

PEER REVIEW OF WHITE PAPERS
PREPARED IN 2007 FOR
HYDRAULIC PROJECT APPROVAL HABITAT CONSERVATION PLAN

CHANNEL MODIFICATIONS
FISH PASSAGE
FLOW CONTROL STRUCTURES
HABITAT MODIFICATIONS
FISH SCREENS
MARINAS AND SHIPPING/FERRY TERMINALS
SHORELINE MODIFICATIONS



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EXECUTIVE SUMMARY

The Washington Department of Fish and Wildlife (WDFW) has the legislated responsibility to “preserve, protect, perpetuate, and manage” the fish, wildlife, and shellfish resources of the state, including their habitat. The state Hydraulic Code (RCW 77.55), administered by WDFW, is the primary tool for protecting and managing fish and shellfish habitat. The Hydraulic Code requires that any work that will “use, obstruct, divert, or change the natural flow or bed” of the salt or freshwaters of the state must be conducted under the terms of a permit (Hydraulic Project Approval or HPA) issued by WDFW.

In order to assure the HPA program is in compliance with the Endangered Species Act (ESA) WDFW is developing a Habitat Conservation Plan (HCP) as provided in Section 10 ESA.

In 2007 WDFW contracted with Herrerra Environmental Consultants, Inc. to prepare white papers on seven activities subject to HPA regulation: Channel Modifications, Fish Passage, Flow Control Structures, Habitat Modifications, Fish Screens, Marinas and Shipping/Ferry Terminals, and Shoreline Modifications. WDFW commissioned PH2 Consulting Services LLC to coordinate a peer review of the papers and prepare this report.

Three to five experts reviewed individual white papers. (Two to four Washington Department of Transportation experts reviewed five of the white papers. This is considered as one review.) Upon receipt of all comments, those for each white paper were combined by white paper section and provided to each reviewer of that white paper. The Peer Review Coordinator subsequently convened a post-review meeting for each white paper. Participants were the reviewers, appropriate WDFW staff, and the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service lead person for the HCP. Discussion of white papers at these post-review meetings elicited additional comments.

Major issues the reviewers raised for the white papers are:

- Lack of a clear link between the subject activity of each paper and effects on potentially covered species.
- Lack of definition and inconsistent use of key terms.
- Lack of definition and inconsistent and inadequate treatment of cumulative effects.
- Haphazard treatment of data gaps.
- White papers are “salmon centric.”
- Risk of take presentation was not well understood and deemed not very helpful.
- Inadequate presentation of mitigation measures.
- Improper use of the conceptual model of Williams and Thom (2001)

1.0 INTRODUCTION

The Revised Code of Washington (RCW) at RCW 77.04.012 directs the Washington Department of Fish and Wildlife (WDFW) to “preserve, protect, perpetuate, and manage” the fish, wildlife, and shellfish resources of the state. This mandate necessitates that the habitat that these resources rely upon be properly protected and managed. The most important tool for doing so for fish and shellfish is the state Hydraulic Code (RCW 77.55). The Hydraulic Code requires that any work that will “use, obstruct, divert, or change the natural flow or bed of state waters” must be conducted under the terms of a permit (Hydraulic Project Approval or HPA) issued by WDFW. It applies to all fresh and saltwater areas of the state.

WDFW issues HPAs with conditions (requirements) for the protection of fish and shellfish, including their habitats. Over 4000 individual HPAs are issued annually, with additional work approved under different general approvals. Activities subject to regulation under the Hydraulic Code range, for example, from simple gold panning to construction of a major naval homeport facility.

To ensure that the HPA program is in compliance with the federal Endangered Species Act of 1973 or ESA (16 U.S.C. 1531 et seq.), WDFW has initiated an effort to develop a Habitat Conservation Plan (HCP) to support its application for an Incidental Take Permit (ITP) as provided in Section 10 of ESA. The application must be approved by the National Oceanic and Atmospheric Administration Fisheries Service (NOAA or NOAA Fisheries; formerly called and sometimes referred to herein as National Marine Fisheries Service or NMFS) and United States Fish and Wildlife Service (USFWS), collectively referenced as “the Services.”

WDFW has not made a final decision on which species they will propose to have covered in the HCP. For purposes of the white papers, they asked the authors to consider 52 species in their analysis (Table 1-1). These are referred to herein and generally in the white papers as the 52 HCP species.

Table 1-1. The 52 HCP species addressed in the white papers.

Common Name	Scientific Name	Status^a	Habitat
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	FE/FT/SC	Freshwater, Estuarine, Marine
Coho salmon	<i>Oncorhynchus kisutch</i>	FT/FSC	Freshwater, Estuarine, Marine
Chum salmon	<i>Oncorhynchus keta</i>	FT/SC	Freshwater, Estuarine, Marine
Pink salmon	<i>Oncorhynchus gorbuscha</i>	SPHS	Freshwater, Estuarine, Marine
Sockeye salmon	<i>Oncorhynchus nerka</i>	FE/FT/SC	Freshwater, Estuarine, Marine
Steelhead	<i>Oncorhynchus mykiss</i>	FE/FT/SC	Freshwater, Estuarine, Marine
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	FSC	Freshwater, Estuarine, Marine
Redband trout	<i>Oncorhynchus mykiss</i>	FSC	Freshwater
Westslope cutthroat trout	<i>Oncorhynchus clarki lewisii</i>	FSC	Freshwater
Bull trout	<i>Salvelinus confluentus</i>	FT/SC	Freshwater, Estuarine
Dolly Varden	<i>Salvelinus malma</i>	FP	Freshwater, Estuarine
Pygmy whitefish	<i>Prosopium coulteri</i>	FSC/SS	Freshwater
Olympic mudminnow	<i>Novumbra hubbsi</i>	SS	Freshwater
Lake chub	<i>Couesius plumbeus</i>	SC	Freshwater
Leopard dace	<i>Rhinichthys falcatus</i>	SC	Freshwater
Margined sculpin	<i>Cottus marginatus</i>	FSC/SS	Freshwater
Mountain sucker	<i>Catostomus platyrhynchus</i>	SC	Freshwater
Umatilla dace	<i>Rhinichthys umatilla</i>	SC	Freshwater
Pacific lamprey	<i>Lampetra tridentata</i>	FSC	Freshwater, Estuarine, Marine
River lamprey	<i>Lampetra ayresi</i>	FSC/SC	Freshwater, Estuarine
Western brook lamprey	<i>Lampetra richardsoni</i>	FSC	Freshwater
Green sturgeon	<i>Acipenser medirostris</i>	FSC/FT/SPHS	Freshwater, Estuarine, Marine
White sturgeon	<i>Acipenser transmontanus</i>	SPHS	Freshwater, Estuarine, Marine
Longfin smelt	<i>Spirinchus thaleichthys</i>	SPHS	Freshwater, Estuarine, Marine
Eulachon	<i>Thaleichthys pacificus</i>	FC/SC	Freshwater, Estuarine, Marine
Pacific sand lance	<i>Ammodytes hexapterus</i>	SPHS	Marine & Estuarine
Surf smelt	<i>Hypomesus pretiosus</i>	SPHS	Marine & Estuarine
Pacific herring	<i>Clupea harengus pallasii</i>	FC/SC	Marine & Estuarine
Lingcod	<i>Ophiodon elongatus</i>	SPHS	Marine & Estuarine
Pacific cod	<i>Gadus macrocephalus</i>	FSC/SC	Marine (occ. Estuarine)
Pacific hake	<i>Merluccius productus</i>	FSC/SC	Marine & Estuarine
Walleye pollock	<i>Theragra chalcogramma</i>	FSC/SC	Marine (occ. Estuarine)
Black rockfish	<i>Sebastes melanops</i>	SC	Marine & Estuarine
Bocaccio rockfish	<i>Sebastes paucispinis</i>	SC	Marine & Estuarine

Common Name	Scientific Name	Status^a	Habitat
Brown rockfish	<i>Sebastes auriculatus</i>	SC	Marine & Estuarine
Canary rockfish	<i>Sebastes pinniger</i>	SC	Marine & Estuarine
China rockfish	<i>Sebastes nebulosis</i>	SC	Marine & Estuarine
Copper rockfish	<i>Sebastes caurinus</i>	FSC/SC	Marine & Estuarine
Greenstriped rockfish	<i>Sebastes elongates</i>	SC	Marine & Estuarine
Quillback rockfish	<i>Sebastes maliger</i>	FSC/SC	Marine & Estuarine
Redstripe rockfish	<i>Sebastes proriger</i>	SC	Marine & Estuarine
Tiger rockfish	<i>Sebastes nigrocinctus</i>	SC	Marine & Estuarine
Widow rockfish	<i>Sebastes entomelas</i>	SC	Marine & Estuarine
Yelloweye rockfish	<i>Sebastes ruberrimus</i>	SC	Marine & Estuarine
Yellowtail rockfish	<i>Sebastes flavidus</i>	SC	Marine & Estuarine
Olympia oyster	<i>Ostrea lurida</i>	SPHS	Marine & Estuarine
Northern abalone	<i>Haliotis kamtschatkana</i>	FSC/SC	Marine
Newcomb's littorine snail	<i>Algamorda subrotundata</i>	FSC/SC	Marine
Giant Columbia River limpet	<i>Fisherola nuttalli</i>	SC	Freshwater
Great Columbia River spire snail	<i>Fluminicola columbiana</i>	FSC/SC	Freshwater
California floater (mussel)	<i>Anodonta californiensis</i>	FSC/SC	Freshwater
Western ridged mussel	<i>Gonidea angulata</i>	None	Freshwater

Notes: Some of the HCP species have been grouped when appropriate (each group is separated by a gray-shaded line).

