905).

flora and fauna of the earth are their relatives, and that all human and nonhuman objects possess a soul. Accordingly, Native Americans view the world as a society, rather than a mechanism, that is made up of beings, rather than objects. "Whether human or nonhuman, these beings are associated with and related to one another socially . . . in the same ways as human beings to one another. These patterns of association and relationship may be structured in terms of kinship, empathy, sympathy, reciprocity, sexuality, dependency" or any other ways humans interact with each other. "Plants, animals, rocks, and stars are thus seen not as 'objects' governed by laws of nature, but as 'fellows' with whom the individual or band may have a more or less advantageous relationship."[82]

What is common between the Indian-way and the will of the Legislature is the mutual vigor of reciprocity. The Merriam-Websters Dictionary defines the word reciprocal as:

- shared, felt, or shown by both sides
- serving to reciprocate : consisting of or functioning as a return in kind[83]

The significance of reciprocity is embedded in both the Indian-way as well as in the aforementioned tenets declared by the State Legislature. The Legislature declared that it is a fundamental and inalienable right of the people of the state of Washington to live in a healthful and pleasant environment and to benefit from the proper development and use of its natural resources.[84] And today, by way of the Treaty of Olympia (1856), the Indian-way of the Quinault Indian Nation is a property right protected by the Constitution of the United States where, as mentioned, the Winans Decision provides that, "the treaty was not a grant of rights to the Indians but a grant of rights from them – a reservation of those not granted.[85]" Therefore, the right of taking fish at all usual and accustomed grounds and stations breathes life to our way-of-life whereby stewardship of our land is reciprocated by the return of healthy stocks of salmon.

Barring Alternative 4, the PEIS entirely misses the mark of reciprocity by focusing on a single generation of Washington State Citizens and by proposing flood damage reduction actions that attempt to engineer the Chehalis Basin out of 400 million years of evolution. Only a folly could ever attempt to conquer or subdue the evolution of the Pacific Northwest without affecting lasting or permanent adverse change. As explained in forthcoming sections, the development potential of the Build Out Analysis represents the cause of the exploitation of land but disregards its effect on a way-of-life.

The Adversity of Prosperity

The context of the Build Out Analysis is limited solely to that of development potential or the continued urbanization of the modeled 100-year floodplain. The Analysis also acknowledges the current and historical economic prosperity of the Green River Valley – which, in the Case Study, stems from the flood control measure of the Howard Hanson Dam in the early 1960s. The prosperity of the Green River Valley however, is built upon generations of cause and effect where the negative aspects of urbanization perpetuate to this day. These aspects are entirely absent in the Build Out Analysis and the PEIS as a whole.

Today, there exists $7.3 billion in floodplain structures and contents in the Green River Valley. There are 22,000 residents, 100,000+ jobs, 100 million sf of warehouse and distribution space (2nd largest on the West Coast), and the Valley comprises 1/8th of the GDP for the entire State of Washington, with an annual taxable revenue of $8 billion.[86] This tangible prosperity of billions upon billions of dollars is protected from flooding by miles and miles of engineered dikes and levees, dams on the Cedar, Green and White Rivers as well as historical actions such as the complete diversion and elimination of rivers in the Valley. These

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82 Sarah A. Garrott, *New Ways to Fulfill Old Promises: Native American Hunting and Fishing Rights as Intangible Cultural Property*, Oregon Law Review, Vol. 92, 2014, p. 575.

83 "Reciprocal." *Merriam-Webster.com*. Merriam-Webster, n.d. Web. 12 Nov. 2016.

84 RCW 43.21A.010

85 United States v. Winans, 198 U.S. 371, 381 (1905).

86 Green River, King County, Washington, *System-Wide Improvement Framework (SWIF), Interim Report*, February 2016, p. 5-7.

changes have come at great cost to health and vitality of the natural environment of the Green River Valley and the ways-of-life that depend on it.

Historically, watersheds of the Puget Sound lowland ecoregion contained an abundance of complex, diverse, and productive salmonid habitat in the form of small stream ecosystems and associated riparian ecotones. However, development of these lowland watersheds has significantly impacted the ecological integrity of their aquatic ecosystems. The cumulative effects of watershed urbanization have resulted in a loss of natural forest and wetland cover, as well as a significant increase in impervious surface area. Riparian forests, floodplains, and off-channel wetlands have also been severely degraded by the incremental encroachment of residential and commercial development.[87]

The effects of watershed urbanization on streams are well documented. They include extensive changes in basin hydrologic regime, channel morphology, and physicochemical water quality. The cumulative effects of these alterations produce an in-stream habitat considerably different from that in which salmonids and associated fauna evolved. In addition, development pressure has a negative impact on native riparian forests and wetlands, which are intimately involved in stream ecosystem functioning.[88]

The following table summarizes the impacts of urbanization on aquatic ecosystems:

Table 2.0 - Summary of the impacts of urbanization on aquatic ecosystems.

Environmental Concern	Potential Impact	Cause - Source
Increase in Runoff-Driven Peak or Bankfull Stream Flows	Degradation of aquatic habitat and/or loss of sensitive species	Increased stormwater runoff volume due to an increase in basin imperviousness
Increase in Runoff-Driven Flooding Frequency & Duration	Degradation of aquatic habitat and/or loss of sensitive species	Increased stormwater runoff volume due to an increase in basin imperviousness
Increase in Wetland Water Level Fluctuations	Degradation of aquatic habitat and/or loss of sensitive species	Increased stormwater runoff due to an increase in basin imperviousness
Decrease in Dry Season Baseflows	Reduced aquatic habitat and less water for human consumption, irrigation, or recreational use	Water withdrawals and/or less natural infiltration due to an increase in basin imperviousness
Streambank Erosion and Stream Channel Enlargement	Degradation of aquatic habitat and increased fine sediment production	Increase in stormwater runoff driven stream flow due to an increase in basin imperviousness
Stream Channel Modification due to Hydrologic Changes and Human Alteration	Degradation of aquatic habitat and increased fine sediment production	Increase in stormwater runoff driven stream flow and/or channel alterations such as levees and dikes
Streambed Scour and Incision	Degradation of aquatic habitat and loss of benthic organisms due to washout	Increase in stormwater runoff driven stream flow due to an increase in basin imperviousness

[87] Christopher W. May and Richard R. Horner, *The Cumulative Impacts of Watershed Urbanization on Stream-Riparian Ecosystems*, (date unknown), at Introduction.
[88] *Id.*

Excessive Turbidity	Degradation of aquatic habitat and/or loss of sensitive species due to physiological and /or behavioral interference	Increase in stormwater runoff driven stream flow and subsequent streambank erosion due to an increase in basin imperviousness
Fine Sediment Deposition	Degradation of aquatic habitat and loss of benthic organisms due to fine sediment smothering	Increase in stormwater runoff driven stream flow and subsequent streambank erosion due to an increase in basin
Sediment Contamination	Degradation of aquatic habitat and/or loss of sensitive benthic species	Stormwater runoff pollutants
Loss of Riparian Integrity	Degradation of riparian habitat quality and quantity, as well as riparian corridor fragmentation	Human development encroachment and stream road crossings
Proliferation of Exotic & Invasive Species	Displacement of natural species and degradation of aquatic habitat	Encroachment of urban development
Elevated Water Temperature	Lethal and non-lethal stress to aquatic organisms – reduced DO levels	Loss of riparian forest shade and direct runoff of high temperature stormwater from impervious surfaces
Low Dissolved Oxygen (DO) Levels	Lethal and non-lethal stress to aquatic organisms	Stormwater runoff containing fertilizers and wastewater treatment system effluent
Lake & Estuary Nutrient Eutrophication	Degradation of aquatic habitat and low DO levels	Stormwater runoff containing fertilizers and wastewater treatment system effluent
Bacterial Pollution	Human health (contact recreation and drinking water) concerns, increases in diseases to aquatic organisms, and degradation of shellfish harvest beds	Stormwater runoff containing livestock manure, pet waste, and wastewater treatment system effluent
Toxic Chemical Water Pollution	Human health (contact recreation and drinking water) concerns, as well as bioaccumulation and toxicity to aquatic organisms	Stormwater runoff containing toxic metals, pesticides, herbicides, and industrial chemical contaminants
Reduced Organic Matter (OM) & Large Woody Debris (LWD)	Degradation of aquatic habitat and loss of sensitive species	Loss or degradation of riparian forest and floodplain due to development encroachment
Decline in Aquatic Plant Diversity	Alteration of natural food web structure and function	Cumulative impacts of urbanization
Decline in Aquatic Invertebrate Diversity	Alteration of natural food web structure and function	Cumulative impacts of urbanization
Decline in Amphibian Diversity	Loss of ecologically important species	Cumulative impacts of urbanization
Decline in Fish Diversity and Abundance	Loss of ecologically important species	Cumulative impacts of urbanization

Source: Christopher May, *Watershed Processes and Aquatic Resources: A Literature Review*

The impacts of urbanization of the Green River Valley are such that the current habitat quality of the Green River valley is highly degraded. This degradation takes the form of stream channelization, increased sedimentation, impaired water quality, minimal wetland and riparian buffers, and disturbed hydrological regimes. The Green River, restricted by riprap and earthen levees, is no longer able to enter its flood plain; and therefore natural channel migration processes, riparian corridors, wetland development, off-channel habitat, and large woody debris (LWD) recruitment have been virtually eliminated in the middle and lower Green sub-watersheds. All of these elements are crucial to the formation of suitable salmonid habitat.[89] The scarcity of properly functioning freshwater and marine habitat in Central Puget Sound basins means that hatchery fish produced from local broodstock will remain essential for salmon harvest and conservation. In these basins, the Puget Sound Chinook Recovery Plan goal of self-sustaining and harvestable salmon populations is not likely achievable in the foreseeable future. [90] Further, as a result of the outright elimination of the Black River and the diversion of the Cedar River into Lake Washington, Coho, Chum and Pink Salmon runs were unable to migrate through Lake Washington and were permanently extinguished from existence.[91] A steady loss in habitat of the Green-Duwamish River, White-Puyallup River and Lake Washington is illustrated in the following table:

Tribal Indicator	Status	Trend Since SOW 2012 Report
Water Quality	Approximately 193 miles of stream in WRIAs 8, 9, and 10 are listed as "impaired waters" by the Washington State Department of Ecology 2012 Water Quality Assessment. An additional 42 miles in WRIAs 8 & 9 are assumed to exceed water temperature standards for fish, based on adjacent impairments or other data.	Declining
Coho Pre-Spawn Mortality	Based on NOAA and USFWS models, 269 stream miles or 56% of known coho distribution in the Green-Duwamish and Lake Washington basins are predicted to have a PSM rate of 5% or more, with 141 miles predicted to have 35%-100% PSM.	Declining
Water Wells	From 2010-2014, wells increase by 4.5% (369) in the Lake Washington and Green-Duwamish basins. The Puyallup-White basin saw a 2.6% increase (101) in wells. From 2010-2014, 26 new wells were added to the already existing 1,314 wells in the Soos Creak Basin. Summer-fall flows in Big Soos Creek show a statistically significant decline that coincides with development of municipal and private wells in the subbasin.	Declining
Water Quality - Low Flows	A total of 482 miles of streams in the Lake Washington and Green-Duwamish basins are identified as having low streamflow problems, while in the Puyallup-White basins there are 120 miles of stream with low flow concerns.	Declining
Impervious Surface	From 2006 to 2011, there was a slight increase (1.3%) in impervious surface corresponding to the economic recession. The trend is for a growing human population and more construction activity adding more impervious land cover.	Declining
Shoreline Modifications/Forage Fish Impacts	From 2005 to 2014, shoreline modifications have shown a positive trend in King County, with more armoring being removed than constructed. During this time period, 681 feet of new armoring were constructed, along with the removal of 903 feet. 2.6 miles of armoring were replaced during the same time period. An estimated 82% of Lake Washington's shoreline remains heavily modified with bulkhead and riprap.	Declining
Overwater Structures	Since 2011, Lake Washington and Lake Sammamish have seen an increase of about 60 (1%) new docks, making a total of 4,157 overwater structures.	Declining
Large Woody Debris	Wood counts in the lower Cedar and Green rivers have less than 5% of the expected key piece quantities. Watershed Analysis data on large woody debris (LWD) in the upper White River (above Mud Mountain Dam) suggests the LWD and key piece quantities is in a "poor" condition as it relates to necessary functions for salmon habitat.	Declining

Source: Muckleshoot Indian Tribe, *2016 State of Our Watersheds Report Green-Duwamish River, White-Puyallup River and Lake Washington Basins,* 2016, p. 103.

[89] U.S. Department of the Army, Seattle District, Corps of Engineers, *Riverview Park Ecosystem Restoration Side Channel Construction,* City of Kent, Kent, WA, July, 2011, p. 1.

[90] Muckleshoot Indian Tribe, *2016 State of Our Watersheds Report Green-Duwamish River, White-Puyallup River and Lake Washington Basins,* 2016, p. 100; United States v. Washington, 384 F. Supp. 312 (W.D. Wash. 1974), aff'd, 520 F.2d 676 (9th Cir. 1975), at 367.

[91] *Id.*

In addition to the current and continued degradation of habitat in the Green River Valley; as well as the outright extinction of Cedar River Chum and Pink salmon, and the extirpation of the Black River Coho; the Puget Sound Stocks of Chinook and Steelhead are currently listed as threatened[92] under the Endangered Species Act. Additionally, most professional fishery biologists feel that Spring Chinook are either extinct or returning in such low numbers as to not constitute a distinct stock in the Green River.

The late Billy Frank Jr. once wrote, "[w]e must realize that every time any species of fish or wildlife dies, a part of us dies with it.[93]" The prosperity of the Green River Valley has come at great cost – particularly to the Muckleshoot Indian Tribe. Like all treaty tribes in Washington, the Muckleshoot Indian Tribe signed a treaty with the United States where, in exchange for ceding millions of acres of land, tribes reserved various rights and interests. One way to look at it, those treaties and the rights that makeup them established the contemporary identity of treaty tribes where, with respect to fish, "the right of taking fish at all usual and accustomed grounds and stations" became, impart, the identity of the Treaty Tribe. And so it goes, if there are no fish, then what do treaty tribes have a right to? Again, as Billy Frank, Jr. put it, "every time any species of fish or wildlife dies, a part of us dies with it.[94]"

Flood damage cannot be distinguished solely by dollars and cents or real property. As provided in the Washington Administrative Code, "it is more costly to remedy the loss of natural resource lands or critical areas than to conserve and protect them from loss or degradation." To that end, when assessing Build Out or proposing flood control measures, we must look north to the Green River Valley and the Muckleshoot Indian Tribe and ask ourselves, how may we ever remedy an imminent loss of life if we take away the air we breathe?

Development: Beyond the Floodplain Bounds

"The [Build Out] Analysis compares combinations of EIS action elements that correspond with the following EIS alternatives:

- No Action Alternative
- Alternative 1: 2014 Governor's Workgroup Recommendation (which includes Flood Retention Facility and Airport Levee Improvements)
- Alternative 2: Structural Flood Protection Without Flood Retention Facility (which includes Airport Levee Improvements and Interstate 5 [I-5] Projects)[95]"

The Build Out Analysis does not examine Alternative 3 nor does it examine the Restorative Flood Protection Action Element; Alternative 4. "Information for Alternative 4: Restorative Flood Protection is not available at this time; an evaluation of the build out potential associated with that alternative may be included in the future when data are available, as an addendum to this report.[96]"

Chapter 3 of the PEIS describes the *Affected Environment* where "the resources of the Chehalis Basin Study Area that could be affected by construction and implementation of the EIS action elements and combined alternatives[97]" are illustrated. Among these resources is *Land Use;* which is portrayed to encompass the following elements:

- *Regulatory Overview*
- *Land Ownership*

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92 Federal Register, Vol. 72, No. 91, Friday, May 11, 2007, Rules and Regulations, p. 26722; Federal Register, Vol. 79, No. 71, Monday, April 14, 2014, Rules and Regulations, p. 20802.

93 Billy Frank, Jr., *Being Frank, We Are Not Alone,* 1995.

94 *Id.*

95 PEIS, Appendix L; *Build Out Analysis,* p. 1.

96 *Id.*

97 PEIS, Chapter 3, *Affected Environment,* p. 77.

- *Distribution of Land Uses in the Chehalis Basin* represent

Within the *Land Ownership Element,* the PEIS declares that "[m]ost of the land within the Chehalis Basin is privately owned…[98]" Table 3.10-1 delineates land ownership:

Table 3.10-1
Land Ownership in the Chehalis Basin

OWNERSHIP		PERCENTA
Public	State government	13%
	Federal government	7%
	Local government	2%
Tribal		<1%
Private		77%

Source: DNR
(https://fortress.wa.gov/dnr/adminsa/gisdata/metadata/cadastre_parcel.htm

Distribution of Land Uses in the Chehalis Basin includes various land cover types including: *Agriculture; Forestlands, Grasslands, Wetlands; Developed;* and *Bare Ground.* Table 3.10-2 delineates *Land Cover Types in the Chehalis Basin and the Chehalis River Floodplain:*

Table 3.10-2
Land Cover Types in the Chehalis Basin and the Chehalis River Floodplain

LAND COVER TYPES	CHEHA LIS	CHEHALIS RIVER	TYPES OF LAND USES
Agriculture	5%	41%	Livestock grazing, crop farming, and commercial dairy operations
Forestlands, Grasslands, Wetlands	80%[1]	39%	Timber production, recreation
Developed	7%	11.5%	Residential homes, shopping centers, industrial facilities
Bare Ground	8%	8.5%	Gravel or sand bars (Grays Harbor), water, landslide areas, gravel pits

The purpose of the Build Out Analysis is to "evaluate potential development, or build out, in the modeled Chehalis River 100-year floodplain…to inform the land use analysis (element) in the [PEIS].[99]" As provided above, the *Land Use* element is not confined solely to the 100-year floodplain but rather; the *Land Use* element encompasses the entire Chehalis Basin as a whole. Additionally, the PEIS acknowledges direct and indirect significant adverse impacts to other elements of the environment, such as *Fish, Groundwater, Geology*, et al., caused by actions that are associated with development. Therefore, the outright failure of the Build Out Analysis to evaluate potential development beyond the bounds of the 100-year floodplain fundamentally falls short at adequately informing the *Land Use* element of the PEIS.

Notwithstanding Table 1.0 and the information of the previous section, the PEIS acknowledges, among other statements, the following adverse impacts to *Fish, Groundwater* and *Geology* – associated with development:

[98] PEIS, Chapter 3, *Affected Environment: Land Use,* p. 196.
[99] PEIS, Appendix L; *Build Out Analysis,* p. 1.

> "The construction of new roads…has the potential to increase the amount of impervious surface adjacent to the Chehalis River and runoff carrying fine sediment. High levels of fine suspended sediment in the water could cause a direct impact on fish by causing gill abrasions, which is a hazard to fish health. In addition, there could be an indirect impact on fish because sedimentation slows the delivery of oxygenated water through spawning substrate to incubating eggs, and high turbidity interferes with vision, impairing foraging and predator avoidance behaviors.[100]"

> "Relocating floodplain land uses to upland areas could result in an adverse impact on groundwater depending on the location, and associated magnitude of subsurface excavation and resulting impervious surface.[101]"

> "[R]ural development and agricultural use, resulting in some amount of increased impervious surfaces and exposed soils. Increased rates of runoff and sediment delivery to stream channels would be expected (Beechie et al. 2013).[102]

> "Many studies have also documented increases in landslides and surface erosion resulting from timber-harvesting and road-building practices (Dragovich et al. 1993; Dyrness 1967; Guthrie and Evans 2004; Jakob 2000; Ketcheson 1977; Montgomery et al. 2000; Robison et al. 1999; Swanson and Dyrness 1975; Swanson et al. 1987; Swanston 1974).[103]"

By its nature, the Restorative Flood Protection Alternative negates the harmful effects of land disturbance. Additionally, Alternative 4 builds resiliency to those harmful effects as well as builds resiliency against the disastrous effects of Climate Change. This resiliency only gets better and stronger with time. The PEIS describes these benefits with regard to development:

> "The agricultural and other land uses within the floodplain areas to be treated would be relocated to areas outside the affected floodplains (up to 16,000 acres). As a result, upland areas currently having some form of forested cover would likely be converted to rural development and agricultural use, resulting in some amount of increased impervious surfaces and exposed soils. Increased rates of runoff and sediment delivery to stream channels would be expected (Beechie et al. 2013). However, these effects would be expected to be largely negated by watershed processes operating within the restored riparian forest and wetland corridors within the treated floodplain areas. Large, contiguous riparian corridors are effective at ameliorating effects of land disturbance located upstream (Naiman et al. 1992; Naiman et al. 2005).[104]"

Benefits of the Restorative Flood Protection Alternative that build resiliency to climate change stem from:

> "Overall, riparian and floodplain plantings, enhancement of floodplain wetlands, and shade to support cooler stream temperatures are expected to offset climate change impacts and forge a more resilient future floodplain…[105]

Alternative 4 is the only PEIS Alternative intended to create large, contiguous riparian corridors that are effective enough to ameliorate the harmful effects of land disturbance in the upper Chehalis Basin. Furthermore, the Restorative Flood Protection Alternative is the only PEIS Action Element that establishes the necessary resiliency to climate change that is vital to the future prosperity of the Chehalis Basin. Again, those benefits only grow stronger and better with time.

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100 PEIS, Chapter 4, *Action Elements: Impacts and Mitigation Flood Retention Facility (FRO and FRFA)*, p. 282.

101 PEIS, Chapter 4, *Action Elements: Impacts and Mitigation Restorative Flood Protection*, 334.

102 *Id.*

103 PEIS, *Combined Alternatives: Impacts and Mitigation Cumulative Impacts*, p. 520.

104 PEIS, Chapter 4, *Action Elements: Impacts and Mitigation Restorative Flood Protection*, p. 343.

105 *Id.*, p. 350.

The Build Out Analysis focuses on three Alternatives alone – No Action, Alternative 1 and Alternative 2 – none of which serve to offset the significant adverse impacts of development or climate change; or the necessary resiliency thereof.

As provided, the Restorative Flood Protection Alternative was completely omitted from the Analysis. The consequences of this omission are significant as, regardless of any PEIS Alternative(s) moving forward, future development in the Chehalis Basin is inevitable whereas the public and decision makers alike must be afforded the unabbreviated opportunity to consider any and all impacts – whether good or bad – that are associated with development in the Chehalis Basin.

Our Intangible Future

The circumstances of development potential and the Chehalis Basin Strategy as a whole are extraordinary. The crossroads of today are not so far removed from the cause and effect of yesterday. From the Chehalis Basin, we need not look any further than 90 miles north to Seattle or 90 miles south to Portland to find the extreme cause-and-effect of economic development. Since 1900 the Puget Sound region has changed from a thinly populated region with much wilderness still intact to one of reasonably dense population, with two large cities, both growing, and many small ones; intensive agriculture; and increasing industrialization… Indians had nothing to do with any of this change. That it has affected the salmon and steelhead, however, is beyond doubt. Puget Sound salmon landings for a period of years as reported by the Washington Department of Fisheries confirm the change… [I]f the numbers taken are any indication of the numbers present, the overall trend since 1913 has been downward.[106]

In 1953…the Department of Fisheries stated: 'The main cause of salmon depletion can be traced directly to environmental changes that have taken place since the advent of civilization in the Pacific Northwest.[107]

In 1958, Clarence F. Pautzke, then assistant director of the Department of Fisheries, wrote: "What has then reduced these runs so drastically and in many areas caused a complete loss of certain races? I believe the answer can be stated simply – the loss of environment to the fish.[108]"

The struggle of declines to salmon populations in the Puget Sound persists to this day. This trend is thus followed by the continued loss of habitat. We know that we cannot stop the massive population growth anticipated in this region over the coming decades, but we can ensure that the associated development is designed and implemented in ways that will better protect salmon and its habitat.[109] Salmon recovery is based on the crucial premise that we can protect what habitat remains while we restore previously degraded habitat conditions. Unfortunately, significant investments in recovery may not be realized because the rate of habitat loss continues to outpace restoration.[110]

Everything in U.S. history is about the land – who oversaw and cultivated it, fished its waters, maintained its wildlife; who invaded and stole it; how it became a commodity ("real estate") broken into pieces to be bought and sold on the market.[111] The late Native historian Jack Forbes always stressed that while living persons are not responsible for what their ancestors did, they are responsible for the society they live in, which is a product of that past. Assuming this responsibility provides a means of survival and liberation.[112]

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[106] American Friends Service Committee, *Uncommon Controversy, Fishing Rights of the Muckleshoot, Puyallup, and Nisqually Indians,* Second Paperback Edition (University of Washington Press, Seattle and London, 1975), p. 162

[107] *Id.* P. 165.

[108] *Id.*

[109] A Report from the Treaty Indian Tribes in Western Washington, *Treaty Rights at Risk, Ongoing Habitat Loss, the Decline of the Salmon Resource, and Recommendations for Change,* July 14, 2011, p. 7.

[110] *Id.*, p. 3.