^a Status:

FE=Federal Endangered
 FP=Federal Proposed
 FT = Federal Threatened
 FC = Federal Candidate

FSC = Federal Species of Concern
 SC = State Candidate
 SS = State Sensitive
 SPHS = State Priority Habitat Species

An extensive set of administrative rules (Washington Administrative Code [WAC] 220-110) guides administration of the Hydraulic Code. It also includes the major conditions, called technical provisions, which are commonly incorporated into HPAs. These rules, last comprehensively revised in 1994, will be an important element of the HCP. It has been determined that the WACs will need to be reviewed and revised to meet requirements of the Services.

Revised WACs must necessarily be based on the most recent and best science. In order to assure this, in 2006 WDFW contracted with Anchor Environmental and its sub-contractors to complete four white papers to evaluate the potential impacts, potential for take (as defined under ESA), potential mitigation and conservation measures, and data gaps for five HPA activity types: small-scale mineral prospecting, overwater structures, non-structural pilings, water crossings, and bank protection. Overwater structures and non-structural pilings were addressed in one white paper.

The Services recommend that information prepared in support of a HCP undergo technical (peer) review to ensure that it is accurate, complete, and adequately rigorous. PH2 Consulting Services LLC was selected as the Peer Review Coordinator. The results of the peer review were presented in PH2 Consulting (2007).

In 2007, WDFW commissioned Herrera Environmental Consultants, Inc. to prepare white papers on seven additional HPA activity types: Channel Modifications, Fish Passage, Flow Control Structures, Habitat Modifications, Fish Screens, Marinas and Shipping/Ferry Terminals, and Shoreline Modifications. PH2 was again selected to coordinate a peer review of each of the papers.

Specific objectives of the peer review was to:

- Provide the scientific community with a venue for reviewing the documents and methods developed in support of the HCP.
- Identify potential shortcomings in the information and/or additional relevant information.
- Increase visibility and credibility of scientific materials.
- Assess the adequacy of management and mitigation measures presented in the white papers and identify additional management and mitigation measures suggested by the reviewers.

The results of the peer reviews are the subject of this report.

1.1 Reviewer Selection Process

The Peer Review Coordinator was presented an initial list of technical experts as potential peer reviewers for each white paper as recommended by WDFW staff members. NOAA Fisheries also provided a list of potential agency reviewers for each white paper. Others were added to the initial list based on Peer Review Coordinator, tribal, and other

recommendations. Potential reviewers came from academia, Washington treaty Indian tribes, the Services, city government, state government agencies other than WDFW, and private industry.

Each potential reviewer was contacted by email and asked if he or she would be willing to participate in the peer review. All were known to have expertise relative to the topic they were asked to review, but were requested to submit a resume, Curriculum Vitae, or other showing of expertise (Appendix A) to review the white paper(s) they were invited to review. At least one follow-up email was sent to non-respondents. Those who did not respond to these contacts were subsequently contacted by telephone. Several potential reviewers did not respond to any of the contacts.

It is important that the peer review process not be tainted by even the appearance of bias among the reviewers. Each potential reviewer was asked to respond to a series of questions that would have disclosed any bias or appearance. One potential panelist was disqualified on the basis of having participated in the writing of one of the white papers.

The number of reviewers that agreed to participate in the review process ranged from five to seven per paper. However, several selected reviewers ultimately did not submit comments.

The intent was to have a tribal reviewer for each of the white papers. None could be located that would agree to review the Fish Screen white paper. Three of the reviewers selected for the other six white papers did not submit comments.

1.2 Review Panels

Thirty-one individuals participated in the review (Table 1-2). For the five papers that the Washington Department of Transportation (DOT) reviewed, Ken Schlatter was the primary reviewer and coordinator, with DOT experts per Table 1-2 on various topics reviewing and commenting on the portions that were within their area of expertise.

Table 1-2. Technical experts selected to review the seven white papers

White Paper	Name	Affiliation
Channel Modifications	Randy W. McIntosh	NOAA Fisheries
	Stephanie Ehinger	NOAA Fisheries
	Ken Schlatter (Sandra Stephens, Robert W. Schanz)	DOT
	Robert E. Bilby	Weyerhaeuser Corporation
Fish Passage	Ken Schlatter (Brian Bigler)	DOT
	Jeremy Gilman	Makah Tribe
	Bryan Nordlund	NOAA Fisheries
	Scott M. Potter	Washington Department of Natural Resources (DNR)
	Gary R. Sprague	City of Seattle
Flow Control Structures	Dennis Carlson	NOAA Fisheries
	Ken Schlatter (Sandra Stephens, Erin M. Britton)	DOT
	Joel Moribe	NOAA Fisheries
Habitat Modifications	Ken Schlatter (Kelly McAllister, Garrett W. Jackson, Jim Laughlin)	DOT
	Thomas G. Hooper	NOAA Fisheries
	Randy W. McIntosh	NOAA Fisheries
	Thomas F. Mumford Jr.	DNR
	Rudy Salakory	Cowlitz Tribe
Fish Screens	Bryan Nordlund	NOAA Fisheries
	Richard V. Haapala	CH2MHill
	Edward E. Donahue	HDR/Fish Pro
Marinas	Carol Cloen	DNR
	Ken Schlatter (Sharon Rainsberry, Kojo Fordjour)	DOT
	Thomas Ostrom	Suquamish Tribe
	John Stadler (underwater noise sections only)	NOAA Fisheries
	Justin Yeager	NOAA Fisheries
Shoreline Modifications	Hugh Shipman	Washington Department of Ecology
	Ken Schlatter (Erin M. Britton)	DOT
	Phyllis Schwyhart Meyers	NOAA Fisheries
	James S. Brennan	University of Washington Sea Grant Program

In addition to the above, Ronald M. Thom (Battelle Marine Sciences Laboratory) reviewed and commented on Section 6.0. He is one of the co-authors of the paper that provided the conceptual model the authors present in Section 6.0. He also reviewed Section 7.0 of the Marinas and Shipping/Ferry Terminals white papers and provided general comments on how the authors used the model. His comments are applicable to all the white papers, however, as they all used the same basic approach. His comments are found in Appendix K.

Because of their expertise and the demands of their jobs, these experts all had to allot time from full schedules to participate in the peer review process. WDFW is grateful that they were willing to do so.

1.3 The Review Process

Following distribution of the white papers to the selected reviewers, five pre-review meetings were held in mid-June and early July; each selected reviewer was asked to attend any one of the five. The purpose of the meetings was to:

- Present reviewers an overview of the process the WDFW is using to develop a HCP for the HPA program and explain how the white papers fit into the overall HCP development process.
- Describe the peer review process and expectations for reviewers.
- Explain how the white papers and reviewers' comments will be utilized.
- Present reviewers with the Microsoft Word table in which to submit their comments.
- Describe the post-review process (post-review meetings and development of final report by PH2).
- Review the time lines.
- Identify peer reviewers for each of the white papers.
- Answer any questions reviewers might have.

A summary of the pre-review meetings is presented in Appendix B.

Following receipt of all the comments for each white paper, the Peer Review Coordinator combined all comments into one table for each white paper. The combined comments tables for each of the seven white papers are individually presented in Appendices C through I.

Each of the reviewers was provided a copy of the combined comments table for the paper(s) they reviewed and asked to provide any additional comments they might have in light of comments made by other reviewers. A post-review meeting was subsequently held for each white paper. Reviewers were asked to attend the meeting for their white paper and most did. A summary of the post-review meetings is included as Appendix J.

At the meetings, the combined comments were discussed for the purpose of clarifying any ambiguous areas, hearing any comments one reviewer might have on the comments of another reviewer, and identifying any areas of disagreement among reviewers as reviewers considered the comments made by others (which they of course did not have when they conducted their initial review). There were few significant areas of disagreement; most of those were resolved. Those that were not resolved are noted in the discussion for each white paper in Sections 2.0 through 8.0. These discussions of the comments for each white papers include a summary of the written comments submitted by the reviewers as well as those made at the wrap-up meetings.

1.4 Instructions to Authors and Evaluation of Achievement

In order that readers of this document might better understand and evaluate the white papers and reviewers' comments, pertinent instructions to the authors are reprinted here:

“For each topic to be reviewed, the contractor will write (or update) a technical white paper (including annotated bibliography) characterizing the state of the knowledge of the topic based on an outline to be provided by WDFW. The general content and level of detail expected for the white papers will be similar to Treated Wood Issues Associated with Overwater Structures in Marine and Freshwater Environments (Poston 2001 – available at <http://wdfw.wa.gov/hab/ahg/finaltw.pdf>).

Through a comprehensive review of published (peer reviewed) and unpublished (gray) literature, the white paper must fully evaluate the impacts of the HPA activities and the potential for take of the species that may be covered in the HCP. In order to characterize potential take, the white papers need to describe the threshold of impact at which actual damage or loss (i.e., take) of fish and their habitats occurs. The papers must also evaluate the severity of take, the mechanism responsible for the take, and how best to mitigate for that take. The white papers must also quantify, or otherwise characterize, the cumulative impacts of multiple projects of a single type and at what point cumulative impacts may reach the level of take.

*The white papers will provide **specific** management recommendations to mitigate (i.e., avoid, minimize, compensate) impacts and the potential for take of the species and habitats that may be covered in the HCP. Specifically these management recommendations should be based on thorough review of published and unpublished literature, as described above. Where possible, the white papers must include numeric standards (e.g., construction standards, set back or buffer standards, and/or mitigation standards) to meet different levels of*

resource protection (e.g., take avoidance, no net loss, minimal impact).

Because of the lack of specific information and uncertainty associated with some of these topics, the WDFW recognizes the need for best professional interpretation of existing information and available science and encourages the contractor to consider providing a qualitative risk assessment for those topics. A risk assessment is a means of characterizing the probability (or possibility) of occurrence of an adverse impact to public resources. The purpose of a risk assessment is to synthesize what we know about potential impacts and to translate that knowledge into tools managers can use to predict those impacts based on characteristics of the specific proposed activity. The assessment could use “level of take”, or more qualitative categories of disturbance based on severity, recovery time, etc., as the measure of impact versus human disturbance or change in habitat that results from the activity.

The white paper will also briefly summarize the major gaps in our knowledge that have the potential for relatively large and heretofore unforeseen impacts to fish and fish habitat that could be suitable for research.

The white papers and associated literature reviews will serve as the foundation of “best available science” as defined and implemented by the State of Washington and therefore must be of the highest professional quality that can withstand the rigors of legal challenge.”

There were several ways in which the authors did not meet the obligations stated in the above instructions:

- While each of the white papers provided a bibliography, none were annotated.
- In general, the papers did a satisfactory job of locating and describing relevant studies of the impacts of the covered activities. In general, however, they did not satisfactorily discuss the potential impacts on the 52 HCP species.
- Salmonids, particularly salmon, were emphasized and other species for the most part received much lesser consideration. This is in part due to the fact that there is more information relative to salmonids, but there was little attempt to extrapolate from studies on one (or more) species to the 53 HCP species more broadly.
- The potential for take from the impact mechanisms was characterized for each of the 52 HCP species in each of the papers. For the most part, it was difficult to understand how the ratings were determined. Because of this and other problems, reviewers generally deemed the ratings of not much value.
- In almost no case did authors describe the threshold level for the various impacts at which damage or loss would occur.

- Cumulative effects were never quantified. Most discussions of cumulative effects were extremely brief and superficial. None discussed the point at which cumulative impacts would reach the level of take. Much of the discussion was simply about direct and indirect effects rather than cumulative effects. The instructions were to quantify, or otherwise characterize, the cumulative impacts of multiple projects of a single type. The authors did not consistently consider cumulative effects of multiple projects of a single type. More often, they considered cumulative effects of one type of impact (e.g., dredging). In some white papers, there was internal consistency in how cumulative effects were considered.
- The white papers all failed to meet the instructions regarding mitigation measures. There was no attempt to systematically consider the described effects and list mitigation measures to address them. In general, no mitigation measures were even recommended. The authors simply reported measures or lists of measures that are found in the literature, with no effort to evaluate them for necessity, practicality, effectiveness, or other aspect. Many were very general rather than specific. Almost no numeric standards were provided. Most measures presented were those that might reduce impacts; few were those that would avoid impacts. There was no discussion of the compensatory aspect of mitigation or any measures presented for doing so. There was little evidence that professional judgment had been exercised.
- The presentations of data gaps were obviously not systematically analyzed. A logical approach would be to systematically note the data gaps as they discussed the effects of the various mechanisms and submechanisms in Section 7. Rather, they appear to have been those that were mentioned in the studies consulted in preparing the white paper or that happened to occur to the authors during preparation of the white papers. Glaring gaps that showed up during the effects discussions often were not carried into the discussion of data gaps.
- Reviewers deemed the Fish Screen white paper of little value, which would not qualify as best available science. There were too many errors, omissions, and other indications that the authors were unfamiliar with fish screening issues.
- The discussion of impacts of underwater sound on fish was also deemed of dubious value. Again, errors of commission and omission cast substantial doubt on the effort. The same basic material was utilized in each of the white papers.

1.5 Review Comments

The comments on each white paper are discussed individually in Sections 2.0 through 8.0. The most significant comments and any areas of disagreement are presented and discussed. All comment submitted in writing by reviewers are combined in the format of the table that review comments were submitted to the Peer Reviewer. These tables are

presented individually in Appendices C through I. Additionally, Ronald M. Thom's comments on Section 6.0 are Appendix K.

Many of the most significant comments submitted by reviewers apply broadly to most or all of the seven white papers and are called "global comments" herein. The major ones are listed below. In each of the Sections 2.0 through 8.0 for the individual white papers, any comments unique to that paper on any particular global comment are given first, identified by the global comment number. Other major comments specific to that white paper follow. For each of the white papers, all comments submitted in writing by reviewers, and major ones that came up during the post-review meetings, are presented in the appendix specific to that white paper. For those papers that DOT reviewed, the comments for all DOT reviewers are combined

Many of these comments would have been unnecessary had their been effective coordination between the authors and comprehensive technical editing to assure that there was consistency within and between white papers and that the authors effectively addressed the issues per the WDFW instructions. Lack of same is a major detraction from the utility of the white papers.

Global Comments

1. Definitions and use of terms is a major problem. Understanding of terms used in a technical document is essential to understanding the document. To this end, explicit definitions and consistent use as defined is mandatory. In these white papers, unfortunately, numerous key words and terms are not defined and are used variously, and carelessly, between and even within individual white papers. Some terms that are defined are used in ways not consistent with the definitions. At least two terms are defined erroneously. Since there are no universally accepted definitions of most of these terms, the understanding, utility, and value of the white papers is greatly impaired. So was reviewers ability to comment. This problem was consistently cited by white paper reviewers and is probably the single-most significant criticism.