[111] Roxanne Dunbar-Ortiz, *An Indigenous Peoples' History of the United States,* (Beacon Press; Boston, MA, 2014), p. 1.

[112] *Id.*, p. 235.

We Are Not Alone
March 1995

WE ARE NOT ALONE, and we will not survive alone. The world does not belong to us. We belong to it. These have been the beliefs of Indian People for thousands of generations.

This has been a fundamental difference with the non-Indian society which has made every effort in its western expansion to "conquer" Nature. An attempt by people to conquer Nature is, in our view, an attempt to conquer themselves. It makes no sense.

People must understand that we live in a delicate system of life in which every creature is important. The health of people is in the long run far more dependent on the survival of this system than its reliance on economic booms.

Over the past few generations, populations have skyrocketed and people have placed ever-increasing pressures on our precious environment. The focus has been placed on the exploitation of the last remaining oil reserves, the final parcels of property around rivers and lakes, the final drops of water and the last of the ancient trees. What good would a strong economy be in a world starkly devoid of life and natural resources? We must ask this question of ourselves as we make decisions that will affect the next millennium.

We need the bald eagle. We need the grey whale and the grizzly bear. We need the whooping crane and all other creatures that have been saved from extinction by laws such as the Endangered Species Act, the Clean Water Act, and the Timber/Fish/Wildlife Agreement. Around the world, species are going extinct each and every day and others are on the brink of extinction.

For the past 200 years, western society has forced change on the American Indian. In fact, we have been an endangered species. All this time we have spoken about the need to respect Nature, rather than just view her as something to be used. It is only through this respect that any of us, Indian or not, will survive.

Those who only relate to economics must come to the realization that economics are based on sound natural resources. Jobs and a strong economy are critically important, to be certain, but in the long run these things are just as dependent on healthy fish and wildlife as is our spiritual and natural heritage. We must realize that every time any species of fish or wildlife dies, a part of us dies with it.

BILLY FRANK, JR.
Being Frank
March 1995

ATTACHMENT 7

CHEHALIS BASIN STRATEGY DRAFT PROGRAMMATIC EIS INDEPENDENT REVIEW

Resource Dimensions

Economics | Community Solutions | Land Use | Natural Resources | Regulatory Support

Gig Harbor, Washington | www.ecologicalecon.com

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TABLE OF ACRONYMS & ABBREVIATIONS

ASHA	Aquatic Species Habitat Actions
BCR	Benefit-cost ratio
CBA/BCA	Cost-benefit analysis / Benefit-cost analysis
DOE	Washington State Department of Ecology
EIA	Economic Impact Analysis
ESA	Endangered Species Act
FRFA	Flood Retention and Flow Augmentation Facility
FRO	Flood Retention Facility
I-5	Interstate 5
IO	Input-output
MFP	Managed Forest Practices
NEPA	National Environmental Policy Act
NPV	Net Present Value
OFM	Washington Office of Financial Management
O&M	Operation and maintenance
OM&R	Operation, maintenance, and replacement
PEIS	Programmatic Environmental Impact Statement
QIN	Quinault Indian Nation
RCC	Roller-compacted concrete
SEPA	Washington State Environmental Policy Act
UV	Use Value
WDFW	Washington Department of Fish and Wildlife
Work Group	Governor's Chehalis Basin Work Group
WSDOT	Washington State Department of Transportation

PROJECT BACKGROUND AND PURPOSE

The Chehalis Basin is a large and ecologically diverse river basin in Western Washington. The Basin provides a wide variety of social, cultural, economic, and ecosystem benefits at multiple scales. The Basin also carries large and devastating floods that are predicted to worsen both in severity and frequency. Recent floods demonstrate this trend; the five most severe floods occurred in the last 30 years.

Flooding in the Chehalis Basin is a long-standing, complex problem. Recognition that solutions must be integrated geographically and across jurisdictions led to the creation of the Chehalis Basin Strategy. The Chehalis Basin Strategy is a collection of potential actions designed to reduce recurring flood damages and improve river habitat.

The Strategy consists of a No Action Alternative and four Action Alternatives. Potential actions include large-scale flood reduction actions (e.g. restorative flood protection or flood retention facility), local-scale flood reduction actions (e.g. floodproofing, land use management, and flood warning system), and habitat improvement actions. The Action Alternatives are combinations of possible actions.

Alternative 1 centers on a flood retention facility (dam) to reduce peak flood levels. Alternative 2 centers on structural flood protection (such as levees and interstate improvements) but no dam. Alternative 3 combines nonstructural flood protection such as floodproofing, land use management, and flood warning system improvements (no large-scale flood damage reduction actions). Alternative 4 reduces peak flood levels by restoring natural floodplain capacity and improving habitat. Each Alternative also includes various Aquatic Species Habitat Actions (ASHAs) to improve declining habitat conditions.

The Washington Department of Ecology (DOE) prepared a Draft Programmatic Environmental Impact Statement (PEIS) to evaluate impacts of the five alternatives. The Draft PEIS includes a benefit cost analysis of the alternatives (Appendix C), conducted by EES Consulting, Inc.

INTRODUCTION

In September 2016, the Quinault Indian Nation (QIN) retained Resource Dimensions of Gig Harbor, Washington to conduct an independent external peer review of the Draft Programmatic Environmental Impact Statement (published September 29, 2016) for the proposed Chehalis Basin Strategy Alternatives.

All sections of the draft PEIS and its appendices were reviewed, with focus on Appendix C, *Draft Economics Study Update* and Sections 3.5, and 4.2.5 to 4.8.5, *Tribal Resources*.

PURPOSE OF INDEPENDENT REVIEW

In general, the purpose of independent peer review is to strengthen the quality and credibility of decision documents. This independent peer review assesses the quality and effectiveness of the draft PEIS. The review addresses the accuracy, thoroughness, and technical soundness of scope, assumptions, methods, analyses, and calculations. As appropriate, we identify additional data or analyses required to make sound decisions regarding the selection and implementation of Alternatives. Further, we have addressed environmental impacts to the extent that they have accompanying socio-economic impacts.

The following questions are considered:

1) Are appropriate methods employed to fully evaluate the extent of economic and social impacts of the proposed actions?
2) Are the reviewed chapters internally logical, complete and consistent?
3) Does the draft PEIS meet the standard for addressing the potential for project activities to have disproportionately high or adverse human health or environmental effects on Tribes and minority and/or low-income populations, in accordance with Executive Order 12898?
4) Does the draft PEIS adequately address impacts/effects of alternatives on the QIN's utilization of treaty resources?
5) Does the draft PEIS appropriately address mitigation measures for potential damage to treaty resources?

SUMMARY OF INDEPENDENT REVIEW COMMENTS

Table 1 provides a summary of our findings. Comments are discussed in order following the summary table.

Table 1. Summary of Independent Review Findings

Comment #	Summary of Review Comments
Deficiencies	
1.	Limited scope of economic analysis; the extent and nature of economic impacts are unknown.
2.	Limited scope of economic analysis; report does not capture benefits and damages to ecosystem services, by alternative.
3.	The Economic Study fails to satisfy requirements of the Scope of Work in employing appropriate methods to determine monetary or quantitative estimates for certain impacts.
4.	The Draft PEIS fails to include a cumulative impact analysis as a component of the economic analysis.
5.	The BCA contains errors, inconsistencies, and omissions. As conducted, the BCA, is of limited use.
6.	Estimating future economic benefits of flood risk management involves significant uncertainties that are not adequately addressed in the draft PEIS.
7.	The analysis and discussion of climate change and associated economic impacts presented in the Economics Study Update is of limited usefulness.
8.	Calculations of economic and ecological benefits do not consider the economic opportunities for carbon sequestration or forest management.
9.	Future costs associated with projected environmental mitigation are not adequately detailed by Alternative.
10.	Costs presented in Chapter 3 are not discounted and cannot be compared.
11.	Piecemeal submission of corrections, modifications and explanatory documents post-release of the draft PEIS together with data gaps, incomplete analysis and errors render the Economics Study (Appendix C) of very little utility in providing the public and decision makers with accurate, transparent and comprehensive information on the economic impacts, by alternative.

Table 1. Summary of Independent Review Comments (continued)

Issue #	Summary of Review Comments
Errors, Inconsistencies, Omissions, Incomplete or Underestimated	
12.	Numerous errors occur throughout the draft PEIS Economics Study.
13.	Several important costs are incomplete and underestimated.
14.	Fishery Use Values are underestimated because analysis does not include impacts to fish populations outside the Chehalis Basin.
15.	Uncertainty analysis is incomplete and does not include potential cost overruns and construction delays, and explanation of range is piecemeal.
16.	Many costs have not been included and the analysis is not complete.
17.	The value of ecosystem services is not considered.
18.	No attempt is made to quantify, evaluate, or otherwise address certain potentially significant impacts, by Alternative.
19.	No attempt is made to quantify the effects of build-out scenarios.
20.	Impacts to recreation are understated and not quantified.
21.	No analysis of potentially disproportionate adverse impacts on minority populations, low-income populations, or Indian tribes in the affected area has been conducted.
22.	No sensitivity analysis has been conducted on BCRs estimated for Alternatives.
23.	Lack of explanation for tables and figures hinders interpretation and creates confusion.
24.	Substantiating citations to technical documents, data, or other information are generally lacking throughout the report.
25.	Treatment of the managed forestlands benefit is inconsistent with the draft PEIS.
26.	The cost-benefit analysis presented in the draft PEIS is incomplete and flawed to the extent that it should not be used in decision making context.

FINDINGS

METHODS AND APPROACH

GENERAL COMMENTS

The economic and environmental issues surrounding the Chehalis Basin Strategy Alternatives are complex, and the analyses necessarily involve many uncertainties. We identify concerns in the Draft PEIS and relevant appendices regarding the breadth and detail of the Economic Study. Overall, the economic analysis presented in Appendix C and the Draft PEIS are poorly executed.

Section 2.1 of Appendix C states that "BCA is the valuation of changes in societal welfare..." While benefit-cost analysis (BCA) arguably assists in promoting rational decision-making, the reality is that the use of BCA requires definite numbers on each side of the balance sheet to accurately compare costs and benefits across all alternatives. The purpose of any good BCA is to identify and monetize all effects of proposed policies or projects. Any project will result in positive impacts (benefits) for some stakeholders, and negative impacts (costs) for others. Thus, assessing who are the gainers and losers from a project or changed policy — who bears the costs and who reaps the benefits and to what extent — is the essence of BCA.

In general, BCA suffers from major methodological limitations. Many complex environmental management issues, such as those associated with flooding in the Chehalis Basin, involve unavoidably uncertain outcomes. Carefully conducted, BCA can offer an educated estimate of the best alternative. However, even when done well, present and future benefits and costs are unpredictable; precision in economic efficiency and social welfare are not guaranteed.

Further, Section 2.1 goes on to say that "...EIA is a measure of changes in expenditures resulting from a project." This is a gross over simplification and misrepresentation of how economic impact analysis (EIA) explains the effects of a particular project on a local, regional, national, or global economy.

EIA is a quantitative analytical method used to estimate and examine the positive or negative changes in business revenues and profits, personal wages, jobs and relevant taxes that a particular action brings to economies and communities surrounding a project. In estimating the total economic impact, EIA evaluates the direct, indirect, and induced impacts from projects.

Appendix C suggests that the economic analysis conducted for the four Alternatives evaluates "... the changes in expenditures as measured in the EIA framework." We find no evidence that an EIA has been conducted.

SUMMARY OF MAJOR FINDINGS

This independent review draws the following major findings regarding the current Economic Study and results of the BCA:

1) **We find that traditional benefit cost analysis alone is not a suitable approach to evaluating the extent of economic impacts of the proposed Alternatives.**

2) **The range of errors, omissions, deficiencies and inconsistencies within the draft PEIS Economic Study Update (Appendix C) indicate substantial additional work is required to ensure that the document provides the public and decision makers with accurate, easily understood, and transparent findings on which to evaluate Alternatives. The inadequacies in the current draft PEIS are not acceptable; a revised analysis must be submitted for public comment.**

3) **The Economic Study Update generally fails to present logical, consistent, and supported information. On these failures alone, the draft PEIS violates SEPA and would not withstand judicial review.**

4) **The BCA presented in the draft PEIS is incomplete and flawed to the extent that it should not be used in decision making context.**

REVIEW FINDINGS

DEFICIENCIES

Independent review has identified several important deficiencies. Comments with an importance factor of one are most important, three the least. Discussion of specific limitations and deficiencies that affect the validity of analysis and findings, thus utility of the BCA, follow Table 2.

Table 2. General Deficiences

Comment #	Page(s)	Section	Importance Factor	Comment
1	General		1	Limited scope of economic analysis; the extent and nature of economic impacts are unknown.
2	1, 32	1, 4	1	Limited scope of economic analysis; report does not capture benefits and damages to ecosystem services, by alternative.
3	General		1	The Economic Study fails to satisfy requirements of the SOW in employing appropriate methods to determine monetary or quantitative estimates for certain impacts.
4	General		2	The Draft PEIS fails to include a cumulative impact analysis as a component of the economic analysis.
5	General		1	The BCA contains errors, inconsistencies, and omissions. As conducted, the BCA is of limited use.
6	24-37	4	1	Estimating future economic benefits of flood risk management involves significant uncertainties that are not adequately addressed in the draft PEIS.
7	C-6	Appendix C	2	The analysis and discussion of climate change and associated economic impacts presented in the Economics Study Update is of limited usefulness.
8	24-37	4	2	Calculations of economic and ecological benefits do not consider the economic opportunities for carbon sequestration or forest management.

Table 2. General Deficiences (continued)

Comment #	Page(s)	Section	Importance Factor	Comment
9	18-23	3	2	Future costs associated with projected environmental mitigation are not adequately detailed by Alternative.
10	18-23	3	2	Costs presented in Chapter 3 are not discounted and cannot be compared.
11	General		1	Piecemeal submission of corrections, modifications and explanatory documents post release of the draft PEIS together with data gaps, incomplete analysis and errors render the Economics Study (Appendix C) of very little utility.
Additional	18, 32, 26, 28	3, 4	3	Overuse of averages (e.g. cost estimates, managed forestlands, flood depths, and acreage of cropping patterns).

1. **Limited scope of economic analysis; the extent and nature of economic impacts are unknown.**

   The Economics Study Update implies than an economic impact analysis (EIA) has been conducted (p. 17). No EIA has been conducted. And, while reference is made to Appendix N of the 2014 study, the Appendix itself is referred to as an "Economic Primer," (pp. 223-226) wherein the discussion focuses on the differences between CBA and EIA. Again, no EIA has been conducted.

   Of additional concern is the suggestion that together BCA and EIA result, "...in a complete measure of economic benefits." This comment, the limited scope of the BCA, and the misleading statements outlined above create a false picture of the total economic impacts.

   If analyses employed in the Economic Study Update or the 2014 study had followed standard impact analysis methodology, the reports would have, at minimum, summarized the quantitative scale of impacts for each Alternative in a meaningful way (e.g. economic impacts such as business and tax revenue generated and jobs created). Among other things, the quantification of impacts provides comparability, which informs the Alternatives decision.

   Further, the draft PEIS identifies several impacts that have economic consequences (addressed in this review in Comments 2, 4, 17, among others), which should be examined to give decision-makers an accurate understanding of the potential impacts of each alternative on local economies. WAC 197-11-440(6)(a) states that the affected environment, significant impacts, and mitigation sections of an EIS shall "analyze significant impacts of alternatives including the proposed action."

   We find that the methods used to conduct economic assessment do not include accepted EIA practices and the data required to conduct such an alternative-based analysis are missing from

the draft PEIS. As conducted, the economic analysis leads to unsubstantiated inferences and interpretations of impacts that are both incomplete and difficult to interpret as reasonable.

2. **Limited scope of economic analysis; report does not capture benefits and damages to ecosystem services, by alternative.**

   Ecosystem services are products and services provided by the environment. Any improvements or damages to the environment have impacts on ecosystem services that can be assigned a dollar value using well-established scientific methods. Chapter 4 of the draft PEIS outlines a series of environmental impacts. Appendix C, however, makes no attempt to quantify the non-market values associated with those impacts. The draft PEIS implicitly recognizes the importance of including environmental impacts by monetizing fish populations; monetizing a token environmental impact does not make all other environmental impacts disappear.

   Each of the four alternatives has a different portfolio of impacts. To fully evaluate the economics of each alternative, the draft PEIS should look at improvements and damages to ecosystem services and their associated values (see Comment 3 for discussion of the contractor's requirement to consider non-market values). Inclusion of non-market valuation is well-established in environmental decision making (e.g. Atkinson and Mourato, 2004[1]; Brown, 2009[2]; Fisher et al., 2009[3]). Appendix C claims to qualitatively describe environmental and non-environmental effects where possible, but fails to do so with respect to many of the environmental impacts included in the draft PEIS (p. 2).

   Resource Dimensions conducted an ecosystem service valuation for the Friends of Grays Harbor that illustrates the possible magnitude of ecosystem services in the Chehalis Basin study area. Study results indicate that the Grays Harbor nearshore ecosystem provides $411 million to $3.3 billion in total ecosystem services value and additional $45 to $279 million in carbon storage. The value of ecosystem services would differ for the Chehalis Basin Strategy, but the magnitude of the values illustrates the need for further study and analysis. Such an analysis could inform residents about how much they might need to pay to replace lost or damaged services provided by nature.

   Omission of non-market values leaves substantial economic impacts out of the decision-making process, ignores important differences between Alternatives, and violates statements made within the Economic Study itself.

3. **The Economic Study fails to satisfy requirements of the Scope of Work in employing appropriate methods to determine monetary or quantitative estimates for certain impacts.**

   The Scope of Work (SOW) entered into by and between Anchor QEA, LLC and HDR on August 13, 2013 instructs the PEIS sub-contractor HDR to do the following:

---

[1] Atkinson, G. And S. Mourato. 2004. Environmental Cost-Benefit Analysis. *Annual Review of Environment and Resources*. 33: 317-344.

[2] Brown, P.H., D. Tullow, B. Tilt, D. Magee, and A.T. Wolf. 2009. Modeling the costs and benefits of dam construction from a multidisciplinary perspective. *Journal of Environmental Management*. 90: S303-S311.

[3] Fisher, B., R.K. Turner, and P. Morling. 2009. Defining and classifying ecosystem services for decision making. *Ecological Economics*. 68 (3):643-653.

"Conduct three workshops to develop and refine the inputs and outputs to the environmental benefits analysis. These workshops include:
(a) assessment of performance and uncertainty of physical impacts (e.g. fish passage, etc.) for baseline and build scenarios; (b) economic valuation of direct impacts to fish and other directly monetizable outcomes; and (c) economic valuation of indirect effects of ecosystem services and other outcomes that are more difficult to monetize."

As identified in this review, the Economic Study fails, on several accounts, to accurately calculate several economic valuations that would be captured under subpart (b). A greater flaw, however, is the lack of economic valuation of those effects that would be captured under subpart (c).

The related SOW entered into by and between PEIS contractor Anchor QEA, LLC and its sub-contractor EES Consulting on October 13, 2013, instructs the subcontractor, in Section 5 Comparison of Alternatives to, *"... develop appropriate methodology for the comparison of alternatives.... Each of these methodologies require a determination of which costs and benefits to include in the analysis and a methodology for assessing the magnitude of potential benefits and costs."*

Subsection 5.3 Environmental Benefit Cost Analysis goes on to state the following:

"The Project Team will estimate the Environmental Benefits and Costs using methods which are consistent with updated Principles and Guidelines requirements, and provide enough flexibility to reveal relative merits of alternatives under different benefit/cost methodologies.

The economic valuation will build directly from data and analysis on two key elements: impact of structures on changes in environmental indicators and impact of environmental indicators on fishery population."

Subsection 5.3 Benefit/Cost Analysis states:

"The methodology, or methodologies, selected in the above task will be used in the benefit-cost analysis for the alternatives. Alternatives studied will include flood hazard mitigation strategies or structures defined by the Work Group as well as the optimum water retention structure developed from the engineering, hydraulic, and environmental work completed in this study. The benefits and costs for each alternative will be monetized given the most current information, technology, modeling tools, and expert opinion available. Depending on the characteristics of the estimated benefits or costs, any uncertainty in the estimation techniques or assumptions will be clearly documented. As a result of uncertainty, a range of possible cost and benefit values for each item may be provided.

Specific benefits and costs are described below. These benefits and costs will be included as determined by the methodology selection process.

- *Flood Damage Reduction Benefits*
- *Transportation Benefit Analysis*
- *Environmental Benefits*
- *Transportation Benefits*
- *Power Supply*
- *Other Benefits and Costs such as*
  - *County, regional, or state input-output modeling*
  - *Intrinsic or non-use values*
  - *Recreation values*
  - *Cultural resource values*
  - *Public safety*
  - *Economic development sustainability"*

The draft PEIS Economic Study fails to meet numerous important SOW requirements. In so doing, the draft PEIS is fundamentally flawed and should not be relied upon for use in decision making. Comment 17 of this review addresses the failure of the draft PEIS to capture the benefits and damages to ecosystem services or other economic valuation of non-market good and services that may be more difficult to monetize.

4. **The Draft PEIS fails to include a cumulative impact analysis as a component of the economic analysis.**

   The Economic Study Update fails to examine the cumulative effects of alternatives using existing information and data. WAC 197-11-792(2)(c)(iii) states that impacts of the proposed actions may also be cumulative. The failure to include a cumulative impact assessment as part of the economic analysis results in a piecemeal understanding of both economic and environmental impacts. Quantitative assessments are critical to evaluate cumulative and potentially adverse impacts.

   Even where an alternative may not individually have a significant impact, when combined with other reasonably foreseeable projects (as identified in build-out scenarios presented in Appendix L, for example) it may contribute to significant spatial and temporal cumulative impacts. Specific to the development example above, the DOE's "Frequently Asked Questions about SEPA" page states: "The EIS should look at how the impacts of the proposal will contribute toward the total impact of development in the region over time."[4]

   Additionally, lack of comprehensive treatment of cumulative impacts in the draft PEIS reduces information and data that could be included in the Economic Study Update. For example, the discussion of Alternative 1 in Chapter 5 models changes in fish populations solely due to flood retention facilities and ASHAs. The combined effects on downstream water flow from taller levees, farm pads, and local bank hardening projects (pp. 365, 409, and 410) are not modeled, and subsequent effects on fish populations are not included in the economic analysis.

[4] DOE. Frequently Asked Questions about SEPA. Accessed October 28, 2016. Available at: http://www.ecy.wa.gov/programs/sea/sepa/faq.htm

We contend that various losses attributable to proposed Alternatives should be considered cumulatively as well as individually.

5. **The BCA contains errors, inconsistencies, and omissions. As conducted, the BCA is of limited use.**

   Errors, inconsistencies, and omissions in the BCA (discussed in more detail in the next section) decrease confidence in the results. Overall, the analysis does not meet established standards of rigor. This is particularly concerning because the analysis is presented as a legitimate tool to help decision makers compare alternatives. SEPA does not mandate inclusion of economic analysis, so if it is to be included, it should clearly add value to the decision-making process.

   WAC 197-11-450 states that, *"a cost-benefit analysis is not required by SEPA. For purposes of complying with SEPA, the weighing of the merits and drawbacks of the various [environmentally different] alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations."* As BCA was conducted despite that mandate, the analysis should not be misleading and must be done accurately to provide a quantified comparison of costs and benefits associated with all alternatives (WAC 197-11-726 states that a "Cost-benefit analysis means a quantified comparison of costs and benefits generally expressed in monetary or numerical terms").

   As BCA was conducted for the draft PEIS, it must of particular value. Not only did the BCA omit many important qualitative considerations, it contains substantial errors, inconsistencies, and omissions. Therefore, we contend that the BCA is of very limited utility for decision making.

6. **Estimating future economic benefits of flood risk management involves significant uncertainties that are not adequately addressed in the draft PEIS.**

   A comprehensive examination of uncertainty is critical to understanding and accurately comparing alternatives (Apel et al., 2004).[5] The draft PEIS does not include clear presentation of the inherent array of uncertainties associated with the scale and complexity of proposed Alternatives.

   The Economic Study Update does explain the range of values used to calculate costs and benefits in Sections 3 and 4. Those ranges, however, are generally simplistic and are not based on underlying uncertainty in the outcome of each Alternative (e.g. risks of personal injury and loss of life, uncertainty about public health/safety, and future social, economic, and environmental conditions). For example, the ranges used to calculate the benefits of reduced damaged to structures, content, and inventory (p. 34) were subjectively selected based on uncertainty in flood modeling software (using average flood depth by census block; p. 26), not on uncertainty surrounding outcomes of flood damage reduction actions. Additionally, several sub-sections in Section 4 only include variation in cost rather than incorporating hydraulic data (Sections 4.13, 4.14, 4.17.1, and 4.17.3).

[5] Apel, H., A.H. Thieken, B. Merz, and G. Bloschl. 2004. Flood risk assessment and associated uncertainty. *Natural Hazards and Earth System Sciences.* 4:295-308.

Uncertainties that *are* included are summarized in ranges of net benefits for each perspective (pp. 43-44, 50-51, and 57-58). The Benefit Cost Ratios (BCR), however, do not reflect those ranges. BCRs should be presented with confidence intervals, or at minimum a range of ratios that correspond with the uncertainty analyses for each perspective.

The potential impacts of each Alternative are based on probabilities of flood occurrence and expected damages associated with those floods, illustrated by the damage curves on p. 25. The treatment of uncertainty focuses solely on the Y axis (damages) of that graph. There is also uncertainty in the X axis, the probability distributions of flood occurrence (i.e. error bounds in the probability distributions; CRAFDR et al., 2000).[6]

Accurate calculation of future economic benefits of flood risk reduction requires comprehensive understanding of all uncertainties. The draft PEIS should include a thorough discussion of uncertainties that provides the foundation for complete examination of uncertainty in the BCA.

Selective inclusion of uncertainties creates a misleading impression that results are based on an accurate analysis of uncertainty.

7. **The analysis and discussion of climate change and associated economic impacts presented in the Economics Study Update is of limited usefulness.**

   Climate change impacts and potential economic opportunities, costs, and ecological benefits are not adequately addressed by Alternative. Further, climate change estimates are missing for Alternative 4 (Tables C-6 – C-8). Excluding climate change effects, including potential economic opportunities and ecological benefits for Alternative 4, presents an incomplete framework for comparing the costs and benefits of this alternative to Alternative 1, 2 and 3.

   DOE's "SEPA and Greenhouse Gas Emissions" Q&A page indicates that SEPA's climate change guidance includes evaluating vulnerability of projects to the impacts of climate change.[7] It includes the following statement: *"The built environment may be impacted by rising sea levels, increased storm runoff, or reduced stream flows, which may exacerbate other environmental impacts."*

   The draft PEIS itself refers to DOE's guidance on climate change effects with the following bullet (citation link is broken), directing inclusion of, *"Adverse impacts of climate change on the proposed action element (e.g., increased sea levels, reduced snowpack, changes in water availability, changes in streamflow timing, increased forest fires, more extreme precipitation events and flooding)."* The Draft PEIS considers impacts to each action element from climate change (Chapter 4) and outlines possible mitigation (e.g. adding additional freeboard in floodproofing [p. 419] and increasing the height of the Aberdeen/Hoquiam levee [p. 401]). There is no indication that the

[6] Committee on Risk-Based Analysis for Flood Damage Reduction (CRAFDR), Water Science and Technology Board, National Research Council. 2000. *Risk Analysis and Uncertainty in Flood Damage Reduction Studies*. Washington D.C: National Academies Press.

[7] DOE. Q&A SEPA and Greenhouse Gas Emissions. Accessed November 6, 2016. Available at: http://www.ecy.wa.gov/programs/sea/sepa/climatechange/QA.pdf.

climate change analysis in the Economics Study Update analyzed any effect of climate change outside of impacts to fish populations and more frequent/severe flooding.

Additionally, the limited explanation of methods and assumptions in the brief narrative that introduces the climate change analysis (p. C-6) precludes interpretation and understanding of results. **Omission of climate change analysis for Alternative 4 and inadequate discussion of assumptions and methods renders the climate change analysis of limited usefulness.**

8. **Calculations of economic and ecological benefits do not consider the economic opportunities for carbon sequestration or forest management.**

   The Economics Study Update does not quantify or qualitatively address benefits of carbon sequestration. Emerging markets for carbon storage, designed to offset the impacts of climate change, have created opportunities to finance afforestation (establishing forest cover where none exists). Studies have shown that carbon credits can completely offset the cost of habitat restoration projects after only two decades of growth (Matzek et al., 2015).[8] 100 years of growth could provide benefits above and beyond what is needed to cover costs. This indicates that Alternative 4, which is centered on habitat restoration, could partially or completely pay for itself.

   Economic analysis of the benefits of carbon sequestration and forest management (as applicable, by alternative) should have been conducted to address the realistic possibility of recovering the costs of habitat restoration. Analysis should include capturing and storing carbon as timber, deadwood, litter, and understory, and permanently in the soil.

   The 2014 Analysis of Alternatives Report conducted by EES and HDR states, *"The impacts evaluated in this study include the following: [last bullet] Other environmental benefits such as carbon sequestration and resiliency to climate change."*[9] There is no indication in the rest of the document that carbon sequestration was evaluated. Additionally, previous versions of Appendix C indicate that assessment of carbon sequestration was considered but eliminated.

   Emerging markets in nutrient trading provide further opportunity for cost recovery. Nutrient trading markets are designed to reduce nutrient overloads in surface water by using agricultural best management practices or eliminating fertilizer application by converting agricultural lands to

[8] Matzek, V., C. Puleston, J. Gunn. 2014. Can Carbon credits fund riparian forest restoration? *Restoration Ecology*. 23 (1):7-14.

[9] EES and HDR. 2014. Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species. Accessed October 15, 2016. Available at: http://chehalisbasinstrategy.com/wp-content/uploads/2015/09/Comparison-of-Alternatives-Report_Final.pdf.

riparian habitat.[10] An example from Pennsylvania's Susquehanna Watershed indicates that forested riparian buffers can earn multiple credits, including nutrient, sediment, and carbon.[11]

Emerging markets in carbon and nutrient trading create possibilities for recovering costs and should be analyzed quantitatively or qualitatively, by Alternative, and included in BCA, if possible.

9. **Future costs associated with projected environmental mitigation are not adequately detailed by Alternative.**

   Compensatory mitigation is mentioned throughout the draft PEIS, yet future costs associated with projected environmental mitigation are not adequately detailed by Alternative. References to compensatory mitigation in the draft PEIS include the following:

   - Conservation of existing forestland (p. 313)
   - Archaeological data recovery (p. 325)
   - Elevating or floodproofing in newly flooded areas around the airport levee (p. 375)
   - Implementation of stringent stormwater treatment requirements (p. 384)
   - Replanting riparian vegetation or restoring floodplain areas (p. 416)
   - Purchasing and preserving adjacent and off-site areas within the same watershed (p. 485)
   - Acquisition of land that presents an opportunity for in-kind compensation for fish habitat lost (p. 485)
   - Measures for potential impacts on cultural resources and tribal resources (Draft PEIS p. 486 and 513)
   - Removal and decommissioning of utilities (PEIS p. 513)

   Compensatory measures are presented to increase the feasibility of a given Alternative. Therefore, associated costs and benefits should be analyzed, by Alternative, and included in the BCA. Overall the analysis does not sufficiently address costs and effects on a wide range of mitigation measures, inclusive of public services. **Thus, we find that draft PEIS has failed the requirement of WAC 197-11-440(6)(e), generally as well as specific to impacts on treaty reserved rights.**

10. **Costs presented in Chapter 3 are not discounted and cannot be compared.**

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[10] Maryland Nutrient Trading. 2016. What can I trade? Accessed November 11, 2016. Available at: http://www.mdnutrienttrading.com/farmers/q2.php. Virginia Department of Environmental Quality. 2008. Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners. Accessed November 11, 2016. Available at: http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VANPSTradingManual_2-5-08.pdf.

[11] Van de Mark, S. 2010. "A Sustainable Chesapeake: Better Models for Conservation." In D.G. Burke and J.E. Dunn, eds. *The Conservation Fund.* Accessed November 16, 2016. Available at: http://www.conservationfund.org/images/resources/sustainable_chesapeake/Sustainable-Chesapeake-Chapter-5-Credit-Forested-Riparian-Buffer-Susquehana-Watershed.pdf.

Section 3 costs do not sum to project costs in the summary tables presented in the Executive Summary and for each perspective. We could attribute the difference to discounting methodology, but there is so much contradictory information and so little discussion of discounting timelines that it is difficult to follow how and when costs and benefits are applied, and whether costs are indeed discounted. There are several factors that indicate that Section 3 costs should sum to total project costs in summary tables, including the following:

- Sections 5, 6, and 7 present impacts for each perspective. The perspectives have different discount rates. If the project cost column in each perspective was subject to a different discount rate, discounted project costs for each perspective should be presented with the impacts.
- Project costs in Section 3 are presented in $2016, and p. 18 states that the costs are not discounted, levelized, or transformed.
- Page 22 states that timing of construction expenditures for Restorative Flood Protection are not modeled in the study.
- If project costs are discounted, there is no discussion of when costs occur.
- Project costs for Alternatives 3 and 4 are identical across perspectives. If costs were discounted, costs under the federal perspective would be different. Each perspective states in the first sentence that costs and impacts are specific to that perspective, but costs are not outlined for each perspective (see first bullet).

If costs are indeed not discounted, it is unclear why Section 3 costs do not sum to totals in any of the perspectives. For example, Alternative 1 with the FRO dam and low restoration includes the following costs, presented in Table 3.

Table 3. Alternative 1 Costs with FRO Dam and Low Restoration Scenario ($Millions)

	Capital	Annual OM&R	Interest During Construction	Total
FRO with CHTR	274	32	21	327
I-5 Projects	101.7	0.005	1.7	103.405
Airport Levee	4.6	0.008	0.071	4.679
Floodproofing	40.5			40.5
Aquatic Species Habitat	229.3			229.3
Total				**705**

The presumed total from Section 3 costs is $104 million less than the total for the state perspective, and $117 million less than the federal perspective. If there is a good reason for this, it should be clearly enumerated in the document.

Additional confusion arises from the fact that impacts are presented by Alternative while costs are presented by action element, which leaves the reader to sum costs for each action element in each Alternative. **Costs for each Alternative should be presented in such a way that it is clear and easy to understand how the total project costs in the summary tables were calculated.**

11. **Piecemeal submission of corrections, modifications and explanatory documents post-release of the draft PEIS together with data gaps, incomplete analysis and errors render the Economics Study (Appendix C) of very little utility in providing the public and decision makers with accurate, transparent and comprehensive information on the economic impacts, by alternative.**

ERRORS

12. Numerous errors occur throughout the draft PEIS and the Economics Study.

Several important errors were identified during review. Table 4 presents a summary of errors together with location and notation of error type.

Table 4. Errors

Comment #	Page(s)	Section	Table/Figure	Importance Factor	Comment
12	ES-10	ES	ES-2	3	Incorrect "Total" row. Total appears to be a repeat of "Structure" row above, and "Vehicle Damage" row appears to be the totals used in Table ES-3.
	ES-12, 42, C-1	ES, 5, Appendix C	ES-3, 24, C-1	2	Tables ES-12 and Table 24 do not match Table C-1, the full results table — specifically the values for the RFPA.
	ES-11, ES-12	ES		3	The first paragraph under Net Benefits has two table references that say Table ES-2 instead of ES-3. The first sentence on ES-12 under Uncertainty Analysis also references Table ES-2.
	ES-5	ES		2	100-year timeline is too short.
	ES-8	ES		2	Report states that environmental non-use values are quantified, but not included in net benefits. However, we do not find any quantified non-use values.
	ES-14	ES		2	Key findings are misleading. The study shows that Alternative 4 provides the greatest flood reduction benefits. Any uncertainty about values should be built into the model, and uncertainty is not a key finding (bullet 2).
	26	4		3	The last sentence p. 26 states that non-depreciated replacement values are provided in Appendix C. They are not.

INCOMPLETE

13. Several important costs are incomplete and underestimated.

Underestimation and omission of certain engineering, construction, and O&M costs reduce confidence in study results and conclusions. Table 5 provides page numbers for incomplete costs.

Table 5. Incomplete

Comment #	Page(s)	Section	Table/Figure	Importance Factor	Comment
13	9	Appendix A	3.1, 3.2	2	O&M for Alternative 1
13	9	Appendix A	3.1, 3.2	2	RCC Unit Costs
14	ES-12, 42, C-1	ES, 4, 5, 6, 7, Appendix C	ES-3, 24, C-1	2	Fishery Use Values
15	ES-13, 43, 50, 57	ES, 5, 6, 7	Figs. ES-5, ES-6, 3, 4, 5, 6, 7, 8	2	Uncertainty Analysis

Examples include:

- O&M estimates for tunnels are not comparable to Mud Mountain Dam, which has smaller tunnels and very large O&M costs.

  In 2015, USACE issued a bid to repair the liner of a 9 ft. tunnel at the Mud Mountain Dam at a cost of $10 million to $25 million (USACE solicitation #W912DW-16-R-0006). The same tunnel was repaired around 1962; maintenance costs on the dam were $136 thousand in that year (about $1.1 million in 2016 dollars; USACE, 1962). If the 1962 tunnel repair was only 20% of that year's maintenance costs, the tunnels required $10.5 million to $25.5 million in repairs in 52 years. Two similar tunnel repairs would consume between 21% and 50% of the total structural repair fund for entire 100-year lifespan of the FRO dam (which has three tunnels). Additionally, HDR reported the annual value for the mechanical and structural repair funds using a % Cap, so only $51,000 per year for structural repair was accounted for in the total O&M costs (the costs that were incorporated into the BCR). $51,000 per year for structural repair would yield only $1.9 million after 52 years ($2016). It would take over 300 years of reported structural repair funds to pay for the *just the tunnel repairs* that were necessary for the Mud Mountain Dam. While the above example is an admittedly crude estimation, initial research indicates that dam O&M costs may be significantly underestimated.

- RCC Costs are underestimated.

  Many factors influence RCC unit costs, including production and placement rates, haul distances from aggregate source, cementitious materials, required equipment, quality

control and inspection, and local climate and conditions (USDI, 2005).[12] Draft PEIS Appendix C, Appendix A states that RCC costs vary by facing and seepage control design choices, type and location of aggregate, cost of cement, cost of pozzolans, size and production rate of the RCC plant, and the overall duration and speed of RCC placement. RCC unit cost estimates are based on several RCC dams constructed worldwide. HDR did not build a unit price specifically for Chehalis. Further, they do not provide sources and details required to support their estimates. Direct comparison of dam costs is difficult due to irregularities in RCC unit cost reporting (i.e. whether pozzolan and cement costs are included and whether aggregate location is discussed). Reported costs, however, for eight U.S. RCC dams listed in Table 6 below, indicate that RCC unit costs used to develop cost estimates for the draft PEIS are likely underestimated. No detail is provided on how $65 to $85 per cubic yard range for RCC costs was developed. We therefore assume that the stated range represents the actual high and low costs from their sample of dams. The range of costs reported for the eight RCC dams included in Table 6. is $83 to $239 per cubic yard, with an average of $119. This is substantially higher than the estimated range reported for both proposed dams. Using the Table 6. range, construction costs would increase by $13,439,538 to $114,982,714 for the FRO dam and $23,754,600 to $203,233,800 for the FRFA dam. Using the values in Table 3 of Appendix C of the DEIS, this would increase the expected capital cost of the FRO dam by $65 million (an increase of 24%) and the FRFA dams by $113 million (an increase of 21%-24% depending on fish passage type). While it is difficult to apply these findings to the benefit cost summaries in each of the perspectives (the costs reported in Section 3 to not sum to the summary costs [see Comment 10]), the substantial increases in capital costs would change the BCRs reported in Sections 5, 6, and 7 (and the corresponding tables in the Executive Summary).

Table 6. RCC Costs for Representative Dams

Dam	Year	RCC Cost ($/yd^3)	RCC Cost ($2016/yd^3)
Clear Lake Dam[3]	2002	104	138
Yellow River Watershed Dam No. 17[1]	2004	188	239
New Big Cherry[4]	2005	93	114
Pine Brook[4]	2006	75	89
Genesee No. 2[4]	2007	72	84
Hickory Log Creek[4]	2008	75	83
Elkwater Fork[4]	2008	79	88
Watana & High Devil Canyon[2]	2009	100	112
		Min	**83**
		Max	**239**
		Average	**119**

[12] U.S. Department of the Interior, Bureau of Reclamation. 2005. *Roller Compacted Concrete*. Accessed November 2, 2016. Available at: https://www.usbr.gov/tsc/techreferences/mands/mands-pdfs/RCC.pdf.

[1] Spillway; Costs from Portland Cement Association; International Water Power & Dam Construction. 2008. *RCC Proves Its Worth*. Accessed November 2, 2016. Available at: http://www.waterpowermagazine.com/features/featurercc-proves-its-worth/.

[2] Proposed dams; R&M Consultants, Hatch Acres, and Jack Linnard Consulting. 2009. *Susitna Project Watana and High Devil Canyon RCC Dam Cost Evaluation Final*. Accessed November 2, 2016. Available at: http://www.arlis.org/docs/vol1/Susitna2/1/SuWa197.pdf.

[3] Does not include cost of cement and pozzolan, original bid price; U.S. Department of the Interior, Bureau of Reclamation. 2005. *Roller Compacted Concrete*. Accessed November 2, 2016. Available at: https://www.usbr.gov/tsc/techreferences/mands/mands-pdfs/RCC.pdf.

[4] Cost of RCC materials delivered to the site, mixing, transporting, placing, and curing; U.S. Society on Dams. 2009. *Managing our Water Retention Systems*. 29th Annual USSD Conference, Nashville, TN. Accessed November 2, 2016. Available at: http://ussdams.com/proceedings/2009Proc/95-108.pdf.

14. Fishery Use Values are underestimated because analysis does not include impacts to fish populations outside the Chehalis Basin.

Fishery Use Values are underestimated. They fail to account for fish mortality occurring outside of Washington (for the state perspective, which is the perspective presented in the Executive Summary; EES and HDR, 2014).[13] Use values occurring outside of Washington are likely substantial, given the percentage of mortality that occurs north of the U.S./Canada border.

The 2015 Pacific Salmon Commission Joint Chinook Technical Committee's Chinook Salmon report indicates that 90% of U.S. stocks are harvested in Alaska and Canada.[14] Fishery Use Values reported in the Appendix C Economic Study Update account for at most 10% of the Chinook Use Value. Any impact to Chehalis Basin salmonid populations will have significant implications for the entire economy of Pacific Rim fisheries.

Missing and underestimated costs create invalid comparisons between alternatives and the illusion of useful comparison with substantial data gaps.

15. Uncertainty analysis is incomplete and does not include potential cost overruns and construction delays, and explanation of range is piecemeal.

Uncertainty is generally only calculated for one parameter (if any) of each impact. The Economic Study Update acknowledges that ranges are not meant to represent all possibilities (p. 34). While understandable that every possible uncertainty cannot be included, there is no reference to the extent of excluded uncertainties and how those exclusions limit the analysis. Examples of excluded uncertainties include the following:

- Crop damages do not include uncertainty in crop prices or agricultural trends.
- Floodproofing does not include uncertainty in price of labor and materials.
- Structure, content, and inventory does not include uncertainty in the housing market or flood inundation.
- Cleanup costs omit uncertainty in amount of debris.

[13] EES and HDR. 2014. Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species. Accessed October 15, 2016. Available at: http://chehalisbasinstrategy.com/wp-content/uploads/2015/09/Comparison-of-Alternatives-Report_Final.pdf.

[14] Chinook Technical Committee. 2015. 2014 Exploitation Rate Analysis and Model Calibration. TCCHINOOK (15)-1 V. 1.

- Uncertainty in vehicle damages is not estimated.
- Transportation delays do not include uncertainty in fuel or opportunity costs.
- Temporary living assistance does not include uncertainty in the rental market.
- Dam costs do not include likely cost overruns and construction delays (Ansar et al., 2004).[15]

  Ansar et al., 2004 conducted a statistical analysis of actual versus predicted costs of 245 dams worldwide. They found that actual costs were 96% higher, on average, than estimated costs and project implementation schedules were 44% longer than predicted. Forecasting errors have not improved over time, and expert consultants are systematically overly optimistic about project outcomes.

The discussion of uncertainty does not thoroughly explain ranges. For example, no explanation of the expected/high value for the public assistance ratio is given. Cleanup cost ranges are reportedly based on survey results, but no survey methodology is discussed. Pages ES-13 and 33 state that some ranges were based on literature review, however, no literature sources are cited.

Additionally, the statements on p. 2 that, "The study incorporates uncertainty and risks associated with cost and impact estimates for each action alternative" is misleading. A common distinction between economic risk and uncertainty is that risk applies when probabilities can be calculated for future unknown events, and uncertainty applies when they cannot (Knight, 1921)[16]. There is no risk analysis in the Economic Study Update, despite statements to the contrary (pp. 2, 17). Page 33 states that uncertainty values were calculated without probability distributions. In short, the DEIS does not include any sort of risk analysis, a necessary requirement by most standards (CRAFDR, 2000).[17]

It is important to note that a broad range of impacts are not addressed at all, such as the effect on bond ratings, the cost of municipal borrowing, spending declines and rises in municipal debt, employment declines, disruption of government services, and reduced tourism.

OMISSIONS

Omission of various costs and analyses creates substantial gaps in the analysis that obscure useful comparison between Alternatives and lead to incorrect results and conclusions.

Table 7 provides select identified omissions.

[15] Ansar, A., B. Flyvbjerg, A. Budzier, and D. Lunn. 2014. Should we build more large dams? The actual costs of hydropower megaproject development. *Energy Policy*. 69:43-56.

[16] Knight, F.H. 1921. Risk, Uncertainty and Profit. Boston: Houghton Mifflin Company. Accessed November 6, 2016. Available at: http://www.econlib.org/library/Knight/knRUP.html.

[17] Committee on Risk-Based Analysis for Flood Damage Reduction (CRAFDR), Water Science and Technology Board, National Research Council. 2000. *Risk Analysis and Uncertainty in Flood Damage Reduction Studies*. Washington D.C: National Academies Press.

Table 7. Omissions

Comment #	Page(s)	Section	Table/Figure	Importance Factor	Comment
16	18-23	3		2	Many costs have not been included and the analysis is not complete.
17	24-37	4		1	The value of ecosystem services is not considered.
18	24-37	4		2	No attempt is made to quantify, evaluate, or otherwise address certain areas of potentially significant impact, by Alternative.
19	24-37	4		2	No attempt is made to quantify the effects of build-out scenarios.
20	24-37	4		2	Impacts to recreation are understated and no attempt to quantify economic impacts is made.
21	General				No analysis of potentially disproportionate adverse impacts on minority populations, low-income populations, or Indian tribes has been conducted.
21	24-37	4		2	No sensitivity analysis has been conducted on BCRs estimated for Alternatives.
22	General				Lack of explanation for tables and figures hinders interpretation and creates confusion.
23	General				Substantiating citations to technical documents, data, or other information are generally lacking throughout the report.
Additional	41	5	22	2	Subsistence fishing values.
Additional	ES-12, 42	ES, 5	ES-3, 24	2	Passive use values in summary tables.
Additional	33	4		2	Quantified risk analysis.
Additional	C-6	Appendix C	C-6	3	Exclusion of likely ESA listing under climate change.
Additional	17	2		2	Page 17 states that results are provided using 0% and 7% real discount rates. Where?

Comments 16 through 24 below address several issues with identified omissions.

16. **Many costs have not been included and the analysis is not complete.**

Examples include:

- Local Projects (no costs or benefits)
- Land Use Management (no costs or benefits)
- Flood Warning System Improvements (no costs or benefits)
- Dam Failure Warning System
- Transmission lines for the Forebay Collector Option (Appendix A, p. 17)
- Teardown and rebuilding costs for flood retention facilities.

  The projected lifespan of the dams is 100 years, coincidentally coinciding with the length of the study period. At the end of the 100 years, the dam will have to be torn down or significantly rehabilitated. Excluding these cost is misleading; the dams will leave the next generation with a significant bill. The other Alternatives do not have such significant and certain future costs. Therefore, exclusion of teardown and rebuilding costs creates an inaccurate comparison of Alternatives.

- Costs associated with engineering required to address landslide risk.

  Pages, 250, 266 and 271 of the draft PEIS discuss increased landslide risk from the dams. Page 257 discusses the significant impacts of landslides on water quality in the reservoir and downstream. There is no reference to any engineering costs required to address landslide risk in the reservoir footprint or elsewhere in the project area.

- Costs pertaining to dam mitigation (e.g., sedimentation, gravel augmentation, compensatory mitigation, wetland creation, etc.) are not included.

Similar to Comment #14, missing costs create invalid comparisons between alternatives and the illusion of useful comparison with substantial data gaps.

17. **The value of ecosystem services is not considered.**

Each Alternative presents a varied range of impacts on the ecosystems of the Chehalis Basin. And, while recognized within the draft PEIS, the economic study does not consider ecosystem services that will be directly or indirectly affected by Alternatives.

Additionally, an economic value has not been apportioned to compensate for loss of these services. For instance, the economic benefit from reduced flood damages to cropland is estimated on p. 29, yet it does not contain an estimate of the corresponding loss or benefits for ecosystem services. Further, the indirect impacts of Alternatives on downstream ecosystem services, such as flood mitigation or water quality improvement, is also excluded.

The non-market goods and services provided by functioning ecosystems (e.g., flood prevention, water quality improvement, carbon sequestration, etc.) play a critical role in determining the overall benefits and costs for proposed flood mitigation alternatives. Such analysis are important as they inform decision makers and area residents about the costs of replacing lost or damaged services provided by nature.