Some of the important words that are undefined and often misused include:

- **"Mitigation"** usually means sequentially avoiding impacts, minimizing unavoidable impacts, and compensating for any unavoidable impacts. This also is the general nature of mitigation as described in the WDFW instructions to the authors (Section 1.4, paragraph 3 above). The compensatory aspect is discussed in none of the white papers. Avoidance is sometimes mentioned, but few measures specifically designed to achieve it are presented in Chapter 11 (yet the introduction to Chapter 11 in most of the white papers acknowledges that ESA requires avoidance as well as minimization). Most often, mitigation in the white papers seems to be referring to the minimization aspect. In at least one place, there is a reference to the sequencing of mitigation, but it is never explained what this means, nor is the concept ever

utilized. Mitigation is used in various ways with various meanings or implications throughout the white papers. Some of the different ways include:

- “mitigation measures to avoid and/or minimize potential take” (but not compensate).
 - “management directives and mitigation measures” (mitigation measures apparently cannot be management directives—but according to the next bullet, they could be management strategies).
 - “habitat protection, conservation, mitigation, and management strategies that could avoid, minimize, or mitigate” (mitigation strategies that could mitigate).
 - “minimization and mitigation” and “mitigation/minimization” (minimization is apparently something different from mitigation).
 - “recommendations for impact avoidance, minimization, and mitigation measures” (apparently mitigation is something other than avoidance and minimization).
 - “Habitat Protection, Conservation, Mitigation, and Management Strategies”—title of Section 11.0 (mitigation strategies are apparently related to, but something different from, habitat protection, conservation strategies, and management strategies).
 - “prevention rather than mitigation” (mitigation does not include prevention).
 - “trigger mitigation sequencing to deal with project impacts” (but there is no explanation or definition of what this sequencing is, nor is it ever referenced again or used).
- **“Mechanism”** (or **“impact mechanism”**) is defined in each of the papers in Section 6. For some reason the authors of three of the white papers (Flow Control Structures, Shoreline Modifications, and Channel Modifications) used a different definition than is found in the other four white papers: “an alteration to any of the conceptual framework components along the impact pathway.” This is not correct and readers of these three white papers with this definition in mind will be confused. The impact mechanism is more correctly defined in the other white papers as “an unnatural disturbance to habitat controlling factors such as light, stream energy, substrate, water quality parameters, littoral drift, or channel geomorphology, “ i.e., something that causes a change in a controlling factor (per Figure 6-1). Unfortunately, none of the white papers utilize this definition in their delineation of impact mechanisms and what they present are actually a mix of mechanisms and impacts or effects of mechanisms. (see Global Comment 30)
 - The lack of definition and variable use of **“submechanism”** is a major source of confusion. In many places, “mechanism” and “submechanism” are used interchangeably. As are mechanisms, submechanism are a mixture of actual mechanisms and of effects. See Global comment 30.
 - **“Stressor”** is never defined, is used extensively throughout the white papers, and is used with different meanings.

Stressor is sometimes used interchangeably with impact mechanism; but more often stressors are imposed by impact mechanisms. Most often, stressor equates to submechanism (e.g., stressor/submechanism). In several places, however (e.g. Fish Passage white paper in Section 7.1) there are references to stressors and submechanisms as if they are two different things (“ . . . *many of the impact submechanisms, ecological stressors, and their effects. . .*” and “*Impact submechanisms and stressors associated with construction and maintenance . . .*”

In other places is “. . . *stressors resulting from this submechanism,*” or “*The ecological stressors imposed by the remaining impact submechanisms . . .*” So here, stressors aren’t submechanisms, rather they result from or are imposed by submechanisms. In still other places, stressor equates to the “impact” (i.e., the effect) of the mechanism or submechanism.

Often one finds “**ecological stressor.**” It is not clear if this means the same as or something akin to “stressor.” In places they seem to mean the same thing; in other it appears they might be something different.

- Each white paper uses the terms “**activity**” and “**subactivity,**” as relating to the project types that are the subject of the white paper. Neither term is ever defined and both seem to be used in different ways. In many places they are used interchangeably.
- “**Risk of take**” is discussed extensively in each of the white papers, yet the term as the authors consider it is not explicitly defined. The authors do attempt to equate the levels of risk of take (high, moderate, low, insignificant or discountable, unknown, and no risk) to ESA take assessment. Their comparison is flawed, however).
- “**Discountable,**” as the authors use it in the white papers with regard to risk of take, is not defined, either. It seems to mean negligible, but it is not clear.
- “**Impact pathway**” is another term for which the use is confusing. It is defined in Section 6.0 of each paper as the linkages shown in Figure 6-1 in which alterations to the environment can lead to impacts on the ecological function of the habitat. Yet in many places, “pathways” seem not to be the linkages, but interrupter of the linkages, which seems more like an impact mechanism. In another place, there is: “Therefore, this impact mechanism is not expected to be a primary pathway for . . .” which equates the impact mechanism with the pathway. “Pathway” is a common word with various meanings other than the referenced linkages and is used as such throughout the papers. In the white papers, one finds “pathways” referring to upstream and downstream migration routes for fish. In one place a pathway becomes the physical means by which equipment introduces toxic substances into the water and in another it is the physical route by which metals load to a water body from anthropogenic sources. Elsewhere there is a reference to an energy pathway, the route by which allochthonous material passes through the ecosystem. In some places, however, it is difficult to tell if the meaning is the

linkages or one of the more common use of the word. For example, in one place a “dominant pathway” is shading—which is actually a mechanism in that paper, not a pathway. Sometimes the author use “ pathway” when they use the term in one of its more common meanings and “impact pathway” otherwise, but they did not do so consistently. Had they done so, this would have eliminated a source of confusion.

- **“Cumulative effects”** (or sometimes **“cumulative impacts”**) is one of the few technical terms legally defined. According to the Council on Environmental Quality's (CEQ) interpretation of the National Environmental Policy Act, "cumulative impact" is “. . .*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency...or person undertakes such other actions.*” (CEQ Guidelines, 40 CFR 1508.7, issued 23 April 1971. This is not, however, a universal definition. It is not always possible to tell just what the authors are considering. It is evident, however, that cumulative effects is not consistently considered. See also number 8, below. Note that the CEQ definition includes direct and indirect effects.
- The authors use extensively, but do not define, **“direct effects”** and **“indirect effects”**. The two terms are used in different ways throughout the scientific literature. Those effects that flow directly from an action are direct effects. However, sometimes there is an element of time introduced so that effects are considered direct only if they occur immediately, otherwise they are considered indirect effects. In other quarters, however, an indirect effect would be an effect that flowed from a direct effect. For example, habitat damage might affect a prey species (direct effect), which would cause the decline of a predator species—an indirect effect. Elsewhere these would be called primary and secondary effects (e.g., EPA). It is not clear what the authors mean in the various white papers. Definitions of these terms would have perhaps clarified what the authors meant in their definition of cumulative effects.
- **“Best management practices”** (BMP) is never defined and is used variously. BMPs are normally considered simply to be measures to avoid or minimize impacts (i.e., mitigation measures), but are voluntary rather than mandatory. The term is used in a number of contexts in the white papers; for the most part it seems that BMPs are simply methods to avoid and/or minimize impacts. It is never stated, but the implication seems to be that they should be mandatory. It is never clear what distinguishes BMPs from conservation, habitat protection, mitigation, or management strategies (or measures), or if there is a distinction.
- **“Ecosystem fragmentation”** is a term used in all the white papers. Examples are given, but the term is not defined except in the Fish Passage white paper. After using the term extensively, it is finally defined in 7.6.1.6 as *“the disruption of ecological processes by reducing the connectivity between different components of the ecosystem, or the disruption of ecological*

processes.” Even those white papers that didn’t define the term seem to be using the same as is found in the Fish Passage paper.

This is an unusual definition. First of all, it is unclear what the second clause adds—it seems to be saying the same as the first one. More importantly, it defines the term in a different context than usually found. Ecosystem (or habitat) fragmentation is usually defined as the process whereby habitat is reduced from its original extent to a series of smaller, disconnected patches or fragments. Fragmentation may also occur by virtue of a block to normal migration patterns. Disruption of some ecological processes will be a result of fragmentation, but disruption of processes *per se* is not usually considered ecosystem fragmentation. Reference to other places where the authors’ definition is used would have been valuable.

With disruption of ecological processes constituting ecosystem fragmentation being fairly unique, reviewers did not understand this to be ecosystem fragmentation. Some of their comments reflect this.

- Four of the white papers (Channel Modifications, Flow Control Structures, Shoreline Modifications, and Habitat Modifications) discuss ecosystem fragmentation to some degree. The authors misuse a paragraph from WDFW (2003) to provide a definition: *“Preventing a channel from naturally migrating across the floodplain usually eliminates sources of woody debris, sediment, and side channels; these losses are defined as “lost opportunities.”* WDFW (2003) provides this only as an example of lost opportunity, not a definition. Using the WDFW (2003) quote as a definition is akin to saying rainbow trout are salmonids by definition; therefore the definition of salmonids is rainbow trout.
2. An executive summary should summarize the key points of a document so that the reader can become acquainted with the full document without having to read it all. None of the executive summary sections accomplish that. They are more like partial introductions or partial summaries. Mostly they just repeat some of the information in the introduction.
 3. There are three stated objectives common to all of the white papers. There is no mention of determining data gaps, which they are instructed by the department to do and which they have addressed in Section 10 of each of the papers. This should have been listed as one of the objectives.
 4. The third objective is stated as:

“Identify appropriate and practicable measures, including policy directives, conservation measures, and best management practices (BMPs), to avoid and/or minimize the risks of incidental take of HCP species.”