See Comments 2 and 3 of this review, which address the limited scope of the BCA, omission of non-market values, and work specified in the SOW but not conducted.

The draft PEIS should specify the rationale for the inclusion/exclusion of specific economic benefits for the Alternatives analysis. By wholly omitting discussion and quantitative analysis of ecosystem service values (non-market values), critical information that would reveal important differences between Alternatives is removed from the decision-making process. Further, such omission violates statements made within the Economic Study itself.

18. **No attempt is made to quantify, evaluate, or otherwise address certain potentially significant impacts, by Alternative.**

Several impacts identified for evaluation in the Economics Study Update were removed from the original list of 15 impact areas (p. 15), "determined through several technical workgroup meetings involving various state agencies." Those removed include terrestrial and non-fish aquatic habitat species, other fish species (non-salmonids), the value of hydropower and its renewable qualities, social, historic, or cultural effects, and community health and safety. And, "other environmental benefits", was substantially revised to exclude carbon sequestration (addressed in Comment 8 of this review).

In removing impacts identified in both the SOW and in technical workgroup meetings, the draft PEIS is critically flawed. It fails to acknowledge the diverse and expansive economic, social and environmental impacts that Alternatives will have on communities and the region. WAC 197-11-444 provides guidance on elements of the environment that should be included in review of Alternatives, and WAC 197-11-792 provides guidance on the appropriate range of impacts (direct, indirect and cumulative) for consideration in the EIS process. The following key omitted impacts were excluded from the draft PEIS:

- Social, historic or cultural

  While the stated purpose of the Chehalis Basin Strategy is, *"to maximize the benefits of flood damage reduction and aquatic species habitat restoration actions over both the short and long term, while avoiding and minimizing adverse environmental, social, cultural, agricultural, and economic impacts,"* it is infeasible to do so with virtually no quantification or other alternative-based evaluation of the extensive range of social, historic or cultural impacts.

  Of particular concern is the very limited treatment given to the cultural importance of hunting and fishing to Tribes of the Chehalis Basin region. While difficult to value in conventional metrics, the importance and potentially significant impact on cultural values associated with hunting and fishing cannot be overestimated.[18] By excluding substantive discussion, the analysis effectively assigns cultural impacts a value of zero.

  Further, while the draft PEIS Section 3.12 Historic and Cultural Preservation (pp. 211 – 214) identify the presence of many historic properties, buildings, archaeological sites and

[18] Sandra L. Olsen, *Animals in American Indian Life: An Overview*, *in* Stars Above Earth Below: American Indians and Nature 95, 95 (Marsha C. Bol ed., 1998).

cemeteries, as well as the potential for previously unidentified many cultural resource sites within the Chehalis Basin, no effort is made within the CBA to quantitatively or qualitatively evaluate the range of adverse long-term impacts summarily addressed in Appendix I (p. I-15)

- Terrestrial habitat, wildlife, or upland-dependent species

  The Draft PEIS, Section 3.3 *Wetlands and Vegetation*, describes the types of wetlands and vegetation found throughout the Basin, including certain ESA-listed threatened and endangered plant species, state-protected threatened and endangered plant species, and ESA critical habitats (pp. 127 – 139). Appendix G, Tables G-1 through G-5, address known plant species, occurrences of ESA-listed threatened and endangered plant species, critical habitats, state-protected species, and rare plant species identified by county.

  Similarly, draft PEIS Section 3.4 *Fish and Wildlife*, provides a range of information on salmonids and other fish species (Section 3.4.1.2 *Other Fish Species*; pp. 151-154) and wildlife (Section 3.4.2 *Wildlife*; pp. 157-169), including State WDFW priority habitats and species identified as state and federally-listed threatened and endangered. Appendix G, Tables G-6 through G-12 address known fish and animal species, state and federally-listed species, and proposed species-critical habitat status.

  With the extent of data and information gathered and reported across the draft DEIS and its appendices, combined with extant literature from recent relevant studies, it is unclear why the draft PIES and Economics Study Update do not include economic analysis of terrestrial ecosystems. At a minimum, an explanation behind this significant omission should be provided.

- Public health and safety, and associated risk and uncertainty

  Of critical omission, in the BCA and the draft PEIS in whole, is the evaluation of public health and safety (injury, loss of life, etc.), and associated risk and uncertainty. At a minimum, the decision to exclude such analysis and information should be explained.

The total absence of quantitative or qualitative evaluation of these fundamental impacts, by Alternative, results in categorical failures that render the draft PEIS Economics Study inadequate for use in any decision-making context. **The failure to conduct such analysis and provide comparable results for Alternatives results in the inadequate disclosure of the full extent of impacts associated with each Alternative. By extension, there is no clear understanding of the potential economic benefits provided by Alternatives.**

19. No attempt is made to quantify the effects of build-out scenarios.

The analysis conducted for the draft PEIS wholly excludes quantification of the economic impacts for the build-out scenarios developed (Appendix L). Build-out scenarios provide critical information to evaluate the costs and benefits of various flood management alternatives. While considerable effort went into gathering the necessary information and data to examine annualized losses and gains (e.g., inundation maps, impacted parcel data, existing buildings, land values, current zoning, future flood incidence, etc.), no effort has been made to incorporate those values into the BCA.

At a minimum BCA analysis and findings presented should include changes in tax revenues based on increases/decreases in building stock, costs of mitigation actions, modeled damages to buildings (including contents and inventory), and changes in FEMA flood insurance premiums based on increased/decreased flood risk.

The absence of examination of the relative fiscal costs and economic impacts for build-out scenarios, by Alternative, is an area of deep concern with the draft PEIS. The failure to conduct such analysis results in the inadequate disclosure of the full extent of impacts associated with each Alternative. By extension, there is no clear understanding of the potential economic benefits provided by Alternatives.

20. **Impacts to recreation are understated and no attempt to quantify economic impacts is made.**

    While each Alternative presents diverse recreation impacts, the draft PEIS made no attempt to identify or report any benefits of recreation beyond sport fishing.

    Tourism and recreation in Grays Harbor County alone were found to generate the following economic impacts for the regional economy (Resource Dimensions, 2015):[19]

    - 2,651 jobs,
    - $91.1 million in personal income,
    - $245.8 million in business revenue,
    - $106 million in local purchases, and
    - $28 million in state and local taxes.

    The failure of the draft PEIS to comprehensively quantify the economic impacts of tourism and recreation activities, by Alternative, results in an incomplete analysis of impacts. The importance of recreation-based tourism to the region warrants a robust analysis of economic impacts.

21. **No analysis of potentially disproportionate adverse impacts on minority populations, low-income populations, or Indian tribes in the affected area has been conducted.**

    While Environmental Justice is briefly discussed in the 2014 Comparison of Alternatives report (p. 49), the draft PEIS does nothing to identify or evaluate potential areas within affected communities and their populations that may be disproportionately impacted, by Alternative.

    Although, SEPA does not require in an Environmental Impact Statement an assessment of environmental justice effects of a proposed action, the failure to conduct any evaluation whatsoever on Alternatives generally results in the failure to provide transparent information on which to assess and compare costs and benefits, as well as to understand where actions may disproportionately impact certain populations.

[19] Gustanski, J.A., D. Scarsella, and A. Scofield. Resource Dimensions. 2015. *Economic Impacts of Crude Oil Transport on the Grays Harbor Economy.* August, 2015. pp. 142.

22. **No sensitivity analysis has been conducted on BCRs estimated for Alternatives.**

BCRs change with variations in inputs, assumptions, or the way in which the analysis was designed. The draft PEIS Economics Study Update should include a clear explanation and presentation of the sensitivity of the estimated BCRs, by Alternative, to the vast array of uncertainties inherent in future climatic, social, economic, and environmental conditions.

23. **Lack of explanation for tables and figures hinders interpretation and creates confusion.**

Overall, the draft PEIS and the Economics Study Update do not provide adequate summary discussion for tables and figures. Discussion of tables and figures used for presenting extensive numerical data is an integral part of a well-written and prepared EIS.

In many instances the lack of explanation complicates the reviewer's ability to follow logic, determine where content relates to other sections, and interpret and understand the information presented. This creates confusion and frustration for even the peer reader.

Taking guidance from NEPA regulations directing the preparation of EISs, an EIS "...shall be written in plain language and may use appropriate graphics so that decision makers and the public can readily understand them."[20] Further, a significant body of case law speaks to the translation of technical data in EISs into terms that are easily understood by its intended readership (e.g., *Oregon Environmental Council v. Kunzman).*[21] Table 8 below presents instances where lack of explanation creates confusion.

Table 8. Inadequate Explanations

Comment #	Page	Section	Table/Figure	Importance Factor	Comment
23	32	4	All NPV Tables	2	No specific explanation of timeline used to calculate NPV (i.e. when benefits and costs accrue).
	ES-12, 18	ES, 3	3	2	Costs in Section 3 do not match summary tables.
	18 - 22	3	3 -7	3	Interchangeable use of capital costs / implementation costs.

24. **Substantiating citations to technical documents, data, or other information are generally lacking throughout the report.**

Table 9 presents a summary of instances in which source data or documentation is required to substantiate and support statements or values used in tables.

[20] 40 C.F.R. §1502.8 (2008)
[21] 614 F. Supp. 657, 15 ELR 20499 (D. Or. 1985) at 665.

Table 9. Missing Citations

Comment #	Page	Section	Table/Figure	Importance Factor	Comment
24	20	3	N/A	3	Floodproofing feasibility estimates.
	32	4	N/A	3	Timelines for impacts to species populations from flood retention and restoration projects.
	33	4	N/A	3	Assumption that no project will trigger an ESA listing.
	36	4	14	3	Values in Table 14.
	48	6	32	3	Values in Table 32.

INCONSISTENCIES

25. Treatment of the managed forestlands benefit is inconsistent with the DEIS.

The draft PEIS includes the managed forestlands benefit in all five Alternatives (No Action and four Action Alternatives) and generally compares the Alternatives to current conditions. Appendix C includes the managed forestlands benefit only in the No Action Alternative to establish a baseline for comparison with the Action Alternatives. While we conclude that the Economic Study Update treats the managed forestlands benefit correctly for use in calculating fishery use benefits for each Alternative, we find that more explanation is needed to avoid appearance of inconsistent comparison. This lack of depth and clarity in explanation occurs elsewhere in the Economic Study Update and increases the difficulty in understanding analysis methodology. The current treatment and lack of explanation results in the appearance of an "apples-to-oranges" comparison.

The inconsistency in how benefits to fish populations from managed forestlands are treated between the draft PEIS and the Economic Study Update creates substantial confusion.

CONCLUSION

26. The cost-benefit analysis presented in the draft PEIS is incomplete and flawed to the extent that it should not be used in decision making context.

The general deficiencies, errors, omissions, incompletes, and inconsistencies result in a document that at best only partially captures the costs and benefits of the proposed Actions. At worst, the document reaches conclusions that are not defensible by explanation and evidence presented. We contend that the analyses are overly simplistic and do not capture the full extent of economic and environmental impacts of the proposed projects.

Additionally, the analyses do not allow for accurate comparison of the Alternatives. The many missing benefits and costs would likely substantially change the BCRs presented for each

Alternative. The BCRs are relatively close in value; even small changes could rearrange the order of Alternatives.

The draft Economic Study in its current state is not complete and thus does not satisfy SEPA requirements of public review (WAC 197-11-455(6)). The many post-release additions and corrections will likely result in a final Economic Study that is quite different than the draft. This effectively allows the DOE to bypass the requirement for public review, as there will be no opportunity for formal public comment on the final EIS.

For these reasons, the Economic Study should not be used in the decision making process.

ABOUT THE INDEPENDENT REVIEW

RESOURCE DIMENSIONS

Resource Dimensions is a multidisciplinary economic and policy consulting firm specializing in integrated analyses and the development of sustainable solutions. Drawing on extensive industry knowledge, distinguished professionals, and innovative analytics, we work with communities, tribal agencies, state and federal agencies, and private and non-profit sector partners to develop lasting solutions for a variety of programs, policies and plans.

Our analyses are informed by an understanding of the local, regional and national economy as well as attitudes, beliefs and values — the human/social dimensions. Thinking innovatively as we work to solve a range of complex issues, we lead the field in the use and expansion of methodologies to assess economic and social impacts at the state, regional and local levels. Since 1985, we have completed over 800 projects across the United States and seven other countries.

REVIEW TEAM

Julie Ann Gustanski, PhD, LLM, AICP. Dr. Gustanski has more than 30 years of experience in environmental and natural resource economics, with an emphasis on the valuation of ecosystem services and conservation programs, as well as land use and environmental policy regulatory review and litigation support. As Resource Dimensions' principal since 1995, she has completed economic, socioeconomic, environmental justice, land use analyses, and peer reviews for over 50 regulatory EIS or EA documents, dozens of ecosystem service valuations, and over 300 economic studies centered on diverse resource management and policy issues. Her work has resulted in the conservation and restoration of over two million acres of land and appurtenant resources, tangible policy changes, and shifts in government investment strategies leading to over $90 million in social and environmental investments.

Julie holds a BS in Legal Studies and Environmental Policy from the University of Minnesota (1995 summa cum laude); MEM, Natural Resource Economics & Environmental Policy, Duke University (1990); MPhil/MS, Urban Design & Regional Planning, University of Edinburgh (1987); LLM, Planning Law, University of Edinburgh / Duke University (1987); and PhD, Ecological Economics, University of Edinburgh (1999).

Anna Scofield, MS. Research Economist/Analyst I and Resource Dimensions Associate Partner. With eight years of experience with an environmental non-profit and seven years as a federal fire management professional, Anna is skilled in incorporating technical on-the-ground research into economic modeling. Ms. Scofield recently assisted in the development and analysis of ecosystem service values and changes in contributions for a project in Grays Harbor County, Washington. She is familiar with a variety of economic valuation methodologies and has specialized training in communication, land management leadership, and collaborative planning.

Anna holds a BS in Environmental Management and Protection from California Polytechnic State University (2007 summa cum laude) and an MS in Agricultural Economics from the University of Wyoming (2014).

EXHIBIT A

U.S. Department of Homeland Security
500 C Street SW
Washington, DC 20472

FEMA

August 18, 2010

MEMORANDUM FOR: Regional Division Directors
Regions I - X

FROM: Doug Bellomo, P.E.
Director, Risk Analysis Division

SUBJECT: Procedure Memorandum 64 – Compliance with the Endangered Species Act (ESA) for Letters of Map Change

EFFECTIVE DATE: All Conditional Letter of Map Change submittals received as of October 1, 2010

Background: The purpose of the ESA is to conserve threatened and endangered species and the ecosystems upon which they depend. Congress passed the ESA in 1973 with recognition that the natural heritage of the United States was of "esthetic, ecological, educational, recreational, and scientific value to our Nation and its people." Congress understood that, without protection, many of our nation's living resources would become extinct. Species at risk of extinction are considered endangered, whereas species that are likely to become endangered in the foreseeable future are considered threatened. At present approximately 1,900 species are listed as threatened or endangered under the ESA. The U.S. Department of Interior's Fish and Wildlife Service and the U.S. Department of Commerce's National Marine Fisheries Service (collectively known as "the Services") share responsibility for implementing the ESA.

Section 7 of the ESA requires each federal agency to insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction of adverse modification of designated critical habitat[1].

Section 9 of the ESA prohibits anyone from "taking" or "harming" endangered wildlife and similar prohibitions are generally extended through regulations for threatened wildlife. If an action might harm[2] a threatened or endangered species, an incidental take authorization is required from the Services under Sections 7 or 10 of the ESA.

Issue: Conditional Letters of Map Change (LOMCs) are issued before a physical action occurs in the floodplain and are FEMA's comments as to whether the proposed project would meet minimum National Flood Insurance Program (NFIP) requirements and how the proposed changes would impact the NFIP maps. Because Conditional Letters of Map Revision based-on Fill (CLOMR-Fs) and Conditional Letters

[1] In accordance with Section 4 of the ESA, critical habitat includes specific areas essential to conservation of a species and those areas which may require special management considerations or protection.

[2] Harm can arise from "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" [50 CFR Part 17.3].

of Map Revision (CLOMRs) are submitted to FEMA prior to construction, there is an opportunity to identify if threatened and endangered species may be affected by the potential project. If potential adverse impacts could occur, then the Services may require changes to the proposed activity and/or mitigation.

For LOMC requests involving floodplain activities that have already occurred, private individuals and local and state jurisdictions are required to comply with the ESA independently of FEMA's process. These requests do not provide the same opportunity as Conditional LOMCs for FEMA to comment on the project because map changes are issued only after the physical action has been undertaken.

The following table provides a general summary of FEMA's ESA requirements.

Request	ESA-related Action	ESA Requirement Related to FEMA Process
Conditional LOMC Requests		
CLOMA	No physical modification to floodplain is proposed.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.
CLOMR-F	Proposed placement of fill in the floodplain.	ESA compliance must be documented to FEMA prior to issuance of CLOMR-F. FEMA must receive confirmation of ESA compliance from the Services.
CLOMR	Proposed modifications of floodplains, floodways, or flood elevations based on physical and/or structural changes.	ESA compliance must be documented to FEMA prior to issuance of CLOMR. FEMA must receive confirmation of ESA compliance from the Services.
LOMC Requests		
LOMA	No physical modification to floodplain has occurred.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.
LOMR-F	Placement of fill in floodplain has occurred.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.
LOMR	Modifications of floodplains, floodways, or flood elevations have occurred based on physical and/or structural changes.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.

Action Taken: For CLOMR-F and CLOMR applications, the submittal will be reviewed based on:

- Required data elements cited in the NFIP regulations
- Required data elements cited in the MT-1 and MT-2 Application/Certification Form instructions
- Demonstrated compliance with the ESA

The CLOMR-F or CLOMR request will be processed by FEMA only after FEMA receives documentation from the requestor that demonstrates compliance with the ESA. The requestor must demonstrate ESA compliance by submitting to FEMA either an Incidental Take Permit, Incidental Take Statement, "not likely to adversely affect" determination from the Services or an official letter from the Services concurring that the project has "No Effect" on listed species or critical habitat. If the project is likely to cause jeopardy to listed species or adverse modification of critical habitat, then FEMA shall deny the Conditional LOMC request. This Procedure Memorandum will not change the review process for Conditional Letters of Map Amendment (CLOMA), Letter of Map Amendment (LOMA), Letter of Map Revision based-on Fill (LOMR-F), or Letter of Map Revision (LOMR) applications. In addition, FEMA's Cooperating Technical Partners will be required to comply with this Procedure Memorandum.

Attachment:
Guidance for Compliance with the Endangered Species Act for Conditional Letters of Map Change

Cc: See Distribution List

Distribution List (electronic distribution only):

Office of Chief Counsel

Risk Analysis Division

Risk Reduction Division

Environmental and Historic Preservation Unit

Regional Mitigation Divisions

Regional Environmental Officers

Legislative Affairs Division

Production and Technical Services Contractors

Customer and Data Services Contractor

Cooperating Technical Partners

Guidance for Compliance with the Endangered Species Act for Conditional Letters of Map Change

This document supplements the Federal Emergency Management Agency's (FEMA's) Procedure Memorandum No. 64. It highlights additional resources and frequently asked questions to help guide Conditional Letter of Map Revision (CLOMR) and Conditional Letter of Map Revision based on Fill (CLOMR-F) applicants in the Endangered Species Act (ESA) compliance process. The following sections identify helpful web resources, while the final section includes responses to frequently asked questions.

NATIONAL FLOOD INSURANCE PROGRAM AND LETTERS OF MAP CHANGE

Additional information about the National Flood Insurance Program (NFIP) and Letters of Map Change (LOMC) is available from FEMA.

NFIP: http://www.fema.gov/hazard/flood/info.shtm
LOMCs: http://www.fema.gov/hazard/map/lomc.shtm

ESA OF 1973

Additional information about the ESA and Endangered Species Programs is available from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS). These two agencies, collectively known as "the Services," share responsibility for implementing the ESA and assisting all individuals (public and private) in the ESA compliance process.

NMFS: http://www.nmfs.noaa.gov/pr/laws/esa/
USFWS: http://www.fws.gov/endangered/whatwedo.html

GETTING STARTED WITH ESA COMPLIANCE AND WHO TO CONTACT

CLOMR and CLOMR-F applicants are responsible for demonstrating to FEMA that ESA compliance has been achieved prior to FEMA's review of a CLOMR or CLOMR-F application. The applicant may begin by contacting a local Service office, State wildlife agency office, or independent biologist to identify whether threatened or endangered species exist on the subject property and whether the project associated with the CLOMR or CLOMR-F request would adversely affect the species. These entities are also available to discuss questions pertaining to listed species and ESA compliance.

NMFS Regional Offices: http://www.nmfs.noaa.gov/regional.htm
USFWS Office Directory: http://www.fws.gov/offices/

DEMONSTRATING COMPLIANCE WITH THE ESA

If species may be affected adversely by the project, the applicant (as a non-Federal entity) would be required to obtain compliance through the Section 10 process. This process includes applying for an Incidental Take Permit (ITP) and preparing a habitat conservation plan (HCP). Additional information about Section 10 requirements and the permit application process is available from NMFS and USFWS.

ITPs and NMFS: http://www.nmfs.noaa.gov/pr/permits/faq_esapermits.htm
ITPs and USFWS: http://www.fws.gov/endangered/hcp/hcpplan.html
HCPs and NMFS: http://www.nwr.noaa.gov/Salmon-Habitat/Habitat-Conservation-Plans/Index.cfm
HCPs and USFWS: http://www.fws.gov/endangered/hcp/index.html
NMFS Permit applications: http://www.nmfs.noaa.gov/pr/permits/esa_permits.htm
USFWS Permit application: http://www.fws.gov/forms/3-200-56.pdf

To demonstrate to FEMA that ESA compliance has been achieved, the requestor must provide an ITP, an Incidental Take Statement, a "not likely to adversely affect" determination from the Services, or an official letter from the Services concurring that the project has "No Effect" on proposed or listed species or designated critical habitat. If the project is likely to cause jeopardy of a species' continued existence or adverse modification to designated critical habitat, then FEMA shall refuse to review the CLOMR or CLOMR-F request without prior project approval from the Services. If a Federal entity is involved in a proposal or project for which a CLOMR or CLOMR-F has been requested, then the applicant may coordinate with that agency to demonstrate to FEMA that Section 7 ESA compliance has been achieved through that other Federal agency.

Frequently Asked Questions

For which map change applications does FEMA require demonstrated ESA compliance?
FEMA requires applicants to demonstrate compliance for CLOMRs and CLOMR-Fs only.

Why is ESA compliance required before FEMA can review my CLOMR or CLOMR-F application?
All individuals in this country (private and public) have a legal responsibility to comply with the ESA. FEMA recognizes that potential projects for which a CLOMR or CLOMR-F has been requested may affect threatened and endangered species. As a result, FEMA requires documentation to show that potential projects comply with the ESA before a CLOMR or CLOMR-F application can be reviewed.

Why does FEMA not require demonstration of ESA compliance for other LOMC applications?
Many LOMC requests involve floodplain activities that have occurred already. As a result, FEMA does not have the opportunity to comment on these projects in terms of ESA compliance prior to the physical changes taking place. Private individuals and local and state jurisdictions are required to comply with the ESA independently of FEMA's process.

What will FEMA require from CLOMR and CLOMR-F applicants to demonstrate ESA compliance?
As part of the CLOMR or CLOMR-F application, the requestor must provide an ITP, an Incidental Take Statement, a "not likely to adversely affect" determination from the Services, or an official letter from the Services concurring that the project has "No Effect" on proposed or listed species or designated critical habitat.

How much time will be required to achieve ESA Compliance?
The timeframe needed to achieve ESA compliance will depend entirely on the complexity of the project, the extent to which species may be affected by the project, the quality of biological analyses conducted by the applicant, and the review process as determined by the Services. Therefore, we recommend that LOMC applicants coordinate with the Services as soon as possible within the project development process.

Who is available to answer my questions about ESA compliance?
NMFS and the USFWS both have staff available around the country to answer questions about threatened and endangered species and ESA compliance. Refer to the *NMFS Regional Offices* and *USFWS Office Directory* links on Page 1 of this guidance document to identify the nearest available Service office. FEMA does not have staff available to assist with this process.

How do I determine if there are threatened or endangered species or critical habitat in my project area?
The applicant may begin by contacting a local Service office, state wildlife agency office, or independent biologist to identify whether threatened or endangered species exist on the subject property and whether the project associated with the CLOMR or CLOMR-F would adversely affect the species.

Do I need to hire a biologist for this process?
While hiring a biologist may be unnecessary, doing so may help facilitate the process. Biologists familiar with subject species and the regulatory process can help adequately complete many of the studies required as part of the Section 10 process and fulfill other Section 10 requirements.

How are the following ESA-related terms defined?
"Take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct and may include habitat modification or degradation.

"Harm" can arise from significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

"Section 7" requires all Federal agencies, in consultation with USFWS or NMFS, to use their authorities to further the purpose of the ESA and to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

"Section 10" lays out the guidelines under which a permit may be issued to non-Federal parties to authorize prohibited activities, such as take of endangered or threatened species.