This is quite different from the title of Section 11 (where these measures are found): Habitat Protection, Conservation, Mitigation, and Management Strategies. There is no mention in the title of policy directives or BMPs. See item 1 for discussion of undefined terms, including BMP.

The title terms are not defined, and it is not clear what the distinction is between them. If the distinction is meaningful, the terms should have been defined and individual measures presented should have been appropriately categorized. Generally, none of the presented measures are identified as to which category they belong. They are usually identified only as techniques that may be used to mitigate effects of the particular topic of the white paper. (The Fish Screen white paper has one section on what it calls management strategies and two sections that just refer to “strategies.”) “Strategies” in the title is curious. There are few if any strategies, simply individual measures. It would be more descriptive if the title of the section was simply “Mitigation Measures.

Instructions from WDFW to the authors includes:

“ The white papers will provide specific management recommendations to mitigate (i.e., avoid, minimize, compensate) impacts. . . ”

The compensatory aspect of mitigation is totally ignored in all of the white papers. Most of the measures are of the nature of minimizing rather than avoiding. Many of the listed measures lack specificity have little value. For example: “incorporate monitoring and maintenance,” “use adaptive management,” “emphasize simple low-tech methods,” “conduct pre-project sampling,” “focus on prevention rather than mitigation,” and others.

Included also in the instruction is:

“Where possible, the white papers must include numeric standards (e.g., construction standards, set back or buffer standards, and/or mitigation standards) to meet different levels of resource protection (e.g., take avoidance, no net loss, minimal impact).”

Few numerical standards are provided.

In all white papers, the measures presented in 11.0 are generally just a hodge-podge listing of possible measures. They are not evaluated as to practicality, efficacy, necessity, or any other factor. There was not a systematic attempt to consider the noted impacts and evaluate and present potential mitigation measures. In most cases, the listed measures are not in the form of recommendations from the authors. They are simply presented as measures taken from published sources. Many of the measures are listed as a potential measure to address one type of impact, when they would be just as valid for others. For example, compliance monitoring is often suggested for revegetated riparian areas to assure that revegetation objectives are met;

performance bonds are suggested for projects that disturb a large amount of riparian area; multiseason pre- and post-project biological surveys to assess animal community impacts is suggested for dredging projects, etc. These measures would be equally applicable to many other project types.

A necessary part of successful mitigation will be compliance monitoring and enforcement. This is not mentioned.

In summary, the Section 11.0s are not very helpful to the process of developing new Hydraulic Code WACs or all elements of a HCP. There is generally no clear path from an activity (e.g. a marina), to how a marina triggers an impact mechanism and/or sub-mechanism (e.g. water quality modification), to the biological, ecological, or physical effects, to how those effects impact fish/shellfish species in the cited studies (if any), to extrapolation of how the impacts on species in the study might apply more broadly to the 52 HCP species, to how those effects might translate into “take” per ESA, and what strategies might effectively avoid, minimize, and compensate for that take.

Ron Thom noted that with systematic use of the model, conservation and mitigation measures can be better defined and justified as to their ability to move likelihood of take from a mechanism from a higher to a lower likelihood; and justification for studies to verify this change can be recommended (Appendix K).

One reviewer of the 2006 white papers (PH2 2007) suggested an approach to this section that would be helpful. The suggestion was that each type of project be taken through the steps from planning, site selection, design, materials, construction, operation, maintenance, repair, and removal and list, in sequence, the measures that might be taken at each step to avoid and minimize project impacts. The final element would be examination of potential compensatory mitigation measures for any unavoidable impacts.

5. Each of the papers has Table 4-1, WAC sections potentially applicable to the subject of the white paper. All have the footnote:

*“Note: * indicates that the activity (some say “project type”) may be related to the topics covered in this white paper, but it is not necessarily an implicit component of the activity (some say “activity type”) as specified in the WAC.” It is not clear what this means, only partly due to the use of the undefined word “activity.”*

There are no activities anywhere in the tables—only subactivities, with applicable WACs listed for each subactivity (except in the Shoreline Modifications white paper where WACs for saltwater and freshwater are listed as applicable to “shoreline modifications”—not subactivities). Apparently the “activities” being

referenced are the topics of the individual WAC sections as given in parentheses after the WAC number—not “activities” as referencing the subject of the white paper. But many of these aren’t “activities” even in the common use of the term—e.g., freshwater banks, habitats of concern, prohibited work windows, etc.

Apparently the sense the footnote is intended to purvey is that the WAC sections listed will not necessarily pertain to each project within the subactivity type. If so, it could be stated much more clearly and without using the word activity, which is confusing in this context.

- a. Moreover, the title is incorrect and misleading in each of the papers and many readers are likely to think that all the listed WACs apply and that these represent the sum of all rules and regulations that will apply (The first sentence of the last paragraph in each Section 4.0 reinforces this):

- In most papers the table purports to list the “WAC sections” that apply. But it only lists the WAC sections related to the Hydraulic Code that contain the technical provisions or conditions that **might** be applied to a project. There are administrative provisions of the Hydraulic Code WAC that apply as well.
- Plus, there are numerous WACs other than those related to the Hydraulic Code that apply to most any hydraulic project as well, notably including those in the Department of Ecology. The text in Section 4.0 in some of the papers contains a statement: “*This white paper also summarizes the provisions in the Washington Administrative Code (WAC 220-110) that apply to shoreline modification projects in both fresh and saltwater environments,*” or something similar. This reinforces the impression that Table 4-1 list all WACs applicable to the projects that are subject of the white paper.
- There are regulations other than the WACs that will apply. These include rules and regulations of local, federal, and other state agencies.
- On the face of the table, the WACs listed apply to each project, and this is the impression a reader would have. This is not correct. Only those WAC sections actually listed on the HPA apply. Few projects will be conditioned with every potentially applicable WAC.
- Additionally, it would be appropriate to note that site-specific provisions or restrictions will be placed on most HPAs as well.

- b. In the Fish Passage paper, the title of Table 4-1 refers to the **Hydraulic Code** sections, rather the Hydraulic Code **WAC** sections, which the table actually lists.

- b. In most of the white papers, the “activities” that are the subject of the white paper are referred to, but often are not identified—just the subactivities. Furthermore, “activity” is often used throughout the white papers in one of its more common

meanings. It is often difficult to tell if the reference is to the activity that is subject of the paper, or if “activity” is being used in one of the more common meanings. In some of the papers the authors often use “activity type” when referring to the activity(ies) that is the subject of the paper, and “activity” otherwise. Unfortunately, they are not consistent with this and this cannot be depended upon. Had they done so consistently, the white papers would have been much easier to read and understand. In two of the white papers the activity(ies) is discussed extensively, but never named. In these cases it is difficult to know exactly what is being discussed when the subject is “activity.”

7. The instructions to the authors from WDFW includes: “In order to characterize potential take, the white papers need to describe the threshold of impact at which actual damage or loss (i.e., take) of fish and their habitats occurs.” Thresholds are not provided.
8. In all five papers, the topic of cumulative effects is given brief and generally superficial consideration. In the case of the Fish Passage white paper only one page is devoted. Cumulative effects are never quantified, and none discuss the point at which cumulative impacts would reach the level of take.

The WDFW instructions are to look at the cumulative effects of each project type, which would include all the impacts or what are called submechanisms in the white papers of the particular project type. (*“The white papers must also quantify, or otherwise characterize, the impacts of multiple projects of a single type and at what point cumulative impacts may reach the level of take.”*) This is much more restrictive than the CEQ Guideline definition as noted in item 1, above. Other definitions would fall in between the inclusiveness of the CEQ Guidelines and the more restrictive WDFW instructions or could be even more restrictive; i.e., they might include only the cumulative impacts of a particular impact such as dredging without considering other impacts.

It is seldom clear exactly what is being considered as cumulative effects in the white papers and it is not clearly stated except in the Fish Passage white paper. What is clear, however, is that it is considered differently between and even within some white papers in. In most cases it appears that cumulative effects consider only that of a particular mechanism or submechanism. In other places the consideration seems to be multiple projects of the particular subject of the white paper per the WDFW instructions. The Marinas and Shipping/Ferry Terminals white paper, however, tends to put the cumulative impacts in the context of the existing environment, including impacts from sources other than marinas and terminals.

None of the cumulative effects sections discuss the point at which impacts may reach the level of take.

Except in Fish Screens and Flow Control Structures white papers, the first paragraph of Section 8.0 of contains the sentence :

“Increasing evidence indicates that the most devastating environmental effects are most likely not the direct effects of a particular action, but the combination of individually minor effects of multiple actions over time.”

This is not accurate. Cumulative effects can be direct effects. Had the authors defined what they mean by “direct effects” and “indirect effects” their statement might be more understandable¹.

Also, time is not a necessary element of cumulative effects. Cumulative effects also includes the incremental effects arising from multiple sources at the same time that affect the environment incrementally. The CEQ definition of cumulative effects includes both direct and indirect effects, however they are defined.

It isn't exactly clear what a “combination of effects” is. It would be better to refer to the accumulation of effects or to incremental effects.

The Williams and Thom (2001) model is amenable to cumulative effects analysis. Ron Thom, one of the coauthors of (Williams and Thom (2001) commented that (Appendix K):

“If one assumes that effects are additive, then there are ways to score multiple stressors through addition. If it is justified that one effect has a greater influence if combined with another effect then a multiplier can be applied. All of this is justified and presented in a simple equation. The equation can then be adjusted as new data become available. As presented, the cumulative effects section is highly ‘EIS-like’ and not really an attempt to semi-quantify non-linear interactions.”

Some reviewers suggested that WDFW should prepare a white paper specific to the topic of cumulative effects, considering the Services definition of cumulative effects, which is broadly stated. This was also suggested by reviewers of the 2006 white papers (PH2 Consulting 2007).

9. None of the data gaps sections are comprehensive. Rather, it seems that the ones listed are those that came to the author's minds as they were writing the paper or that they found suggested in one of the references they reviewed. Had there been a systematic analysis as suggested in Global Comment 4 (above), the data gaps would have become apparent.
10. By necessity, there is much overlap between the papers. For example, dredging is common to each of the seven white papers. Authors often refer to one of the other white papers for a discussion of impacts of dredging. This is true also for

¹ See “direct effects” under Global Comment 1.
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other activities common to more than one white paper topic. Reference to other papers is often not specific enough to be helpful. It would have been helpful to summarize the pertinent information found in the referenced paper and give a specific section or page reference where the information is located. Usually there is just a general reference to the other white paper. In some cases, unspecified portions of another paper are “*incorporated by reference as necessary*” or “*as appropriate.*” It is unclear what this means and it does not help the reader.

11. Table 5-1, Range of Occurrence of the HCP Species and Their Habitat requirements, was common for all the white papers. The table made a distinction between “spring-run” chinook and “spring” chinook and between “fall-run” chinook and “fall” chinook. This is an artificial and misleading distinction. “Spring-run” and “spring” chinook are terms used interchangeably as are “fall-run” and “fall” chinook. They do not refer to different races or other subgrouping of chinook salmon.

The table correctly identifies green sturgeon as occurring in fresh, estuarine, and marine waters. For some reason, though, in Section 9.0 of the Habitat Modifications, Fish Passage, Fish Screens, and Shoreline Modifications white papers, green sturgeon are shown as only occurring in marine waters in the Section 9.0 tables summarizing risk of take. In the other three white papers, however, they are correctly shown as also occurring in riverine and lacustrine waters.

12. The white papers generally discuss construction and maintenance jointly. For five of the white papers, a reviewer objected on the basis that construction and maintenance are fundamentally different and should be discussed separately. Regardless of how they are organized and discussed in the white paper, however, reviewers generally felt that it is the nature and magnitude of the activity and potential for impact on fish and shellfish that is important and should be the focus—not whether the activity is considered construction or maintenance.

13. The authors’ presentation of risk of take was generally deemed of negligible value.

- Table 6-3 provides definitions of the terminology used for risk determination in each white paper. Reviewers concluded the table is not very well thought out or connected to the rest of the conceptual framework; as a result the tables in Section 9 (which detail the risk of take) are not very useful. Simplifying and combining the conceptual framework for assessing impacts (Figure 6-1) and the exposure-response model to rate risk of take eliminated many previously-developed categories so there is an incomplete list.
- The definition of low (L) risk of take states that take is likely to occur due to temporary disturbance and minor behavioral alteration. It further states that this would likely equate to an ESA finding of NLTAA (Not Likely to Adversely Affect). This is inaccurate and does

not make sense on its face. If take is likely to occur, NLTAA would not be appropriate. For a NLTAA determination, the likelihood of take must be insignificant or discountable.

- The risk of take narrative correctly specifies the risk as being dependent upon exposure, specific stressor, and life history stage exposed to the stressor. However, the necessary level of detail gets lost and sometimes incorrectly lumped in the Section 9.0 summary tables. It is not always clear how the narrative was condensed into the tables.
- Reviewers also noted that it is not very meaningful to assign risk of take in such a generic manner. Risk of take will be dependent up the specifics of the project and species presence. Nearly all the activities and associated impacts will have the potential to cause take—especially under the worst-case conditions considered in the white papers. Had the authors followed the WDFW instruction to describe the threshold of impact at which damage actually occurs, the white papers would have been much more valuable. This might have been done by indicating the site and project conditions under which potential for take would be significant (LTAA finding). This coupled with spatial and frequency information on the various types of project would have provided a basis for assessing risk of take.
- The Section 9.0 Tables are not something the Services, who will ultimately make the take determinations, would find useful. It doesn't consider the exposure-response well enough (e.g., it leaves out the duration of exposure). It also uses different terminology than the Services do.
- How 'risk of take' scores were determined is not transparent. Use of low, medium, and high scores is appropriate because of the uncertainty in the numerical relationships, but it is critical that the logic justifying the ranking be presented using the conceptual model. Behind the relationships there is some empirical data as well as theory. For example a table showing that if 30% of the shoreline has docks, then it is estimated that take would be moderate, would be very helpful. Use of this method makes the scoring repeatable by others. Also, the information gaps can be verified in the field with focused studies. Furthermore, the recommended studies to fill data gaps are justified if it turns out that some factors may be really important, but there is no verification available.
- There is 'risk' and there is 'uncertainty'. How is uncertainty about the risk made explicit? Some statement somewhere should address how certain the assessment is about the conclusions regarding risk of take.

14. Reviewers have also noted that there is no quantification of the area of alteration. This is a significant weakness as the area altered is the basis for the estimation of take.

15. Each paper states that the analysis considers a worst-case scenario. It doesn't seem that this is actually the case, however. The worst-case scenario for every impact would almost certainly be some level of take for any species exposed to it.

16. Throughout the white papers, the lack of specificity of scale of magnitude of effects of mechanisms and submechanisms greatly impairs the value of the white paper. This is almost totally lacking in all the white papers. For example, most white papers discuss the effects of removal of riparian vegetation. However, there is no information on how often the type of project or activity or subactivity being considered takes place and how they are geographically distributed, the percentage of the time that the activity requires vegetation removal, the amount of vegetation removal required, or the amount of vegetation that would have to be removed for the impacts to be manifested. The white papers are extremely long. Had the discussion of the various impacts been in proportion to their potential effect, the papers probably could have been shortened significantly without diminishing their effectiveness.

Lack of information on the numbers and distribution of the various HPA activities considered in these white papers is a major deficiency, greatly detracting from their value. What does it mean, for example, to know that jetty-induced changes in lakes can alter shorelines to the detriment of sockeye salmon spawning if you have no idea how many jetties occur in the seven Washington lakes that sockeye use, how extensive they are, or how they are located vis a vis the sockeye beach spawning areas?

17. Some of the white papers in Section 4.0 provide a good description of the nature of the activities covered in that white paper. The white papers do not, however, there or anywhere else give any indication of how commonly they are constructed, how large they are, how they are constructed, the extent of the area that has been impacted, how they are permitted, how they are geographically distributed, how often they require maintenance, or any other such information. This information would be valuable in assessing the potential for direct and indirect effects, including cumulative effects.

One reviewer commented that:

“If the work is to be used in the HCP it must be significantly revised to include a description of the activity components - the materials used, how the construction occurs and what methods are used, typical components (e.g., fuel docks, night lighting, asphalt roads, armoring), and operations (e.g., year round, seasonal). The activities must also be clearly linked to the species to be covered as well as to potential biological effects.”

18. The papers are considering 52 potential HCP species, each with unique habitat preferences and requirements. The requirement and preferences for one species will always represent conditions less favorable to another or some others. An action to

benefit one species may, and probably usually will, be harmful to one or more other species. For example, correction of a culvert that historically blocked upstream migration of coho salmon, but not steelhead, will subject rearing steelhead and resident trout and possibly other resident species to increased competition for space and food from juvenile coho. Also, HPA conditions designed to protect salmonids may have negative ramifications, maybe even unforeseeable, for other species.