"ITP" or incidental take permit is a permit issued under section 10(a)(1)(B) of the ESA to a non-Federal party undertaking an otherwise lawful project that might result in the "take" of an endangered or threatened species. Application for an incidental take permit is subject to certain requirements, including preparation by the permit applicant of a HCP.

"HCP" or habitat conservation plan is a legally binding plan that outlines ways of maintaining, enhancing, and protecting a given habitat type needed to protect species. It usually includes measures to minimize impacts and may include provisions for permanently protecting land, restoring habitat, and relocating plants or animals to another area. An HCP is required before an incidental take permit may be issued to non-Federal parties.

Other ESA-related terms not described here may be defined on the following website:
http://www.fws.gov/endangered/pdfs/glossary.pdf

EXHIBIT B

Quinault Indian Nation
POST OFFICE BOX 189 • TAHOLAH, WASHINGTON 98587 • TELEPHONE (360) 276-8211

April 18, 2016

Robert Duff
Senior Policy Advisor – Natural Resources and Environment
Office of the Governor
P.O. Box 40002
Olympia, WA 98504-0002

By U.S. Mail and email

Dear Rob,

To begin, I would like to thank you for meeting with the Quinault Indian Nation's representatives on Friday April 15, in the Governor's conference room. We appreciated the opportunity to present our concerns.

I would also like to take a moment to reiterate those concerns. The Quinault Nation believes that it is imperative to ensure implementation of the best possible solution to address increased flood damage and habitat degradation in the Chehalis River basin. That solution must also preserve and protect the integrity of the treaty rights of the Quinault Indian Nation. To that end, I urge Governor Inslee to move forward with a budget request that does not foreclose any of the options currently on the table to address Chehalis River flood damage reduction and habitat restoration. The alternatives being proposed have wide-ranging implications for landscape alteration, ecological function, and for fisheries. Those fisheries are cherished by many Washingtonians, and are vital to the Quinault Nation in a manner that transcends any economic valuation. Notwithstanding the Quinault Nation's non-economic reliance on Chehalis River resources, I further urge Governor Inslee to provide the funding to undertake preparation of the economic analysis, as requested, which will take an ecosystem-wide approach necessary to address the restorative alternative and the Quinault Nation's treaty rights.

Again, I thank you for meeting last week, for your continued work on these issues, and for mutual respect for our government-to-government relationship.

Sincerely,

Tyson Johnston

Tyson E. Johnston
Vice-President, Quinault Indian Nation

Cc: Craig A. Bill, Executive Director, Governor's Office of Indian Affairs

From: Sharp, Fawn
Sent: Friday, April 29, 2016 3:39 PM
To: Duff, Robert (GOV)
Cc: Johnston, Tyson; Goodell, Junior; Jim Kramer
Subject: Re: Meeting Follow up

Rob,

On behalf of the Quinault Nation, we thank you for supporting our request. That's great news!

We firmly believe a full analysis driven by the best science available is in the long-term best interests of not only Quinault but all of our citizenry.

Our team looks forward to contract negotiations and developing an agreeable scope of work. We, too, believe a collective effort is going to render much success.

Thank you, again, the support in this decision is reflective of a meaningful government-to-government relationship and the excellent leadership from the Governor's Office.

Have a great weekend!

Fawn

Sent from my iPhone

On Apr 29, 2016, at 2:56 PM, Duff, Robert (GOV) <robert.duff@gov.wa.gov> wrote:

> Hello President Sharp,
>
> The Governor was sorry that you could not attend the government to government meeting on April 14th. He was looking forward to seeing you but appreciated the discussion led by Vice President Johnston and Junior Goodell. The government to government relationship between the state and the Quinault Indian Nation is very important to the Governor. He wants to make sure we continue to meet frequently this year as the Chehalis Basin Strategy is developed to reduce flood damage and restore the ecological health of the river.
>
> At that meeting, we talked about the Quinault ecosystems services proposal, timeline of the programmatic environmental Impact statement (PEIS) and briefly about the Quinault position on the Grays Harbor oil terminal proposals. The Governor noted, and is appreciative of, the in depth engagement that the Quinault Indian Nation has taken to help find solutions for both flooding and fish restoration in the Chehalis Basin.
>
> With respect to the ecosystems services report, the Governor tasked me to come to a decision on funding. I discussed past concerns with the state team and have decided that the proposal merits

funding pending some conditions that I think we can work out during the contracting process. Our project coordinator, Jim Kramer, is ready to move forward with your team. I'm confident that we can develop a scope of work that is agreeable.

We support your interest that the restorative alternative has sufficient time to be fully evaluated and considered in the process of the PEIS and the budget recommendations. The restorative alternative is a creative idea and one that the State is very interested in assessing. As we discussed in the meeting, our timeline is designed to provide recommendations to the Governor that can be included in his 17-19 biennial budget proposal to the Legislature.

The State team believes the timeline for a draft PEIS will accommodate a comprehensive review of the restorative alternative that the Quinault has proposed. All of the work on the restorative alternative by your staff and consultant team will be available in the fall for public review, subsequent discussions with the Work Group and government to government meetings before the Governor makes his recommendation to the legislature in December. We did commit to the request by Vice President Johnston to maintain flexibility in the Governor's budget recommendation and not foreclose any options prematurely.

Finally, I want to reiterate our appreciation for Quinault engagement at the technical level, with the Governor's Chehalis Basin Work Group and at the government to government level. You participation has provided valuable input, insight and momentum towards finding a workable solution for the issues we all face in the Chehalis Basin.

As always, I'm happy to talk further about these important issues.

Rob

Robert Duff
Senior Policy Advisor – Natural Resources and Environment
Governor's Policy Office
State of Washington
360-902-0532
robert.duff@gov.wa.gov
Email communications with state employees are public records and may be subject to disclosure, pursuant to Ch. 42.56 RCW.

EXHIBIT C

Gmail Junior Goodell <gillnetter88@gmail.com>

Fresh PEIS Concerns

Jim Kramer <jkramer.consulting@gmail.com> Fri, May 13, 2016 at 7:37 AM
To: Junior Goodell <gillnetter88@gmail.com>
Cc: Cynthia Carlstad <cynthia@carlstadconsulting.com>, Larry Lestelle <lestelle@nwbiostream.com>, Heather Page <hpage@anchorqea.com>, Robert Montgomery <rmontgomery@anchorqea.com>

Junior,

Thanks for sharing your concern and Larry's memo. On Monday, we (you, me, Cynthia, Bob and Heather) met at the Anchor office and we discussed the need to develop a detailed schedule for the summer EDT work. Heather took responsibility to set up a meeting with Chip, John Ferguson and Larry to develop the schedule. I'm sorry Larry had to spend time developing his memo before we got the word out about the plan for the meeting that Heather was organizing. I think the meeting to develop the detailed EDT schedule will address all of Larry's issues. Heather should be contacting the three soon to schedule the meeting.

One issue we may need to discuss amongst ourselves and with DFW is the EDT runs for the ASRP. I think it would be better to run the high and low range for the ASRP in the summer and not the preferred habitat restoration plan. I'm not sure we will know what the preferred restoration plan will be in the summer. I suggest we run EDT for the preferred restoration plan in the fall after the Work Group and others have discussed what they think the preferred ASRP should be.

Let me know if you have other thoughts or questions.

Thanks,

Jim

From: Junior Goodell [mailto:gillnetter88@gmail.com]
Sent: Wednesday, May 11, 2016 6:45 PM
To: jkramer.consulting@gmail.com
Cc: Cynthia Carlstad
Subject: Fresh PEIS Concerns

Jim,

This is Junior Goodell. Quinault's email system has been infiltrated by some kind of virus so the tech folks in Taholah have restricted any emails from coming in or going out that contain any attachments. We're not yet clear as to when our email

system will be back up. So, should an email need sent to me containing any attachments, this is my personal email. Apologies for the inconvenience.

Anyway, I have a somewhat significant matter to address with you. Over the last couple of days I was made aware of significant changes that the State now wants to include in what the Draft PEIS would encompass when it is published this October.

Basically, a decision has somehow been made to include fully updated EDT analyses for various components of the PEIS action elements. Without these updates, the DPEIS would have otherwise been incomplete as well as inaccurate - although the new information would have been available in supplemental documentation.

Larry Lestelle has provided Cynthia Carlstad and me with an assessment of the modeling situation. In his opinion, the July 15 date that the State has set to have all EDT modeling completed—including for the Restorative Alternative—is unrealistic. Use of that date would likely result in a product that QIN would not have confidence in. Larry gives his recommendations for how this problem can be avoided, which would provide everyone with an improved product to help the overall process. His memo is attached.

I agree with Larry's concerns that are delineated in his memo regarding the approach to implement these PEIS changes, given the current timeline and everyone's workloads. I recommend that Larry's proposition be adopted to move us forward in a positive manner. To that end, I would like to see Larry's concerns adequately deliberated amongst the necessary individuals. Can we somehow make this happen? I would appreciate your consideration of this recommendation.

Thanks Jim,

Larry Goodell Jr. *- Chairman*

Off-Reservation River & Ocean Fisheries Committee

Quinault Indian Nation

360-581-0051

EXHIBIT D

M E M O R A N D U M

TO: Junior Goodell and Cynthia Carlstad

FROM: Larry Lestelle

DATE: May 11, 2016

RE: EDT Modeling Plan for DPEIS and FPEIS

This note addresses a recent development in scheduling additional EDT analyses to be included in the draft PEIS (DPEIS). I present my understanding of the matter, describe potential implications, and present an alternative plan on how to proceed to complete the analyses satisfactorily.

Within the past week, the State determined that the DPEIS should include several additional EDT analyses that had previously not been anticipated for the draft publication. While all of the additional analyses were to be included in the final PEIS (FPEIS), the schedule for getting these items included in the DPEIS was apparently thought to be too restrictive to complete the work satisfactorily. These EDT analyses—as I understand them—include the following:

1. Full analysis of the Restorative Alternative;
2. Complete analyses for all relevant species in Grays Harbor tributaries (all major streams entering the estuary from the Wishkah River to the ocean);
3. Chum salmon analyses for all relevant streams and rivers in the Chehalis basin;
4. Updated climate change scenarios;
5. Updated FRO and FRFA scenarios (to include fish passage information still in development); and
6. Possible updates in how the ASRP analysis is to be done.

I am unaware of all the reasons for why the State now wants all of these analyses included in the DPEIS—understandably, it would be good to have the draft document as complete as possible. I am aware, however, that QIN is concerned that the Restorative Alternative was not going to be analyzed using EDT in the DPEIS.

A deadline for having all of the analyses completed so that they can be folded into the DPEIS has been set as July 15. Because of the very intensive modeling effort that needs to be made to meet this date, ICFI has set a date of June 1 to have all inputs finished for the EDT model. This would leave six weeks to complete all of the modeling, do the necessary QA/QC, consider the results, make corrections as needed, and finalize the modeling and summarization.

Having a very good appreciation for the many work elements needed to complete all this by July 15, my reaction is: (1) the work will be rushed, (2) some elements of the needed inputs will not yet be completed, (3) QA/QC will likely suffer, (4) adequate time for reviewing results and formulating well-thought out conclusions will likely be lacking.

Biostream Environmental
Liberty Bay Marina • 17791 Fjord Drive NE – Suite AA • Poulsbo • WA • 98370-8483
360-697-6702 • lestelle@nwbiostream.com

I understood the modeling plan that the parties were working on (until now) to complete both the DPEIS and the FPEIS to be the following:

- All of the EDT modeling that was to be included in the DPEIS has already been completed and submitted by ICFI to the State—to a large extent this consisted of modeling work using the model as it had been configured in 2014-15; we are aware that some parts of that analysis are obsolete because updates are now being made to salmon life history patterns, spawning distributions, and some EDT attribute values. The analyses of the ASRP would consist of modeling results based on very coarse assumptions about the scope and intensity of restoration actions as conceptually roughed-out in 2014-15 (with an addition of a new upper limit on the scope of the treatments).
- All updates to the model and its inputs would be completed in time to produce products for the FPEIS, work that would be accomplished this summer and early fall. The modeling would include analyses at this time to address the six items listed above. The ASRP would be modeled as a diagnosis-driven plan, drawing on EDT results that provide prioritization for both restoration and protection, in conjunction with knowledge about where opportunities for such actions likely do and don't exist (some of this information is currently being gathered from stakeholders). Various technical documents would be formulated in completing the model tasks. This supplemental material would be available to decision makers for any decisions that might need to be made in the overall process prior to the FEIS being completed.

(I should note that I am not endorsing the modeling plan that had existed for either the DPEIS or FPEIS, only acknowledging what the plan entailed.)

It is important to recognize here that the EDT modeling to complete the DPEIS was until now believed to be done. Henceforth, the primary focus of upcoming EDT modeling tasks would be to "get the science right" so to speak—to get the model updated for various elements—then to proceed with getting the alternatives properly characterized in the model, as well as the ASRP as it is being developed this summer, and then to proceed with modeling. While I am very much aware that the schedule for doing the needed tasks was aggressive, I have been of the opinion that it was doable, given the expertise that ICFI has committed to make it happen. I was also confident that sufficient time existed to do the proper QA/QC and product reviews, and to make any corrections and updates as might be discovered to be needed in the process. And importantly, I was satisfied that we would have enough time to study the results to derive sound and defensible conclusions—though the whole process would still have to be done on an aggressive schedule.

Here is my understanding of what modeling inputs and related items have been identified that need to be updated, or at least need further review and collaborative discussions:

1. Historic and current characterizations of off-channel aquatic habitats
2. Water temperatures in the basin
3. Bed scour attribute ratings (these had been revised in the 2014 modeling and have been identified as needing special attention)
4. EDT attribute ratings that will be affected by each of the alternatives (this includes the dam alternatives, the Restorative Alternative, and the ASRP (2016 version)

There may be other items that I am not fully apprised of that need to be completed, such as getting the fish passage criteria completed in time for modeling.

My understanding of how these tasks need to be accomplished includes the following.

Item 1 - To complete the task to update the off-channel habitats, NOAA Fisheries will complete their initial assessment of both historical and current off-channel habitats by the end of the May. A meeting is scheduled for June 3 to review the results and work toward conclusions about how the assessment work is to be incorporated. It is expected that this will take several weeks and probably one or two more meetings besides the meeting on June 3. There is a question of how to join these results with some work being done by Larry Karpack to define how changes in inundation patterns might affect results.

Item 2 - I understand that questions exist about how to incorporate new information on water temperature with information currently in the EDT model. It is hoped that this will be completed by the end of May but some uncertainty exists about this.

Item 3 - Bed scour ratings for the mainstem Chehalis were adjusted in the 2014 version of the model. We have identified a need to address this matter and finalize the ratings for all future model runs. I have discussed this need with NSD scientists but it cannot be addressed until after June 1.

Item 4 – This item is a critical one to the evaluation of all of the alternatives, including the ASRP. A procedure needs to be formulated to define how each of the alternatives will affect the stream environments (including off-channels)—i.e., how the EDT attributes will be affected. I have developed a preliminary approach that might be used and presented it to NSD several weeks ago. It closely aligns with how ICFI addresses this matter also. Participants in the modeling coordination meetings facilitated by John Ferguson recently discussed the need for doing this. It is important that we develop one approach and apply it in the same manner to all of the alternatives (and ASRP)—ensuring that we have an "apples to apples" comparison among the alternatives. I would note that the Restorative Alternative presents more complexity than the dam alternatives due to the more diverse range of channel conditions that need to be addressed compared to those associated with the dam alternatives. The participants in finalizing the approach, rules, and documentation need to include key staff from NSD, Anchor, WDFW, NOAA Fisheries, and ICFI. This process will not begin until after June 1 due to workload demands on NSD associated with the DPEIS alternative descriptions and impacts/mitigation analysis. We anticipate that it could take all of June to complete.

Also, I have not listed the ASRP in the above list—this is a major component of the overall package that needs to be addressed this summer.

All of these items will require some amount of review and discussion among the parties to ensure buy-in and understanding, if not agreement.

What had seemed like a more reasonable schedule to complete modeling tasks this summer (though still aggressive) has turned into just the opposite with the proposed July 15 date for EDT modeling. I am now very concerned about how all of this can be effectively accomplished with the necessary standard of quality.

With all of this in mind, I recommend an alternative schedule for proceeding with EDT modeling to meet the needs of both the DPEIS and FPEIS:

1. Stay the course with ONE more round of intensive EDT modeling, to be accomplished AFTER we make all of the primary data updates identified above, including those to the off-channel habitats, temperature, and bed scour. A substantial portion of June may be required to complete the off-channel habitat work. Ensure that adequate QA/QC is completed.
2. Maintain the schedule for getting the procedure to rate the EDT attributes for the various alternatives done adequately in June, ensuring we take the needed time to resolve differences of opinion satisfactorily that may (probably will) crop up among the parties in the process. It is likely that this will take a good portion of June.
3. Develop the diagnosis-driven ASRP as has been planned and get it incorporated into the modeling at the same time that the alternatives are being modeled. This will likely require all of July.
4. Complete all of the modeling for alternatives and ASRP in August.
5. Once all of this has been completed, and given adequate QA/QC consideration, we would consider the modeling products essentially equivalent to an engineer's 90% design completion.
6. This 90% completion would go into the DPEIS—with a completion date on the modeling products of September 1.
7. The State would then complete the DPEIS.
8. Bringing the modeling products up to 100% completion would mean taking care of any errors and issues discovered at the end of the 90% completion. This round of modeling would be far less intensive and could then be produced efficiently to get products for the FPEIS. This should be able to be completed by the end of the year.

The July 15 date creates many problems as described above that in my opinion should be avoided. I believe this proposed alternative will result in those problems being avoided.

EXHIBIT E

EXHIBIT E

From: Anne Falcon [mailto:falcon@eesconsulting.com]
Sent: Sunday, October 23, 2016 11:06 AM
To: Jim Kramer <jim@jkramer.co>; Junior Goodell <jgoodell@quinault.org>; Steve Malloch <spmalloch@gmail.com>; J. Vander Stoep <jv@vanderstoep.com>; tim@naturaldes.com; Cynthia Carlstad <cynthia@carlstadconsulting.com>; Amber Nyquist <nyquist@eesconsulting.com>; Robert Montgomery <rmontgomery@anchorqea.com>; Heather Page <hpage@anchorqea.com>; Bailey, Chrissy (ECY) <chrb461@ecy.wa.gov>; Kasia Patora <kpat461@ecy.wa.gov>; Thomas Clingman <clingman.tom@gmail.com>
Cc: Anne Falcon <falcon@eesconsulting.com>
Subject: RE: Cost Estimates Meeting Oct 25, 2016

All,

I have attached the slide deck that we will be going through on Tuesday. As part of the review process, several questions have come up regarding the Economic analysis and assumptions that needs to be clarified and possibly updated.

The meeting is intended for us to discuss each of these areas, provide additional information and provide opportunity for input into the assumptions for the final Economics report.

The following issues/assumptions will be reviewed:

- Restorative Flood Protection Costs
  - How were the costs developed & what are the assumptions behind the costs
  - Are they consistent with Impacts?
- Agriculture
  - Acreage
    - Updated cropping pattern for Lewis County
  - Crop Values
    - Benchmarking to 2012 Census
    - Calculated Agricultural crop values by county (Draft report uses average crop value for all counties)
- Flood Proofing
  - Draft Report assumes impacts from Floodproofing equal to costs across all alternatives
  - Issue: Updating Floodproofing impacts based on number of homes floodproofed * value will double count some benefits in Alternative 1 and 4 (and partially Alternative 2). Should Floodproofing benefits be increased?
- Aquatic Species Impact
  - Current fishery benefits are calculated based on EDT results are based on subbasin escapement in the presence of existing harvest. Should increase (decrease) in harvest be considered in the Economic analysis?

Look forward to see you Tuesday.

~ Anne

Anne Falcon
Senior Associate

EES Consulting
570 Kirkland Way, Suite 100
Kirkland Washington 98033

(425) 889-2700 x 227
(425) 893-9906 x 227 (direct)
(425) 273-6671 (cell)

EXHIBIT F

EXHIBIT F

genda

- Restorative Flood Protection costs and benefits
- Agriculture
- Floodproofing Benefits
- Fishery Benefits

estorative Flood Protection

the action element costs line up with the benefits?

Table 1 Restorative Flood Protection Cost Scenarios, $2016 millions

	Low (10-yr floodplain)	Expected (Average)	High (100-yr floodplain)
Buy-Out	$115	$160	$205
Relocation	$150	$225	$300
Construction	$836.7	$836.7	$836.7
Total	**$1,101.7**	**$1,221.7**	**$1,341.7**

Table 2 Restorative Flood Protection Benefit Scenarios, Tied to Costs

	Low (10-yr floodplain)	Expected (Average)	High (100-yr floodplain)
Ag Acreage Relocated	8,500	10,300	12,100
Structure Buy-Out	462	462	462

griculture Benefits

Three categories for avoided damages:

- Crops
- Field clean-up
- Field re-seeding

Avoided agriculture damage benefits are based on two variables:

- Acreage Affected
  - Currently, assumes all agricultural land is used for crop production
- Value of crops or cost to clean-up/re-seed

griculture Benefits – Acreage Affected

Assumes all agricultural acreage contributes to crop harvest

- Leaves out fallow, grazing, or other unused categories

Table 3 Expected Agricultural Acreage Benefits (Avoided Flooding) vs. Total Acreage

	Acreage No Longer Flooded					Acreage Flooded	Total Acreage
	2-Year Floodplain	10-Year Floodplain	20-Year Floodplain	100-Year Floodplain	500-Year Floodplain	100-Year Floodplain	Lewis, Thurston, and Grays Harbor Counties
e 1	3	2,249	2,652	2,400	1,941	26,499	84,676
e 2	-37	-74	-22	31	105	28,868	
e 3	Assumed Equal to No Action					28,899	
e 4	5,005	8,591	9,969	10,475	10,361	21,504	

rop Value – Modeling Approach

Averages yield, prices and acres harvested by crop type for each county

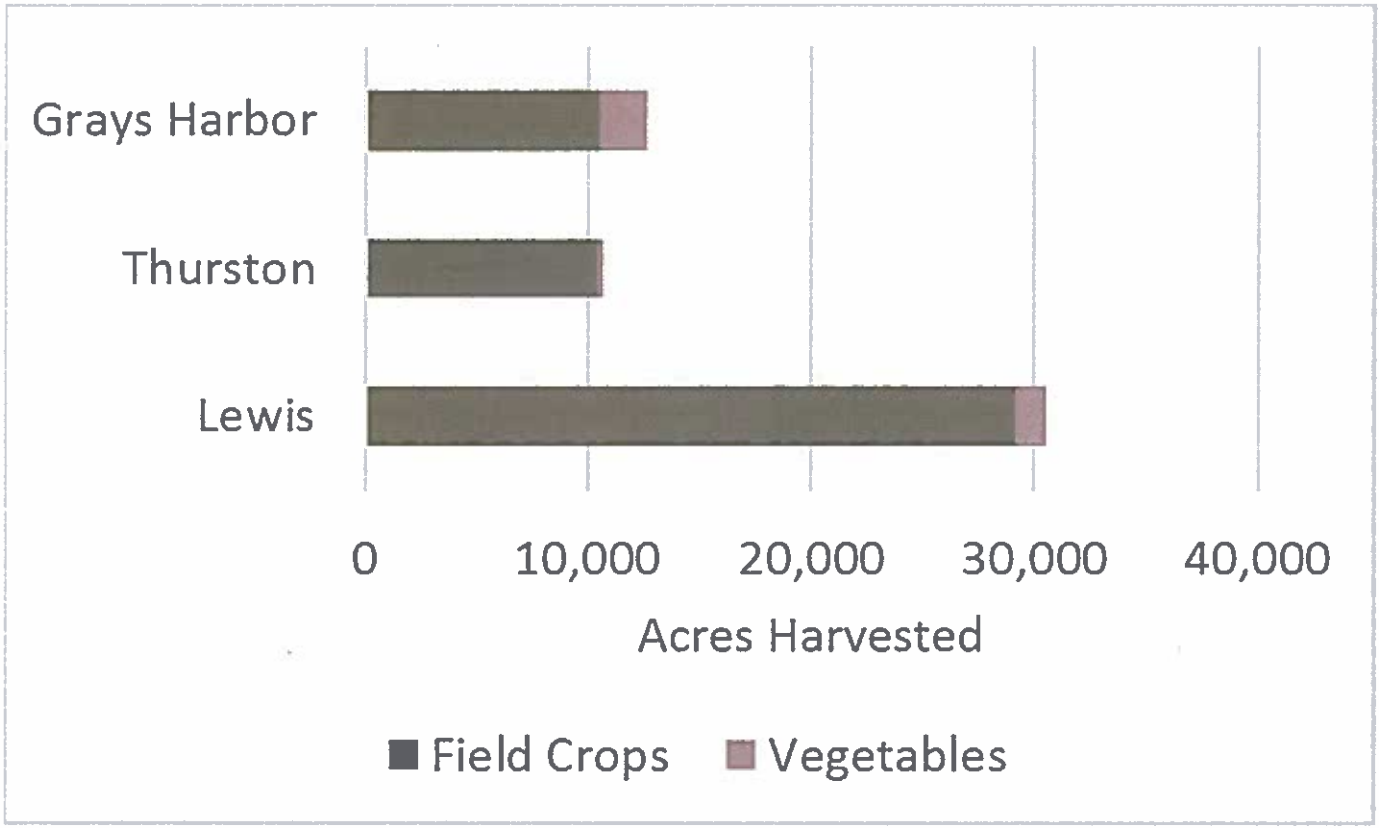
- Some adjustments were made since the draft report, mainly fine-tuning inp data

Crop production only excludes grazing

- Excludes greenhouse, nursery, sod, tree fruit, berries

$2016	Lewis	Thurston	Grays Harbor
Value/Acre Harvested	$698	$513	$1,548

odeling Inputs



rop Value: Top-Down Approach

016	Lewis	Thurston	Grays Harbor	Total
tal Crop Land	54,331	23,071	22,786	100,188
tal Harvested Cropland	45,858	18,357	20,461	84,676
Crop Land Harvested	84%	80%	90%	85%
arket Value Crops Sold	$30,600,189	$51,405,160	$17,572,875	$99,578,224
lue/Acre Harvested	$667	$2,800	$859	$1,176

ource: 2012 Census of Agriculture

omparing Two Approaches

$2016/acre harvested	Lewis	Thurston	Grays Harbor
Model Approach	$698	$513	$1,548
2012 Census Data	$667	$2,800	$859

.ewis County is reasonably close

Thurston:

- Exclusion of high value crop production mainly greenhouse, floriculture, and sod
- Model approach mainly hay with relatively small share of vegetables

Grays Harbor

- Model approach emphasizes field crops and relatively large share of veggies (sweet corn, peas)
- $/acre value is higher because half of the high value vegetables grown
- Census includes aquaculture (cranberries) and modeling does not (results in lower $/acre value)

enefits modeled Two Ways

Modeling approach changes since 9.28.16 Draft Report

- Refined cropping data
- Applied % harvested figure to total agricultural Land (affects both crop and clean-up benefits)

2012 Census Data

- Applies average $/acre value by county
- Applied % harvested figure to total agricultural Land (affects both crop and clean-up benefits)
- Note this method is not consistent with the Principles & Guidelines for Federal evaluations

griculture Benefits Comparison

Agriculture Benefits 100-year NPV $2016, Millions				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
t Report 9/28/16				
n-Up Costs	$25	-$2	$0	$221
) Damage	$59	-$1	$0	$618
l	**$84**	**-$3**	**$0**	**$839**
leling Approach				
n-Up Costs	$22	-$1	$0	$197
) Damage	$21	-$1	$0	$183
l	**$43**	**-$2**	**$0**	**$380**
? Census Approach				
n-Up Costs	$22	-$1	$0	$197
) Damage	$35	-$1	$0	$213
l	**$57**	**-$3**	**$0**	**$409**

oodproofing Benefits

Draft report assumed benefits are at least equal to the costs to floodproof

According to a 2008 FEMA study, floodproofing benefits are significant, about $61,000 per home during the 2007 flood event in Chehalis (adjusted to $2016, replacement value for structure and contents)

Depreciated value of structure and contents:

- $29,500 per home (structure + contents)
- $500,000 for non-residential (based on HAZUS results for structure, content inventory)

oodproofing Benefits

Floodproofing Benefits, 100-Year NPV Expected Annual Benefit, Millions				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
aft 9/28/16	$40	$70	$69	$55
epreciated Values	$394	$561	$582	$566
enefit/Cost	9.7	8.0	8.5	10.3

Adding these benefits likely double-counts flood damage reduction benefits since we are combining HAZUS results with this separate calculation

- Some of the floodproofed structures will also experience reduced flooding due to action elements included in the alternatives. This reduced flooding i reflected in the HAZUS modeling.
- Alternative 3 was not modeled in HAZUS so there would be no double-counting

oodproofing Benefits and Study Results

Expected, Depreciated Values 100-Year NPV 1.5% Discount Rate, Millions ($2016)					
	Impacts		Project Implementation Costs	Net Benefit	Benefit/ Cost
	Flood Damage Reduction	Fishery Use Value (Salmon)			
Alternative 1					
Low Restoration					
FRO RCC with CHTR Fish Passage	$1,283	$15	$601	$696	2.2
FRFA RCC with Conventional Fishway & Forebay Collector	$1,283	$7	$932	$358	1.4
FRFA RCC with CHTR & Forebay Collector	$1,283	$7	$892	$398	1.4
FRFA RCC with Conventional Fishway & Fixed Multi-Port Outlet	$1,283	$7	$916	$374	1.4
High Restoration					
FRO RCC with CHTR Fish Passage	$1,283	$46	$929	$400	1.4
FRFA RCC with Conventional Fishway & Forebay Collector	$1,283	$27	$1,260	$50	1.0
FRFA RCC with CHTR & Forebay Collector	$1,283	$27	$1,219	$90	1.1
FRFA RCC with Conventional Fishway & Fixed Multi-Port Outlet	$1,283	$27	$1,243	$66	1.1
Alternative 2					
Low Restoration	$600	$16	$408	$208	1.5
High Restoration	$600	$47	$735	-$88	0.9
Alternative 3					
Low Restoration	$585	$16	$298	$303	2.0
High Restoration	$585	$47	$625	$6	1.0
Alternative 4					
Low Restoration	$1,901	$55	$1,450	$506	1.3
High Restoration	$1,901	$82	$1,694	$290	1.2

shery Benefits

Current fishery benefits are calculated based on EDT results are base on subbasin escapement in the presence of existing harvest. EDT esults do not explicitly estimate harvest

Should harvest be considered in the economics analysis?

- Considerations
  - Harvest regulation and allocation
  - Use a proportional change for harvest impact based on escapement (EDT)?
  - Smolt-to-adult survival rate (SAR) adjustment to account for harvest
  - Others?

EXHIBIT G

EXHIBIT G

				FRO Dam		FRO Fish Passage	Total - FRO Dam + Fish Passage	
1	Cost Item	Unit	Quantity	Lower Bound Cost Totals	Upper Bound Cost Totals		Lower Bound	Upper Bound
1.1	Land Cost	Acre	811	$3,532,716	$3,532,716		$3,532,716	$3,532,716
	Subtotal -Land Costs			$3,532,716	$3,532,716	$0	$3,532,716	$3,532,716
2	**Construction Costs**							
2.1	Construction Cost	Lump Sum		$129,144,277	$179,731,495	$10,600,000	$139,744,277	$190,331,495
2.2	Contingencies - Construction (based upon conceptual level of design)	20 - 25% of Construction Cost + land cost		$26,535,399	$45,816,053	$3,180,000	$29,715,399	$48,996,053
2.3	Contingencies - Construction (allowance for Change Orders during construction)	8-12 % for Construction Change Orders		$10,614,159	$21,991,705	$1,272,000	$11,886,159	$23,263,705
2.4	Sales Tax	7.8% for Lewis		$12,970,919	$19,308,062	$826,800	$13,797,719	$20,134,862
	Subtotal Construction Costs			$179,264,754	$266,847,315	$15,878,800	$195,143,554	$282,726,115
3	**Planning/Engineering Costs**							
3.1	Planning/Engineering - Design	10- 15% of Construction +		$16,133,522	$37,660,795	$2,381,820	$18,515,342	$40,042,615
3.2	Engineering - Construction	9-12% of Construction + Contingencies (not		$15,284,390	$30,128,636	$1,429,092	$16,713,482	$31,557,728
3.3	Start-Up Commissioning	8-12% of Construction + Contingencies	8%			$1,270,304	$1,270,304	$1,270,304
	Subtotal Planning/Engineering			$31,417,912	$67,789,431	$5,081,216	$36,499,128	$72,870,647
	Total Implementation Costs			**$214,215,382**	**$338,169,462**	**$20,960,016**	**$235,175,398**	**$359,129,478**
4	**Annual O&M Costs**			$628,000	$628,000	$25,000	$653,000	$653,000

				FRFA Dam		FRFA Fish Passage	Total - FRFA Dam + Fish Passage	
1	Cost Item	Unit	Quantity	Lower Bound Cost Totals	Upper Bound Cost Totals		Lower Bound	Upper Bound
1.1	Land Cost	Acre	811	$5,706,360	$5,706,360		$5,706,360	$5,706,360
	Subtotal -Land Costs			$5,706,360	$5,706,360		$5,706,360	$5,706,360
2	Construction Costs							
2.1	Construction Cost	Lump Sum		$187,478,416	$255,057,888	$58,300,000	$245,778,416	$313,357,888
2.2	Contingencies - Construction (based upon conceptual level of design)	20 - 25% of Construction Cost + land cost		$38,636,955	$65,191,062	$17,490,000	$56,126,955	$82,681,062
2.3	Contingencies - Construction (allowance for Change Orders during construction)	8-12 % for Construction Change Orders		$15,454,782	$31,291,710	$6,996,000	$22,450,782	$38,287,710
2.4	Sales Tax	7.8% for Lewis County/Pe Ell		$18,842,472	$27,420,171	$4,547,400	$23,389,872	$31,967,571
	Subtotal Construction Costs			$260,412,625	$378,960,831	$87,333,400	$347,746,025	$466,294,231
3	Planning/Engineering Costs							
3.1	Planning/Engineering - Design	10- 15% of Construction + Contingencies (not sales tax)		$23,491,268	$53,587,053	$13,100,010	$36,591,278	$66,687,063
3.2	Engineering - Construction	9-12% of Construction + Contingencies (not sales tax)		$22,254,866	$42,869,642	$7,860,006	$30,114,872	$50,729,648
3.3	Start-Up Commissioning	8-12% of Construction + Contingencies	8%			$6,986,672	$6,986,672	$6,986,672
	Subtotal Planning/Engineering			$45,746,134	$96,456,695	$27,946,688	$73,692,822	$124,403,383
	Total Implementation Costs			$311,865,119	$384,667,191	$115,280,088	$427,145,207	$499,947,279
4	Annual O&M Costs			$1,372,000	$1,372,000	$1,220,000	$2,592,000	$2,592,000

													Costs Used in Econ Study	
			Restoration -High 60%	Restoration - High 20%	Restoration - Low 60%	Restoration - Low 20%	Protection - high 60%	Protection - High 20%	Protection - Low 60%	Protection - Low 20%	Culverts		High Restoration + High Protection Average + Culverts	Low Restoration + Low Protection Ave. + Culverts
1	Cost Item	Unit												
1.1	Land Cost		$104,763,636	$41,905,455	$31,012,121	$12,404,848	$104,763,636	$41,905,455	$31,012,121	$12,404,848	$0		$146,669,091	$43,416,970
	Subtotal -Land Costs	Acre	$104,763,636	$41,905,455	$31,012,121	$12,404,848	$104,763,636	$41,905,455	$31,012,121	$12,404,848	$0		$146,669,091	$43,416,970
2	Construction Costs													
2.1	Construction Cost	Lump Sum	$341,245,294	$124,780,861	$101,682,415	$37,259,449	$0	$0	$0	$0	$90,640,000		$323,653,077	$160,110,932
2.2	Contingencies - Construction (based upon conceptual level of design)	20 - 25% of Construction Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0	$0
2.3	Contingencies - Construction (allowance for Change Orders during construction)	8-12 % for Construction Change Orders	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0	$0
2.4	Sales Tax	7.8% for Lewis County/Pe Ell	$34,788,697	$13,001,533	$10,350,174	$3,873,815	$0	$0	$0	$0	$0		$23,895,115	$7,111,995
	Subtotal Construction Costs		$480,797,627	$179,687,848	$143,044,710	$53,538,113	$104,763,636	$41,905,455	$31,012,121	$12,404,848	$90,640,000		$494,217,283	$210,639,896
3	Planning/Engineering Costs													
3.1	Planning/Engineering - Design	10- 15% of Construction + Contingencies	$61,072,983	$22,332,145	$18,198,195	$6,668,358	$0	$0	$0	$0			$41,702,564	$12,433,276
3.2	Engineering - Construction	9-12% of Construction + Contingencies	$15,268,246	$5,583,036	$4,549,549	$1,667,089	$0	$0	$0	$0			$10,425,641	$3,108,319
	Subtotal Planning/Engineering		$76,341,229	$27,915,181	$22,747,744	$8,335,447	$0	$0	$0	$0			$52,128,205	$15,541,596
	Total Implementation Costs		$557,138,856	$207,603,029	$165,792,454	$61,873,560	$104,763,636	$41,905,455	$31,012,121	$12,404,848	$90,640,000		$546,345,488	$226,181,492
4	Monitoring & Evaluation	5% of Instream&Floodplain Rest. Costs	$15,268,246	$5,583,036	$4,549,549	$1,667,089	$0			$0			$10,425,641	$3,108,319

				10-year Floodplain		100-year Floodplain
1	**Cost Item**	Unit	Quantity	Totals	Quantity	Totals
1.1	Land Cost	$118,000 per parcel	980	$115,640,000	1740	$205,320,000
1.2	Relocation Cost	Lump Sum	N/A	$150,000,000	N/A	$300,000,000
	Subtotal -Land Costs			**$265,640,000**		**$505,320,000**
2	**Construction Costs**					
2.1	Construction Cost	Lump Sum		$704,870,400		$704,870,400
2.2	Contingencies - Construction (based upon conceptual level of design)	N/A	N/A	N/A	N/A	N/A
2.3	Contingencies - Construction (allowance for Change Orders during construction)	N/A	N/A	N/A	N/A	N/A
2.4	Sales Tax	8.7% for WA State		$61,323,725		$61,323,725
	Subtotal Construction Costs			**$766,194,125**		**$766,194,125**
3	**Planning/Engineering Costs**					
3.1	Planning/Engineering - Design	10% of Construction + Contingencies	10%	$70,487,040	10%	$70,487,040
3.2	Engineering - Construction	Included in Planning/Engineering-Design	N/A	N/A	N/A	N/A
	Subtotal Planning/Engineering			**$70,487,040**		**$70,487,040**
	Total Implementation Costs			**$1,102,321,165**		**$1,342,001,165**
4	**Annual O&M Costs**	Adaptive Management (2.5%) and Monitoring (1%), or 3.5% of Construction Cost	3.5%	**$24,670,464**		**$24,670,464**

EXHIBIT H

CAUSES OF FLOODING DISCUSSION NOTES

Date: October 5, 2016
Time: 10:00 a.m. to 12:00 p.m.
Location: Anchor QEA Seattle, Ecology Office Lacey, WebEx

Attendees

Jim Kramer – Ruckelshaus Center
Chrissy Bailey – Ecology
Dave Bingaman– Quinault Indian Nation
Larry Karpack – WSE
Cynthia Carlstad – NSD
Lisa – NSD
Susan Dickerson-Lange – NSD
Bob Montgomery – Anchor QEA
Nora Schlenker – Anchor QEA
Ken Ghalambor – Ruckelshaus Center
Junior Goodell – Quinault Indian Nation
Larry Lestelle – BioStream
Jessica Lundquist – UW
Tim Abbe – NSD
Leif Embertson– NSD
Steve Malloch – Western Water Futures
Heather Page – Anchor QEA

Action Item Summary

ASSIGNED TO	ACTION ITEM
Heather	Send the CIG report to participants – contains maps of precipitation from the 2007 flood - Can be found here: http://chehalisbasinstrategy.com/wp-content/uploads/2016/09/Mauger-et-al-2016-Effects-of-Climate-Change.pdf
Bob/Larry	The CIG analysis indicates differing levels of increases in the 100-year flow for different parts of the basin. - Follow up with CIG to determine if they have any thoughts on why this is the case.
Bob/Larry	Look at flow changes in other basins

Notes

The purpose of these notes is to record key points, decisions, and discussion topics. They are not intended to be transcripts.

Precipitation/Flow

It was recognized that atmospheric rivers are associated with most floods in Western Washington. Rainfall in the Chehalis Basin is subject to both orographic lift and barrier effects. Meaning that when moisture rich air hits the mountains or hills it is released as rainfall, this is why the highest 24-hour precipitation is seen in the Willapa Hills area. Barrier effects are correlated with areas behind mountains or hills in which there is less precipitation because much of the moisture has already been released from

the air due to orographic lift. The 24-hour precipitation graph included in the presentation was obtained from the PRISM database provided by Oregon State University. Historically, a large portion of flow originates in the upper basin, which correlates with the areas of the heaviest 24-hour rainfall. It was stated that the flow originating in each basin should be discussed separately to better facilitate discussion of different action elements.

Climate Change

The University of Washington Climate Impact Group (CIG) study did not find evidence that there would be a shift in the direction of landfall of atmospheric rivers over the basin; the direction, frequency, and location would likely remain the same. The possibility of rainfall equal to the intensity to that seen in the Upper Chehalis ever falling in the Newaukum was discussed. A 500 year event in the Newaukum would not have the same precipitation amounts as a 500 year event in the Upper Chehalis due to the geography of the region (barrier effect upwind of the Newaukum Basin due to the Willapa Hills). However, Guillaume Mauger at CIG noted, in a discussion with Tim Abbe, that it is not possible to rule out significant precipitation events hitting the Newaukum Basin in the future.

Land Use

It was discussed that channel straightening and incision, riparian zone clearing, forest practices, and land use activities such as increased impervious surfaces, loss of vegetation, and development in the floodplain can all contribute to flood timing and extent. It was noted that it is not known exactly to what extent land use changes effected flooding. The analysis currently underway by NSD may help to answer the extent of flood reduction if the floodplain is restored. Additionally, looking at changes in flow in other basins may help us understand why flow increased in the Newaukum Basin (i.e., what is the pattern of increased flow over time). Larry Lestelle mentioned that urbanization has changed over time (like wetland filling) and it would help to look at the trends in all of the basins. The question remains on how much land use contributes to extreme flooding, and what happens when you add climate change. Jessica Lundquist also brought up looking at sediment contribution in the Newaukum River and if this has an effect.

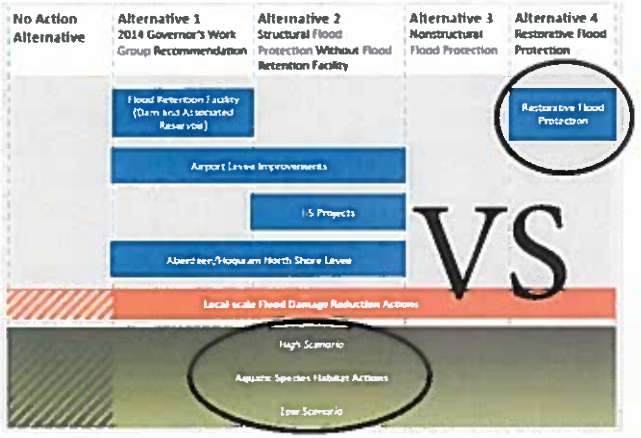
Next Steps

How causes of extreme flooding is portrayed in the EIS is well balanced and further discussion on this topic should reflect that.

EXHIBIT I

EXHIBIT 1

DRAFT CHEHALIS BASIN STRATEGY PEIS COMPARISON OF RFP AND ASHA (WITHOUT LOCAL SCALE FLOOD DAMAGE REDUCTION ACTIONS)



ACTIONS	RFP	ASHA
• RESTORE RIPARIAN HABITAT	● [4]	● [1]
• RESTORE FLOODPLAIN FOREST	● [5]	[6]
• REMOVE FISH PASSAGE BARRIERS		● [1]
• RESTORE OFF CHANNEL HABITAT	● [5]	● [1]
• ADD WOOD TO STREAMS FOR HABITAT	● [2]	● [1]
• RESTORE BANK EROSION TO NATURALLY OCCURRING RATES	●	○ [3]
• RECONNECT FLOODPLAINS	● [4,5]	○ [1]
• CREATE, RESTORE AND ENHANCE WETLANDS	● [4,5]	● [1]
• CONVERT AGRICULTURAL, RESIDENTIAL AND COMMERCIAL LAND USES TO FLOODWAY OR GREENWAY (10-YEAR FLOODPLAIN ONLY)	● [3]	
• DEMOLISH OR PURCHASE FREQUENTLY FLOOD-DAMAGED PROPERTIES	● [5]	
• INCREASE ABUNDANCE OF NATIVE AQUATIC SPECIES	● [3]	● [6]
• CONSTRUCTION TIMING	10 YEARS [7]	15-20 YEARS
• FLOOD REDUCTION DOWNSTREAM OF ACTION AREA	● [4]	UNKNOWN

● STATED OBJECTIVE IS LIKELY

○ STATED OBJECTIVE IS NOT LIKELY IF LANDOWNER APPROVAL NEEDED

Draft PEIS Source:
[1] Executive Summary, Page 8 (ASHA)
[2] Executive Summary, Page 9 (RFP)
[3] Executive Summary, Page 10 (RFP)
[4] Executive Summary, Page 28 (ASHA)
[5] Draft PEIS Section 2: Alternatives, Page 39 (RFP)
[6] Draft PEIS Section 2: Alternatives, Page 57, 58 (ASHA)
[7] Draft PEIS Section 2: Alternatives, Page 47 (RFP)

RESTORATIVE FLOOD PROTECTION (RFP) - ONLY IN UPPER CHEHALIS RIVER WATERSHED

140 RIVER MILES RESTORED

(100% OF 140 RIVER MILES)

RFP SCENARIO:
21,000 ACRES FLOODPLAIN RESTORED
(100% OF 21,000 ACRES)

FLOOD EFFECTS
- INCREASED FLOODING IN RFP TREATMENT AREA
- DECREASED FLOODING DOWNSTREAM OF RFP TREATMENT AREA

FISH EFFECTS
- AVERAGE 127% INCREASE IN SALMONID/ STEELHEAD POPULATION, DEPENDING ON SPECIES (26% - 473%)

AQUATIC SPECIES HABITAT ACTION (ASHA) - ENTIRE CHEHALIS RIVER WATERSHED

ASHA HIGHEST HIGH SCENARIO:

128 RIVER MILES RESTORED

(60% OF 214 RIVER MILES)

BETWEEN

ASHA LOWEST LOW SCENARIO:
4.2 RIVER MILES RESTORED
(20% OF 21 RIVER MILES)

ASHA LOWEST LOW SCENARIO:
230 ACRES FLOODPLAIN RESTORED*
(20% OF 1150 ACRES)

ASHA HIGHEST HIGH SCENARIO:
5,850 ACRES FLOODPLAIN RESTORED *
(60% OF 9,750 ACRES)

* RESTORED FLOODPLAIN AREA NOT MODELED.