This issue is briefly acknowledged in a few cases, e.g., Subsection 7.1.2, paragraph 8 of the Fish Passage white paper. However, it should be at least acknowledged more generally; ideally the issue would be explicitly discussed. How to take this into account will be a challenge in the HCP development process.

19. In general the white papers are “salmon centric.” In part this is because there is more information available for salmon and other salmonids, and many of the studies on effects of anthropogenic disturbance of fish and shellfish habitat relate directly to these species. White paper authors, however, could have used far more professional judgment to extrapolate from effects on salmonids (or other species that are the subject of studies) to other HCP species. Very little of this is done. Mitigation measures in Section 11.0 are mostly aimed at salmon or salmonids.

20. Compaction of hydric and/or riparian soils from heavy equipment operation is a potentially significant habitat impact that should be considered for all seven white papers. It is considered only in the Habitat Modifications white paper, and only for riparian soils. Yet compaction of hydric soils from heavy equipment operation can be a major cause of harm to wetlands during construction.
21. Eelgrass is a significant feature of the environment considered in all the white papers except Fish Screens. There are two species of eelgrass in Washington waters—the native *Zostera marina* and the introduced *Z. japonica*. There are significant differences in the biology and ecology of the two. Yet the papers always discuss “eelgrass” without noting which species is being considered. Most likely the reference was generally to *Z. marina*, but that should have been made clear.
22. With respect to marine aquatic vegetation, the papers (except Fish Screen where this is not an issue) are extremely “eelgrass-centric.” Certainly eelgrass is important, and may be the most important single marine aquatic species, but the other 600+ species of marine algae, including kelp, and the mosaic of different types of communities and unvegetated areas should receive more attention than they do. In many places, they are not considered at all, with the discussion being completely about eelgrass.
23. Underwater noise and effect on fish related primarily to pile driving, but also to operation of dredging and other equipment and vessel operation, is discussed extensively in the white papers.

An expert on effects of sound on fish reviewed the pertinent sections in the Marinas and Shipping/Ferry terminals white paper, which had the most extensive discussion,

and was very critical of the authors' treatment of the subject. While acknowledging that this is a difficult and rapidly evolving subject, he concluded that the authors weren't very familiar with the subject. The expert's review comments for the Marinas and Shipping/Ferry Terminals white paper are in **underlined bold type** per reviewer 5 in Appendix H. Similarly, an expert on noise reviewed Section 7.10 of the Habitat Modifications white paper. His comments are in Times New Roman type per Reviewer 1 in Appendix F. The white papers all use much of the same discussion of this topic, and the comments of these two reviewers should be considered generally applicable to the discussion of this topic in the other white papers. See also 7.0 Marinas and Shipping/Ferry Terminals White Paper Comments in this document.

24. Each of the white papers included a common Table 5-1 Range of Occurrence of the HCP species and their habitat requirements. Range is give by Water Resources Inventory Areas (WRIAs) for freshwater and Tidal Reference Area for marine waters. While this is useful general information, the geographic units are so large that they give little guidance as to distribution at a specific location. Also, information on peak and range of timing, preferably by life history stage, is necessary for maximum utility of the information in the table.
25. Four of the white papers discuss the issue of lost opportunity as an effect of the activities that are the subject of the white papers: Channel Modification, Flow Control Structures, Habitat Modifications and Shoreline Modifications. It is not clear why the other three white papers do not discuss lost opportunity since the activities in those white papers can also result in lost opportunities.

Because of the definition of lost opportunity used by the authors (see lost opportunity under Global Comment 1), lost opportunity is generally discussed in terms of interference with hydrologic and geomorphic processes in the four white papers where it is considered. But lost opportunity is a much broader concept than this.

There are many definitions of lost opportunity—or opportunity cost. A more appropriate one to use in the context of the white papers would include something more general about the opportunities forgone because the choice of a particular action that precludes other opportunities, or the choice between desirable, yet mutually exclusive alternatives. The authors could then provide and discuss examples of lost opportunity specific to projects that are the subject of the particular white paper. These would include other than those that result from interference with hydraulic and geomorphic processes. For example, a dam might flood a stream reach used by salmonids for spawning. The opportunity to do so in the future would be lost. Construction of a dam also might result in lost opportunities unrelated to fish as well².

Lost opportunity is considered a submechanism of the ecosystem fragmentation mechanism in the Shoreline Modifications white paper, but is discussed as an effect not a submechanism. In the others it receives no label. In the Habitat Modifications

white paper it is discussed as an effect of in the ecosystem fragmentation subsections. Why it is a submechanism under ecosystem fragmentation in the Shoreline Modifications white paper is not clear either. Lost opportunity is not necessarily related to ecosystem fragmentation.

One reviewer stated that mitigating for lost opportunity should not be discussed in the white paper because WDFW (2003) states that “. . . *there are no current tools for universal and consistent application of the concept.*” But WDFW (2003) relates specifically to streambank protection, as does the statement about “no current tools”—which seems to be a reference to in-place/in-kind mitigation. One can always mitigate for damage from HPA projects. Mitigation as defined by WDFW policy [and noted in the ISPG guideline—WDFW (2003)] allows for out-of-place and out-of-kind mitigation if in-place/in-kind is not viable. This is also acknowledged in WDFW (2003).

Mitigation for lost opportunity is a concept that WDFW has not previously applied to HPAs. Since lost opportunity must be considered by the Services per ESA Section 10, WDFW will be addressing the issue in the HCP development process.

26. Reviewers had considerable difficulty with Section 6.0:

One reviewer commented that the lack of organization of Section 6.0 makes it incoherent. Since the explanation will also need to be provided in the HCP and possibly the EIS (Environmental Impact Study), it should be reorganized to clearly lay out the process/analysis in a step-wise fashion, complete with figures illustrating work products/matrices.

As noted above in Global Comment 1, for some reason the authors of three of the white papers (Flow Control Structures, Shoreline Modifications, and Channel Modifications) used a different definition of “mechanism” than is found in the other four white papers: “an alteration to **any of the conceptual framework components** along the impact pathway” (emphasis added). This is not the correct definition of Williams and Thom (2001) as presented in the other four white papers, viz, an unnatural disturbance to **habitat-controlling factor (emphasis added)**.

The authors present the conceptual model as presented in Figure 6-1 is found in Williams and Thom (2001). Williams and Thom (2001) in the original model also showed another important input into what the white paper authors show as the Ecological Functions box—mitigation in the sequence of avoiding, minimizing, and compensating. Had the white paper authors done the same and effectively used the model, the problems noted for how they use the term “mitigation” as noted in Global Comment 1 would not have occurred. Nor could they have completely ignored the compensation aspect of mitigation in Section 11.0 of each white paper as they did.

The white paper authors represent the goals of the conceptual model of Williams and Thom (2001) as:

- Elucidate impacts associated with each HPA activity.
- Determine how those impacts manifest themselves in effects on habitat and habitat functions utilized by the species that will be addressed in the HCP.
- Develop recommendations for impact avoidance, minimization, and mitigation measures that target the identified impacts.

These may be the authors' goals for use of the model; they were not goals stated by Williams and Thom (2001) and should not be presented as such. The white paper authors' goals might more properly have been stated as something like "to identify and describe the impact mechanisms associated with each of the white paper topics and to clearly link the mechanisms to effects on the 52 HCP species." Had they specified this goal and achieved it by systematic use of the conceptual model, one of the major criticisms would have been negated, namely, that there was not a clear link from the activity to impact on the HCP species.

Reviewers also commented that the authors' use of the conceptual model causes them to tend to concentrate on impacts on ecological functions and overlook some of the more direct impacts on habitat, such as overcovering or burial of substrate. This is not, however, inherent in the model; Williams and Thom (2001) in their use of the model to discuss shoreline modification issues covered these impacts effectively.

One reviewer of the Marinas and Shipping/Ferry Terminals white paper offered the following, which applies to the other six white papers as well:

"The conceptual framework description (and perhaps the framework itself) needs work. I found it awkward in several ways. By equating impacts with authorized activities, it seems to imply that Marinas/Terminals are impacts in and of themselves (just as their construction and maintenance are considered "mechanisms" earlier). Authorized activities can have immediate (direct) effect on species (sound from pile driving causing barotraumas) or indirect effect on species (interruption of littoral drift starvation of depositional shore forms erosion change in habitat conditions ecological structure available prey covered species). The paper should define what is meant by direct and indirect effects (they are often just lumped together).