FLOOD EFFECTS
- NOT MODELED AND LIKELY A SIGNIFICANT LOCAL EFFECT FOR HIGH SCENARIO

FISH EFFECTS
- AVERAGE 41% INCREASE IN SALMONID/STEELHEAD POPULATION, DEPENDING ON SPECIES (10%-715%)

EXHIBIT J

EXHIBIT J

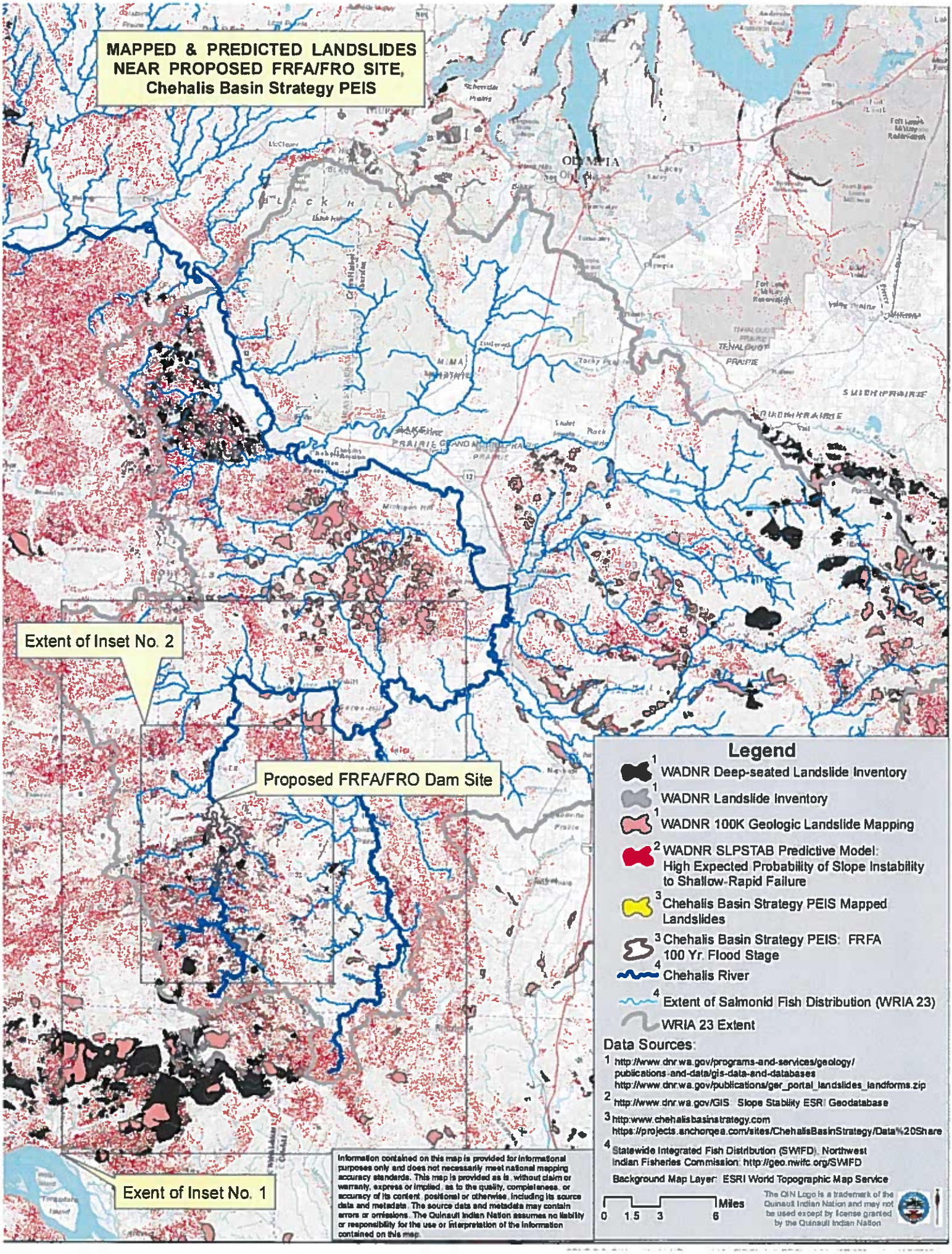

MAPPED & PREDICTED LANDSLIDES
NEAR PROPOSED FRFA/FRO SITE,
Chehalis Basin Strategy PEIS
Extent of Inset No. 2
Proposed FRFA/FRO Dam Site
Exent of Inset No. 1
Legend
1 WADNR Deep-seated Landslide Inventory
1 WADNR Landslide Inventory
1 WADNR 100K Geologic Landslide Mapping
2 WADNR SLPSTAB Predictive Model: High Expected Probability of Slope Instability to Shallow-Rapid Failure
3 Chehalis Basin Strategy PEIS Mapped Landslides
3 Chehalis Basin Strategy PEIS: FRFA 100 Yr. Flood Stage
4 Chehalis River
4 Extent of Salmonid Fish Distribution (WRIA 23)
WRIA 23 Extent
Data Sources:
1 http://www.dnr.wa.gov/programs-and-services/geology/publications-and-data/gis-data-and-databases
http://www.dnr.wa.gov/publications/ger_portal_landslides_landforms.zip
2 http://www.dnr.wa.gov/GIS Slope Stability ESRI Geodatabase
3 http:www.chehalisbasinstrategy.com
https://projects.anchorqea.com/sites/ChehalisBasinStrategy/Data%20Share
4 Statewide Integrated Fish Distribution (SWIFD). Northwest Indian Fisheries Commission: http://geo.nwifc.org/SWIFD
Background Map Layer: ESRI World Topographic Map Service
0 1.5 3 6 Miles
Information contained on this map is provided for informational purposes only and does not necessarily meet national mapping accuracy standards. This map is provided as is, without claim or warranty, express or implied, as to the quality, completeness, or accuracy of its content, positional or otherwise, including its source data and metadata. The source data and metadata may contain errors or omissions. The Quinault Indian Nation assumes no liability or responsibility for the use or interpretation of the information contained on this map.
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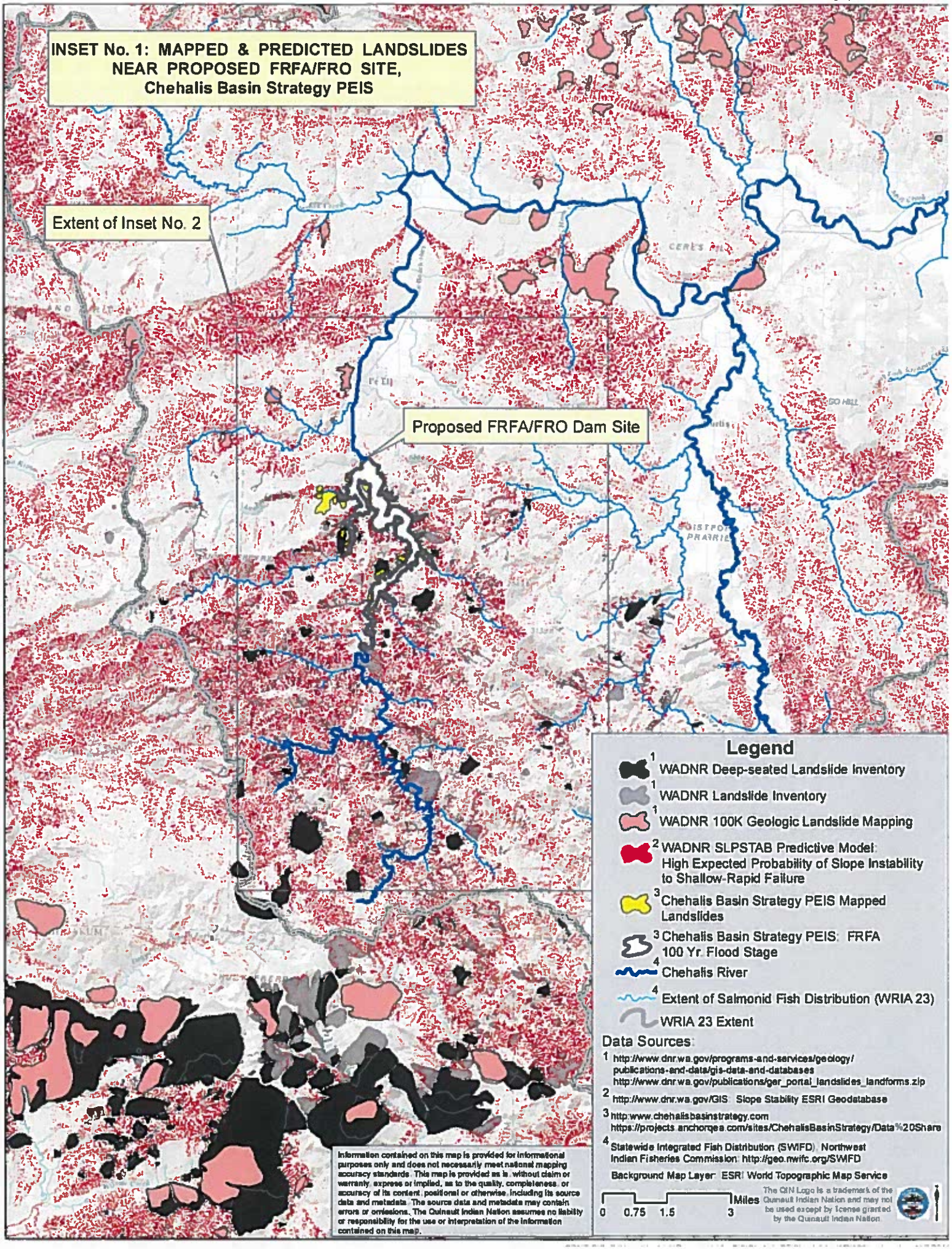
EXHIBIT K


INSET No. 1: MAPPED & PREDICTED LANDSLIDES
NEAR PROPOSED FRFA/FRO SITE,
Chehalis Basin Strategy PEIS
Extent of Inset No. 2
Proposed FRFA/FRO Dam Site
Legend
1 WADNR Deep-seated Landslide Inventory
1 WADNR Landslide Inventory
1 WADNR 100K Geologic Landslide Mapping
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3 Chehalis Basin Strategy PEIS: FRFA 100 Yr. Flood Stage
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WRIA 23 Extent
Data Sources:
1 http://www.dnr.wa.gov/programs-and-services/geology/publications-and-data/gis-data-and-databases
http://www.dnr.wa.gov/publications/ger_portal_landslides_landforms.zip
2 http://www.dnr.wa.gov/GIS Slope Stability ESRI Geodatabase
3 http:www.chehalisbasinstrategy.com
https://projects.anchorqea.com/sites/ChehalisBasinStrategy/Data%20Share
4 Statewide Integrated Fish Distribution (SWIFD). Northwest Indian Fisheries Commission: http://geo.nwifc.org/SWFD
Background Map Layer: ESRI World Topographic Map Service
0 0.75 1.5 3 Miles
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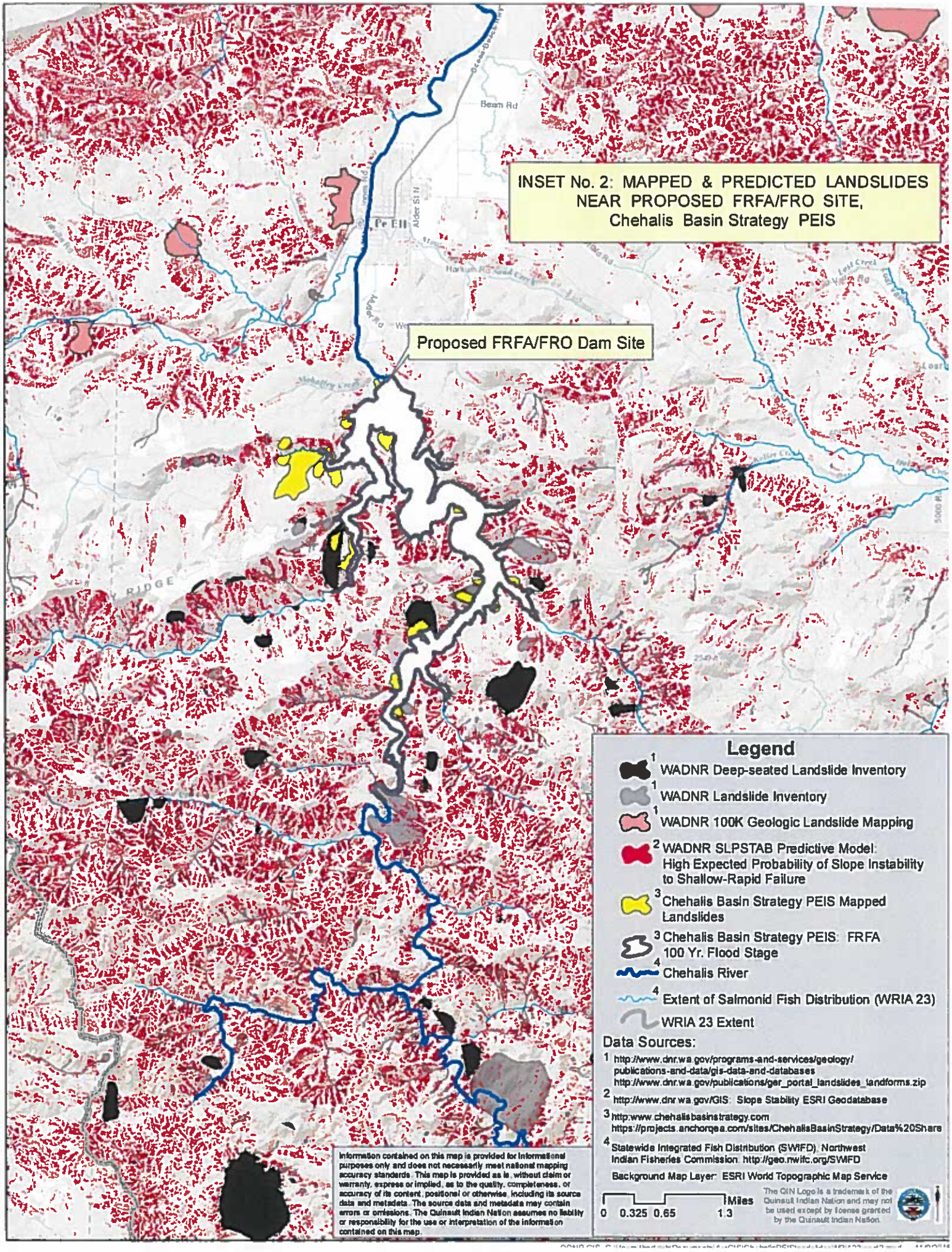
EXHIBIT L


INSET No. 2: MAPPED & PREDICTED LANDSLIDES
NEAR PROPOSED FRFA/FRO SITE,
Chehalis Basin Strategy PEIS
Proposed FRFA/FRO Dam Site
Beam Rd
Alder St N
Pe Ell
Legend
1 WADNR Deep-seated Landslide Inventory
1 WADNR Landslide Inventory
1 WADNR 100K Geologic Landslide Mapping
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1 http://www.dnr.wa.gov/programs-and-services/geology/publications-and-data/gis-data-and-databases
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2 http://www.dnr.wa.gov/GIS: Slope Stability ESRI Geodatabase
3 http:www.chehalisbasinstrategy.com
https://projects.anchorqea.com/sites/ChehalisBasinStrategy/Data%20Share
4 Statewide Integrated Fish Distribution (SWIFD), Northwest Indian Fisheries Commission: http://geo.nwifc.org/SWIFD
Background Map Layer: ESRI World Topographic Map Service
0 0.325 0.65 1.3 Miles
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EXHIBIT M

EXHIBIT M

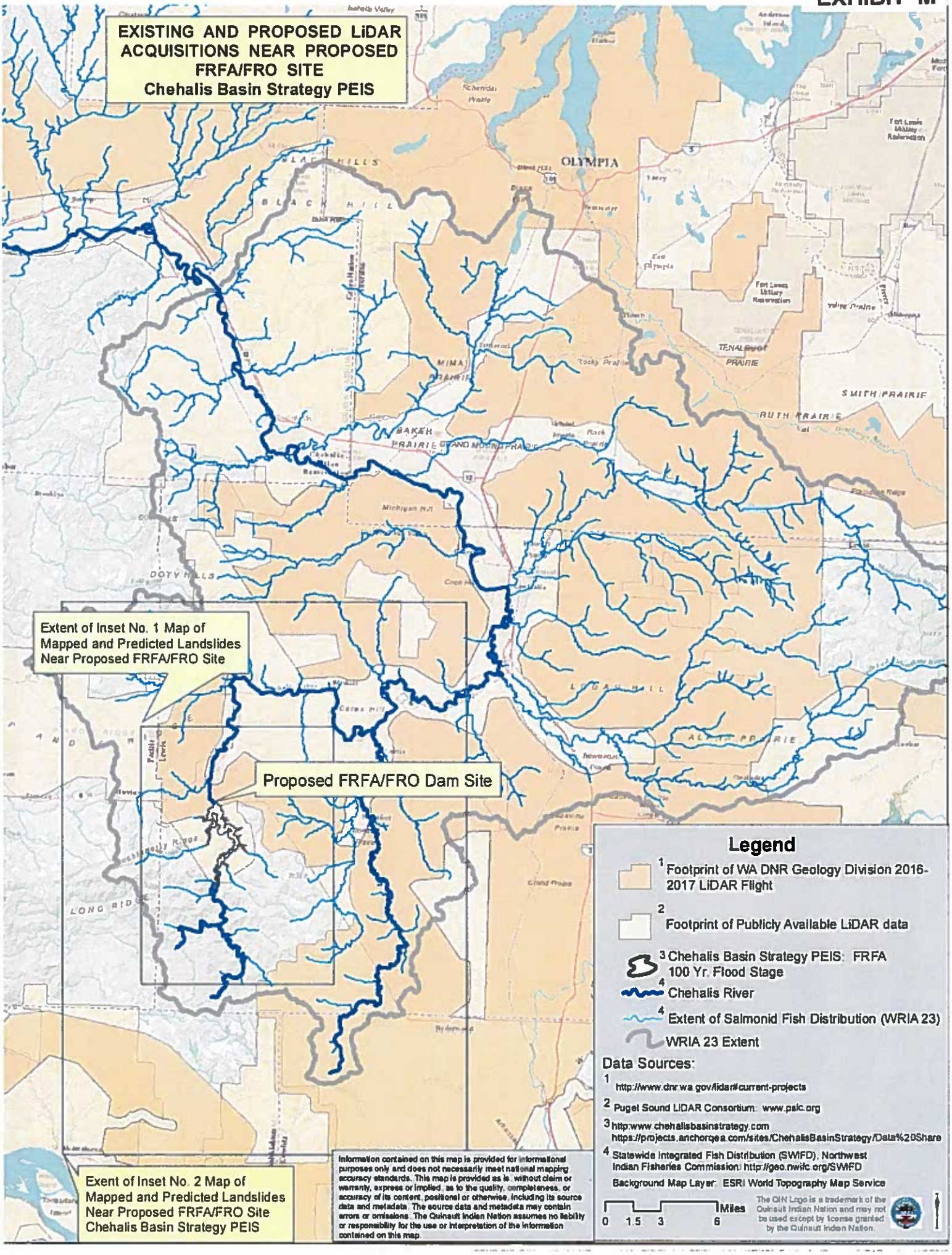
EXISTING AND PROPOSED LiDAR ACQUISITIONS NEAR PROPOSED FRFA/FRO SITE
Chehalis Basin Strategy PEIS
OLYMPIA
Extent of Inset No. 1 Map of Mapped and Predicted Landslides Near Proposed FRFA/FRO Site
Proposed FRFA/FRO Dam Site
Exent of Inset No. 2 Map of Mapped and Predicted Landslides Near Proposed FRFA/FRO Site Chehalis Basin Strategy PEIS
Legend
1 Footprint of WA DNR Geology Division 2016-2017 LiDAR Flight
2 Footprint of Publicly Available LiDAR data
3 Chehalis Basin Strategy PEIS: FRFA 100 Yr. Flood Stage
4 Chehalis River
4 Extent of Salmonid Fish Distribution (WRIA 23)
WRIA 23 Extent
Data Sources:
1 http://www.dnr.wa.gov/lidar#current-projects
2 Puget Sound LIDAR Consortium: www.psic.org
3 http:www.chehalisbasinstrategy.com https://projects.anchorqea.com/sites/ChehalisBasinStrategy/Data%20Share
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EXHIBIT N

EXHIBIT N

Washington DNR

Upcoming 3DEP Application and 2017-2019 LiDAR Collection Plan

Abby Gleason, LiDAR Manager

September 15, 2016

Division of Geology and Earth Resources

- The Division of Geology and Earth Resources (DGER) is the Washington State Geologic Survey, and is a part of the Department of Natural Resources (DNR)
  - Mining, oil and gas regulation
  - Geologic mapping
  - Geologic hazards
  - Geothermal exploration
  - Library and publications

LiDAR is a foundation dataset to support all of this work

DGER LiDAR Program Background

- RCW 43.92.025, 2015: The geological survey must conduct and maintain an assessment of hazards in Washington. The geological survey must acquire and process new LiDAR data or update deficient data and create and maintain an efficient, publically available database of LiDAR data
- Funding for LiDAR collection lasts until 2021 (3 biennium periods)
- Two dedicated positions created to support LiDAR collection and distribution
- 4 additional positions dedicated to landslide hazards – all since January 2016

DGER LiDAR Program Mission

- Improve understanding of geologic hazards across the state
- Collect high quality, consistent LiDAR datasets that can be applied to a wide variety of applications
- Create a centralized LiDAR database available to public
- Provide outreach to inform, educate, and assist with LiDAR collection and interpretation

LiDAR Applications

Geologic hazard mapping including landslides, faults and susceptibility

Urban planning, infrastructure mapping, transportation

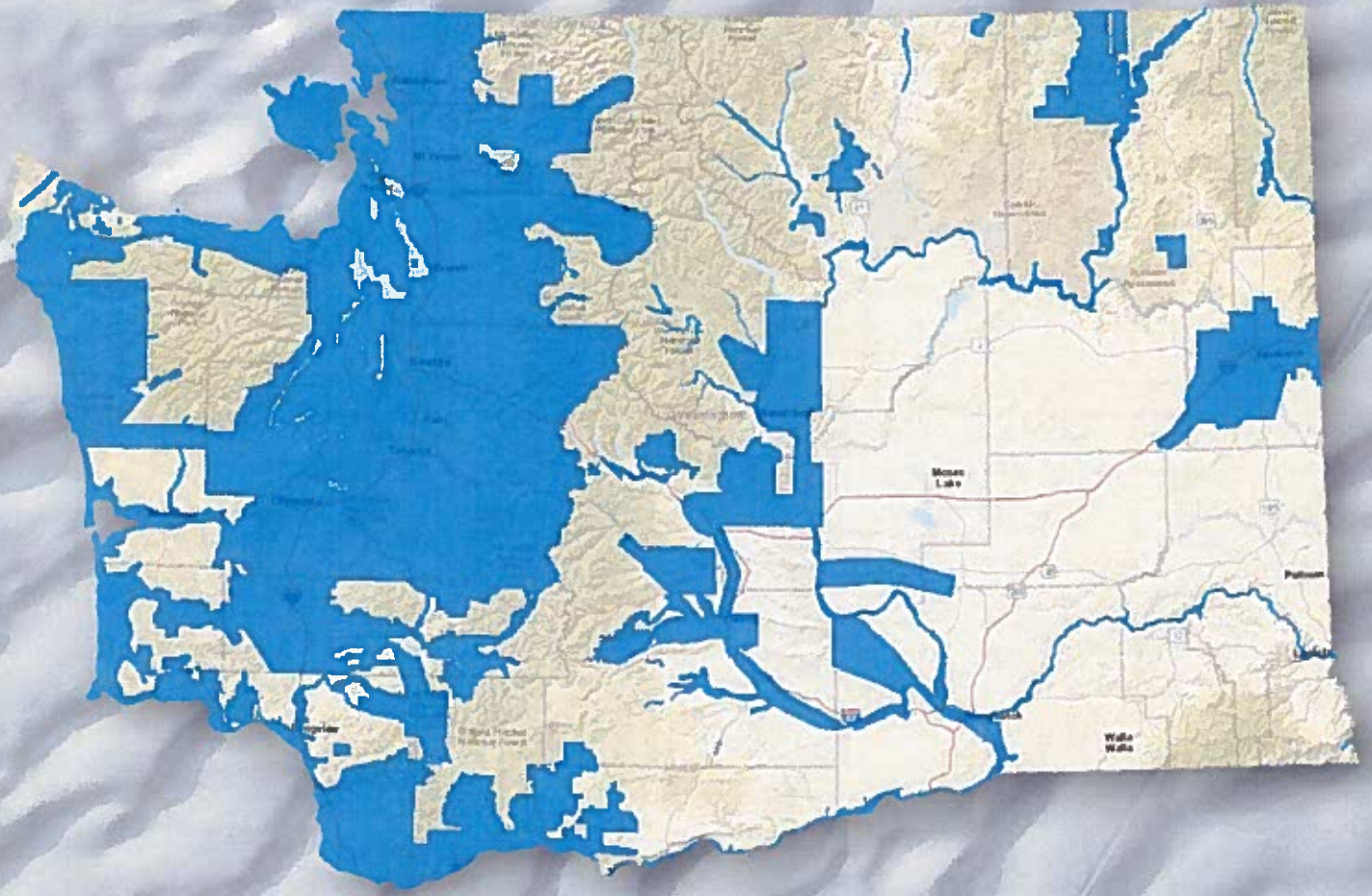
Flood modeling, delineation of inundation zones

Wild fire mitigation

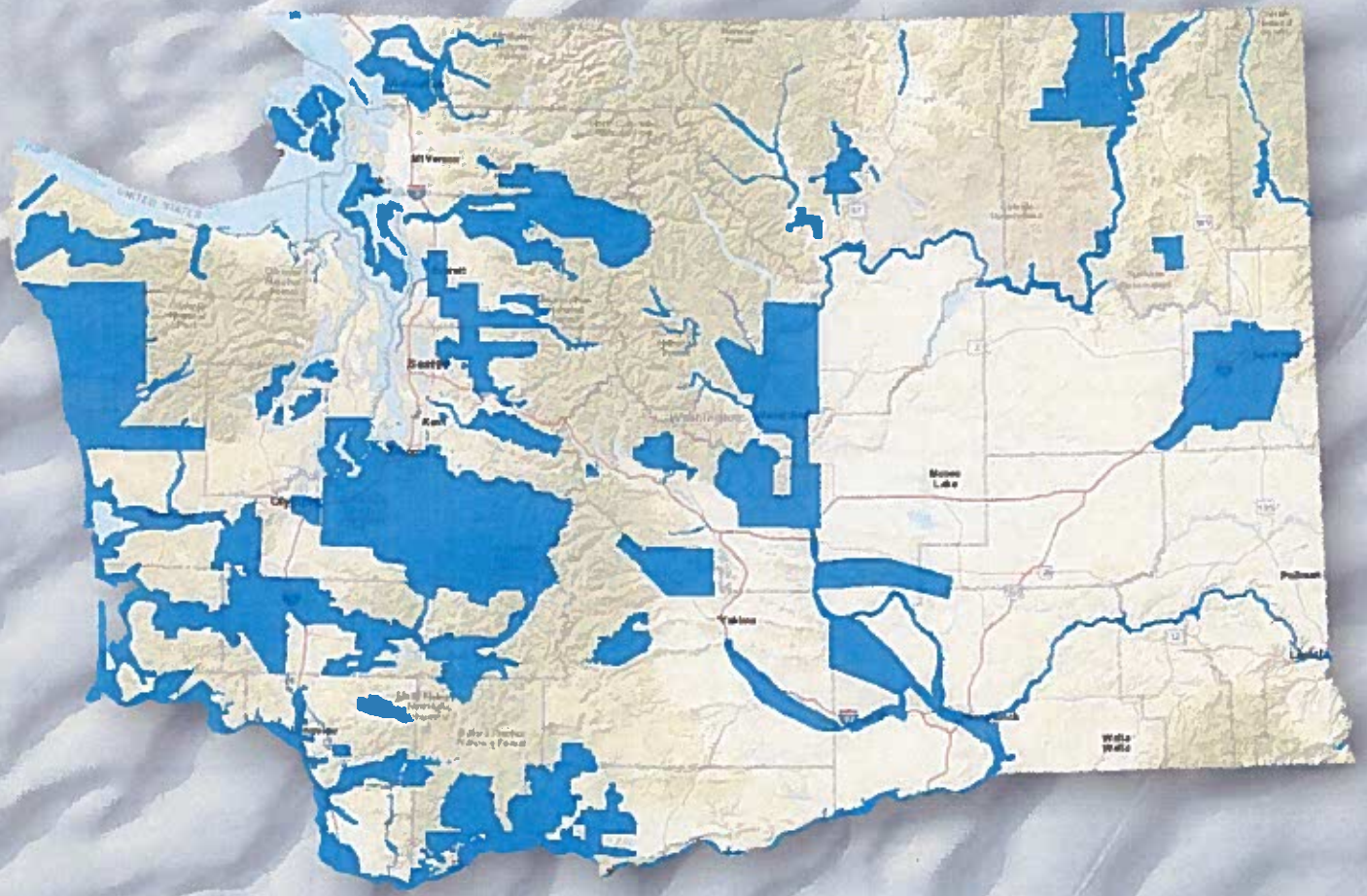
Agricultural applications including field drainage, sun-angle analysis

Forestry and Habitat Monitoring

Current LiDAR Data....



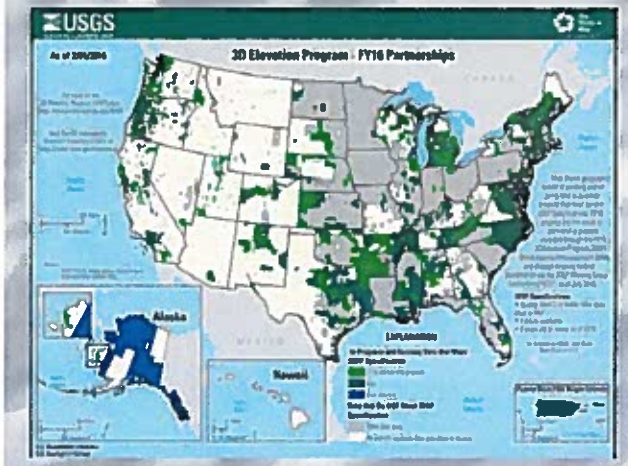
...Depends on Quality



USGS 3D Elevation Program

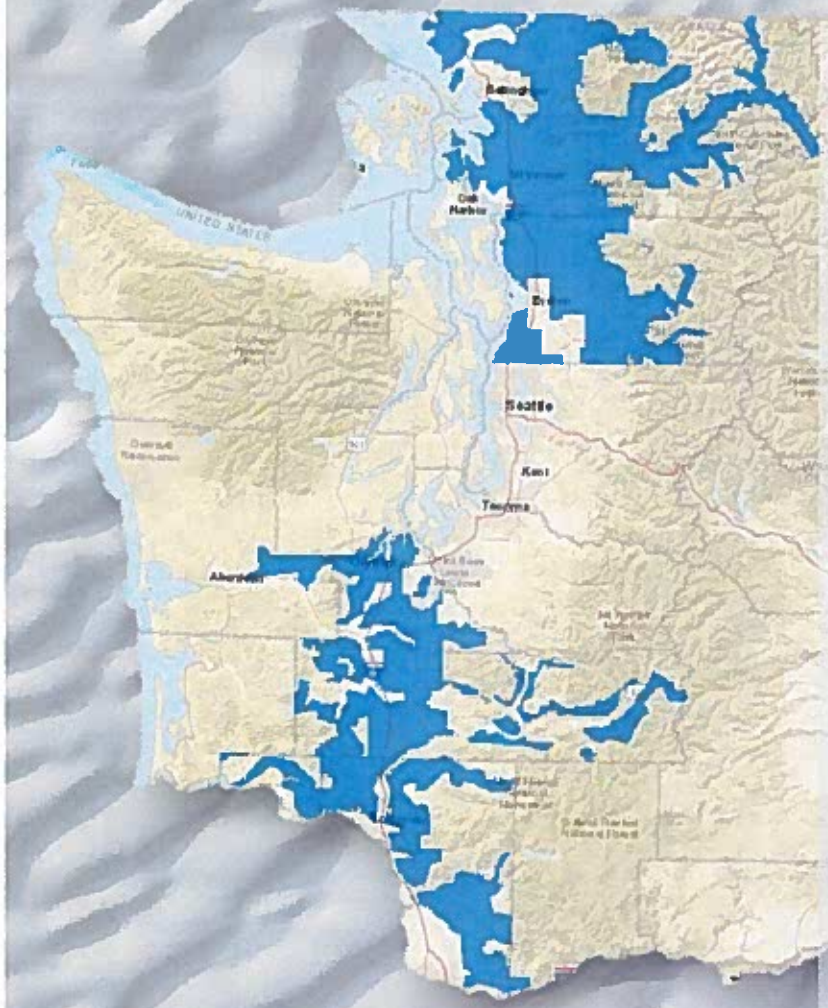
- Based on the results of the National Enhanced Elevation Assessment – 600 business applications identified for LiDAR
- Assessment indicated 5:1 return on investment
- Goal is to map conterminous US in 8 years
- 25% efficiency gain by mapping large areas
- Program focuses on collaboration from Federal, State, Local, Tribal governments and private industry
- Data is in public domain

USGS 3D Elevation Program



- USGS LiDAR Base Specification 1.2, defines requirements and Quality Levels (QL)
- USGS cost share based on QL2, 2 pulses per square meter (ppsm)
- Projects contracted through either Geospatial Product and Service Contracts (GPSC – 80% of projects) or Cooperative Agreements (20% of projects)
- Rating criteria: Older or no LiDAR coverage, or significant change, priority area for multiple agencies and organizations, large projects, overall cost, proposed cost share, past performance of applicant and vendor

Current 3DEP Participation



- Current project began in Spring 2016, will end in 2017
- Area chosen based on hazard mapping needs, partner requirements, and lack of previously existing high quality data
- Required QL1, 8ppsm, due to dense canopy
- Used the GPSC contract option, 5% overhead
- Hydroflattening required
- Local partnerships and 3DEP participation is funding 5,440 square miles of LiDAR collection, 33% more area than could be covered by DGER alone in the same time period

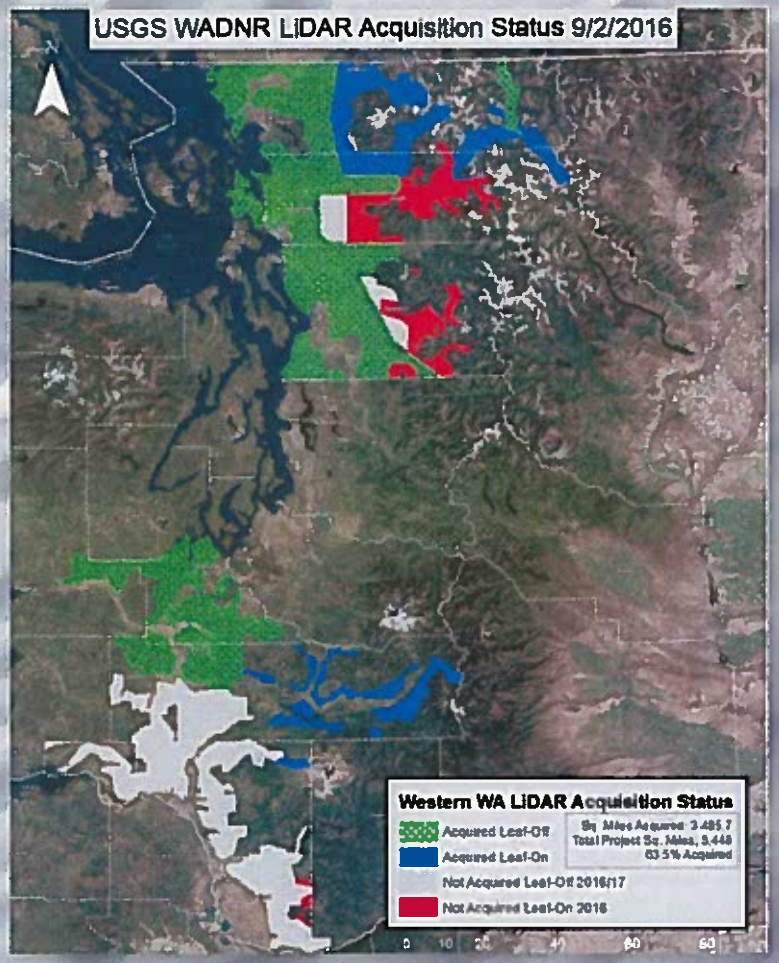
Current 3DEP Participation

- Gathered Partners in September 2015 – Lewis, Snohomish, Skagit, Whatcom Counties; Swinomish Tribe, Seattle City Light, Sierra Pacific Industries
- 3DEP application completed by DNR in October
- Attachment E: Commitment form from each partner describing funding amount and funding category of "guaranteed" or "pending"

Current 3DEP Participation

- 3DEP award announced in January 2016
- DGER completed a Statement of Work with USGS, a Joint Funding Agreement
- At that point needed a decision on "pending" or guaranteed funding from Partners
- Cooperative Purchasing Agreements or Interagency Agreements completed between each Partner and DGER
- Kickoff meeting between DGER, USGS, and Quantum Spatial Inc., the LiDAR vendor

Current 3DEP Participation



- Began acquisition March by QSi
- Three collection periods: Spring leaf-off, Summer leaf-on (high elevations), Fall leaf-off
- Pilot study covers ~5 sq Km, delivered end of August
- Will be delivered in two blocks: North (June 2017) and South (September 2017) to USGS
- USGS will QA the data, ask the Vendor to reprocess as necessary, data then delivered to DGER
- DGER will deliver the data to the customers

Lessons Learned

- Big delivery blocks are a challenge – dissemination takes some time
- Data generally cannot be released early unless there is an emergency
- Partnerships extend coverage, resources, allows for flexibility in funding, expands utility
- DGER and partners often have budget constraints to consider
- Compact Areas of Interest are the most efficient and can be completed faster

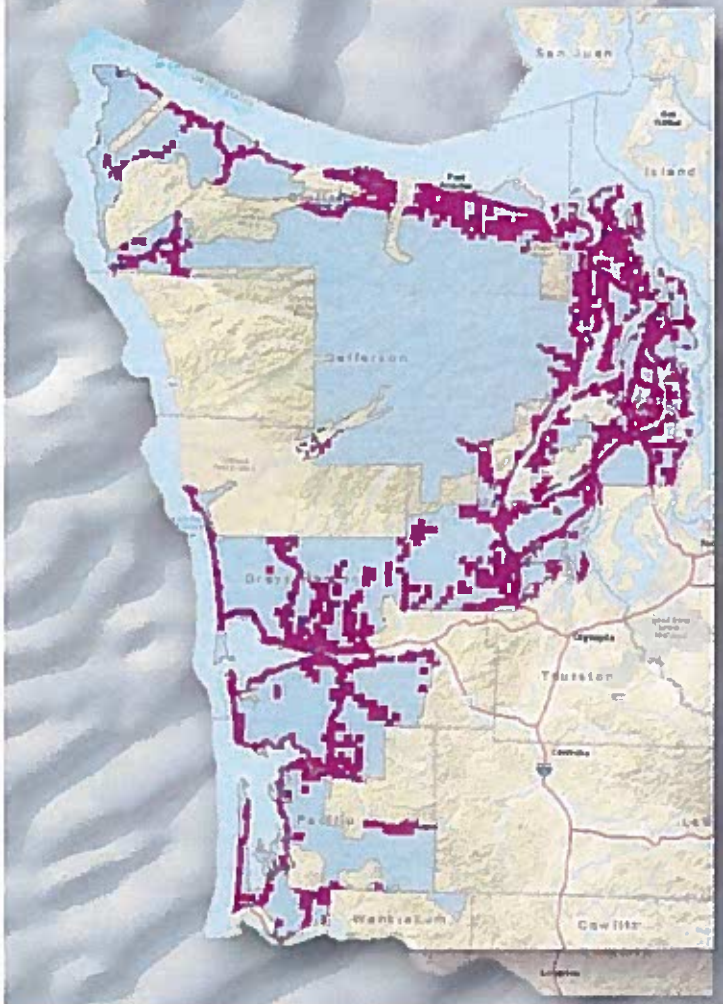
3DEP – 2017 to 2019

- 3DEP is a great opportunity to collect high resolution LiDAR data over a large area:
  - Data consistency
  - High data quality, higher accuracy
  - Centralized project management
  - Cost share: partners, DGER share costs, USGS funds ~22% for QL1 data
  - Allows funding for LiDAR acquisition in Washington to be spread farther

3DEP – Moving Forward

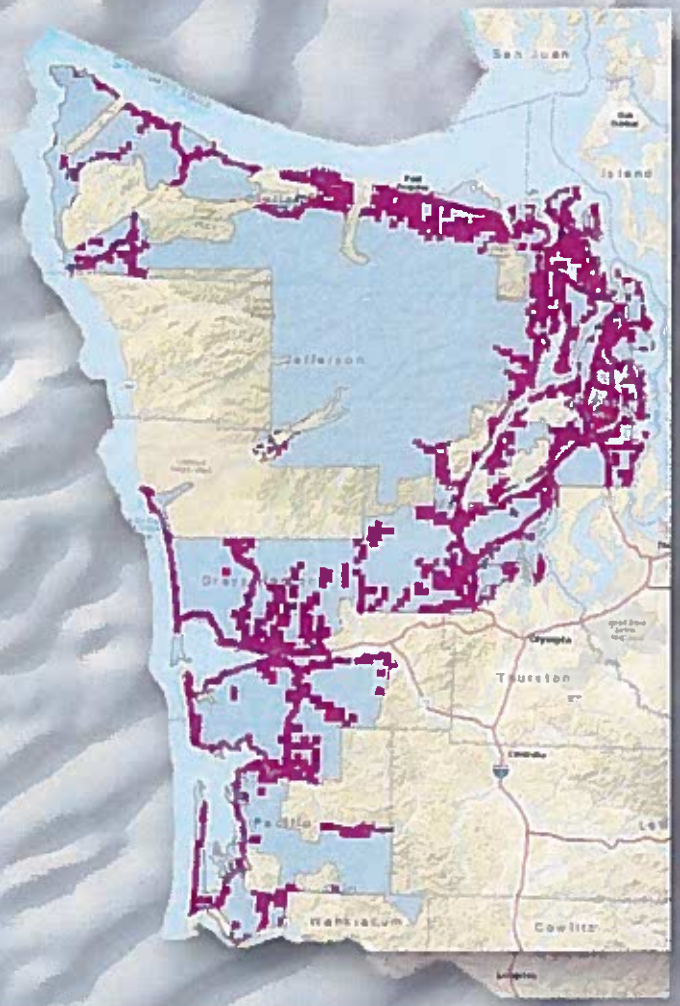
- 2016/17 Solicitation announced August 11, 2016
- Application deadline October 10
- Collection would begin in Fall 2017
- Will apply for GPSC contract, QSi the likely vendor
- Decision on award will likely be Spring 2017
- 8ppsm requirement
- A year in advance, challenging to plan, but 3DEP is a great opportunity for additional funding and support

3DEP – Moving Forward



- Critical area identified for geologic hazards – area DGER is responsible for
- Target area based on outdated LiDAR coverage and lack of coverage
- AOI based on what DGER would like to collect, but actual collection area largely depends on partnerships (example, Olympic National Park)
- AOI also determined by quality datasets already in the region
- Potential partnerships: county, city, tribal governments, power companies, timber companies

3DEP – Moving Forward



- Compared to 3DEP rating criteria:
  - Collects new area or older, low resolution data
  - High national interest from Federal partners
  - Large area (5,200+ sq. miles)
  - GPSC contract method
  - Past experience with 3DEP projects
  - Large contribution to cost share from DGER
  - QL1 does cost more, but necessary for this region for high quality

Cost Share

- Vendor estimate: the cost is ~$600/square mile
  - Takes into account high density collection
  - Required products from the USGS
  - Includes efficiencies for large area collection
- Estimated USGS cost share is ~22%
- Estimated DGER cost share over area that is common interest with partners is ~42%.
- To complete entire target area, partnership is needed to make up difference

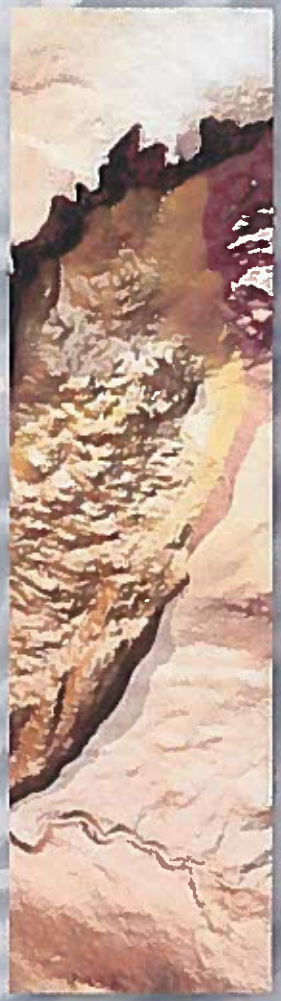
Timeline

- Application due October 10, 2016
- Goal to understand Partnerships: September 22
- If awarded, likely Spring 2017
  - Due to Fall 2017 collection
  - Funding decisions should move to "guaranteed" by that time
  - Will have time to adjust Area of Interest if needed

Information Needed

- From each Partner:
  - A shapefile of their AOI to make sure it is included in final collection area
  - Any particular collection parameters (specific time of year, higher point density, etc.)
  - An estimate of funding that can be applied
  - Funding type – "pending" or "guaranteed". If pending, an estimate of when funding decisions will be made → "Attachment E"

Beyond 3DEP



- If our 3DEP application is not awarded, there are other possibilities
  - DGER/DNR Request For Proposals this Fall
  - Project Management/QA would be done by DGER
  - Could be applied to projects outside of Western Washington

Other Ways to Partner with DGER

- DNR is also responsible for wildfires, forest management, aquatics
  - Any data contributions would go a long way to helping understand Washington ecology and emergency preparedness
- DGER RFP
  - Areas outside of Western Washington that may be outside of current 3DEP AOI
  - Other projects

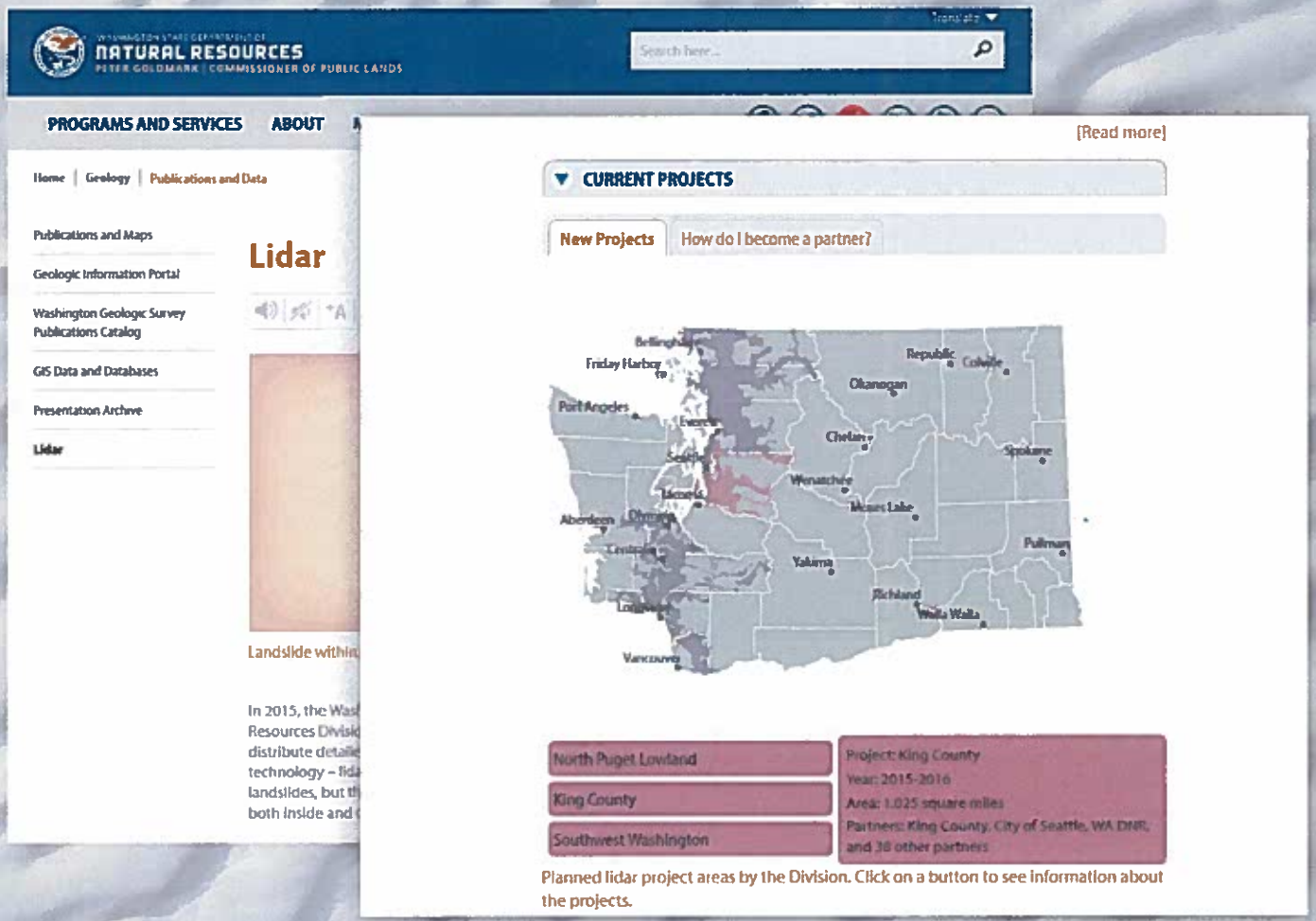
Future LiDAR Portal

- RCW 43.92.025, 2015: create and maintain an efficient, publically available database of LiDAR data
- Big data challenge
- Desired Capabilities:
  - Distribute LAZ files, DEMs, derivatives (hillshade)
  - Allow users to download based on AOI, choose products
  - Intuitive user interface

Future LiDAR Portal

- Two ongoing portal projects
  - Alaska Division of Geological and Geophysical Surveys
    - Almost complete
    - ~1/3 of LiDAR projects available this fall, the rest to follow soon
  - Esri pilot
    - Cloud storage and server, optimized for viewing
- Ultimately, DGER is gaining experience in storage and dissemination solutions

DGER LiDAR Resources



http://www.dnr.wa.gov/lidar

Questions?

Abby Gleason
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EXHIBIT O

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Quinault Indian Nation

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October 6, 2015

Brenden McFarland
Environmental Review and Transportation Section Manager
Department of Ecology

Dear Mr. McFarland:

During our participation in developing the Programmatic Environmental Impact Statement comparing alternative actions to reduce flood damage in the Chehalis River Floodplain, we noticed that an option to reduce flood damage through an ecological restoration was not included for evaluation. In examining some recent science we believe this is a practical alternative approach to reducing flood damage in the Chehalis watershed that should be evaluated; thus, we are proposing to create this option and have it evaluated as part of the Programmatic Environmental Impact Statement. I have attached a draft outlining the basic concepts of our proposal. We have only had a short time to recognize the need and develop the general, conceptual approach for this proposal. The proposal will be revised to include greater detail regarding tasks, time and budget needed to develop information on physical processes, floodplain habitats and riparian restoration necessary to support comparisons of this alternative with the others. The current draft has had input from QIN scientists, QIN consultants and outside agency scientists, and although not polished yet, it is solid science.

We recognize this may hamper the timeline of completion of the PEIS, but strongly believe this alternative merits consideration and evaluation in the PEIS. As mentioned in past meetings, the Quinault Indian Nation is engaged in this project to help bring meaningful restoration to the Chehalis Basin, while reducing flood damage, and we bring this alternative forward to do so,

Sincerely,

Dave Bingaman, Director
Quinault Division of Natural Resources

cc: Rob Duff
Jim Kramer
Erik Neatherlin