Exposure-response model is also confusing. Seems like the salient issues are 1. what is the risk that authorized activity will create the identified stressor at a magnitude or degree that could cause take, 2. what is the risk species will be exposed to identified stressor. If the answer is High-High or Low-Low, the potential for take is High and Low respectively. With High-Low or Low-High the risk is probably more in the moderate range. Also, such an assessment should

consider the scale of the potential effect (does it affect a few individuals or entire populations?).

Organizationally, it may be better to elucidate all possible stressors that could arise from authorized activities together with the expected HCP species responses based on the literature. Then separately describe how (including when, where, frequency, duration, and finally how consequentially) the authorized activities create the identified stressors in the environment. Otherwise, when I look at tables 9-X, I assume that the “risk of take” for a particular activity in some way aggregates or accounts for all of the stressors associated with that activity. But then later in the tables I see mechanisms that are primarily associated with a single or perhaps few stressors (altered DO).”

27. What are called mechanisms in each of the white papers is a mix of actual mechanisms and effects. The logic of this is not apparent and the authors should have explained why this is so.

For example, in the Channel Modifications white paper two of the mechanisms are construction and maintenance and dredging equipment operation--actual mechanisms. Four others are hydraulic and geomorphic modifications, aquatic vegetation modifications, water quality modifications, and ecosystem fragmentation--all of which are effects of construction and maintenance and/or dredging.

Where the “mechanism” is an actual mechanism it is usually stated fairly broadly (e.g., construction and maintenance). The submechanisms then sometimes are specific types of the mechanism. For example, in the Shoreline Modifications white paper, the submechanism of construction and maintenance are pile driving, construction vessel operation, work area dewatering, and construction/maintenance dredging. In other cases, the submechanisms are effects of the impact mechanism. For example, in the Channel Modifications white paper, the impact submechanisms of construction and maintenance are noise-related disturbances from materials placement, noise-related disturbances from vessel operation, and burial. In other cases, the submechanism of mechanisms that are in fact mechanisms are a mix of specific types of the mechanism and effects of the mechanism. For example, in the Flow Control Structures white paper, the submechanisms consist of three effects (elevated underwater noise, bank/channel/shoreline disturbance, and contamination from chemical and fuel spills) and three specific types of the impact mechanisms (dewatering, flow bypass, and fish handling; channel rewatering, and construction and maintenance dredging).

Where the mechanism itself is actually an effect, it is usually fairly broad (e.g., riparian vegetation modifications). Sometimes the submechanisms in this case are secondary effects. For example, in the Flow Control Structures white paper, the submechanisms of riparian vegetation modifications are altered shading, solar input,

and ambient air temperature; altered bank and shoreline stability; alter allochthonous inputs; altered groundwater-surface water interactions; altered LWD transport and recruitment; and altered community composition. (i.e., construction or another actual mechanism causes loss of riparian vegetation, which results in altered shading, solar input, etc.) In other cases, the submechanisms are particular types of the mechanism. For example, in the Flow Control Structures white paper the submechanisms of the water quality modification mechanism are specific types of water quality modifications: altered temperature regime, altered dissolved oxygen, altered suspended solids and turbidity. Increases in contaminated sediments, altered pH levels, altered nutrient loading introduction of toxic substances, altered salinity, and metal toxicity.

Where an impact mechanism is actually an effect, it is almost universally discussed as an effect and not as an impact mechanism. For example, in the Channel Modifications white paper, ecosystem fragmentation is called an impact mechanism. In the discussion in Section 7.0 it is discussed as a secondary effect of many of the primary effects of the two actual impact mechanisms: changed shoreline, altered current velocity, altered channel and floodplain landform, altered wave action, increasing tidal prism, and many others. Some of these causes of ecosystem fragmentation are submechanisms of the impact mechanism of hydraulic and geomorphic modifications. (So you have the situation where a mechanism is an effect of a submechanism.) These “impact mechanisms” are never discussed as such—only as effects. Similarly, submechanisms that are in fact effects are discussed as effects.

Why ecosystem fragmentation and all the other impact mechanism that are called effects are labeled is such is unknown and makes no obvious sense. This is especially true since there seems to be no pattern to what is called an impact mechanism and submechanism and especially true in light of the information in the fourth paragraph of this point. The authors should explain their reasoning.

Adding further to the seemingly illogical situation further is that there is a distinctive lack of consistency among the papers in what are called mechanisms and submechanisms (as well as what submechanisms are listed with which mechanisms). Just a few examples:

- The white papers inconsistently consider dredging and its effects and it is not clear why. In the Fish Screens, Fish Passage, Flow Control Structures, Marinas and Shipping/Ferry Terminals, and Shoreline Modifications white papers, dredging or dredge and fill are submechanisms of the impact mechanism of construction and maintenance. In the Channel Modifications white paper, dredging is an activity; operation of dredging equipment is an impact mechanism. In the Habitat Modifications white paper, dredging does not receive any label. However, it is discussed under the water quality modifications impact submechanism for its potential to remobilize pollutants into the water, as a source of material for beach nourishment, as a source of

turbidity that juvenile chum were shown to avoid, and as possibly entraining mussels.

- In six of the white papers, ecosystem fragmentation is called an impact mechanism. In the Marinas and Shipping/Ferry Terminals white paper, however, it is not labeled and is simply presented as an effect, i.e., the result of the operation of an impact mechanisms or submechanisms. It is not clear why this is so.
- In the Marinas and Shipping/Ferry Terminals white paper, pile driving is an impact mechanism of contraction and maintenance. In the Fish Screen White Paper it is not given a label (except in Table 6-3 it is a “transient action”), but it is noted that it is used for placing sheet piling for coffer dams and is discussed extensively as a source of noise, i.e., a mechanism whose effect is underwater noise. In some white papers, habitat loss is a submechanism of ecosystem fragmentation (e.g., Shoreline Modifications). In others, habitat loss is not even considered as either a mechanism or submechanism though habitat loss is discussed as an effect (e.g., Habitat Modifications, Flow Control Structures).
- In the Shoreline Modifications white paper, loss of opportunity is a submechanism of ecosystem fragmentation (but discussed as an effect of the impact mechanism). In the Channel Modifications, Flow Control Structures, and Habitat Modifications white papers, it is simply an effect.

There seems to be a simpler, more obvious, and more logical approach and white paper organization to dealing with the effects of the project types discussed in the various white papers. The model of Williams and Thom (2001) would facilitate this approach:

- Establish the impact mechanisms for each white paper project types (or activity/subactivity): e.g., dredging, pile driving, construction vessel operation, channel dewatering, various operational impacts, maintenance activities, existence of the structure, etc.
- Explain how the impact mechanism is related to the activity. For example, dredging is necessary to gain sufficient depth for vessels to moor in a marina, to provide an access channel of sufficient depth and width, maintenance dredging to retain that depth and width over the years of use, etc. Provide information on the frequency and extent of the impact mechanism, e.g., extent of construction dredging and frequency and extent of maintenance dredging.
- Following the model, discuss the direct and indirect impacts on controlling factors, habitat structure and on through to effects on the 52 HCP species of each impact mechanism.
- Along with this, provide some information on the distribution and frequency of the project types

One good discussion of the effects of dredging, for example, could be the basis for the discussion of dredging associated with each subactivity within the white papers and could simply be referenced with note of anything unique to the particular activity. Or it could also basically be incorporated into the other white papers, with differences noted as to how the activity/subactivity is related to dredging, any other differences, etc. This would have reduced the length and complexity of the papers and made them more “user friendly.”

An example of a clearer presentation of the interaction between mechanisms, controlling factors and effects for marinas and terminals can be found in Table 4-6 of the DNR Aquatic Resources Program Endangered Species Act Compliance Project Potential Effects and Expected Outcomes Technical Paper (2007).

28. It was apparent that use of the Williams and Thom (2001) model was not carried through in Sections 7.0 through 10.0 of any of the white papers. Had it been, there would not have been the criticism of a lack of a clear link between the subject activity of each paper and effects on the HCP species. Moreover, careful use, especially considering the full model with mitigation input, would have negated much of the criticism of Section 11.0.

Ron Thom summarized his review of the authors use of the model (Appendix K):

In summary, use of the conceptual model throughout the assessment would go a long way toward systematizing the assessment, justifying data gaps, and recommendations for conservation and mitigation. It would also make the white paper a ‘living document’ in that the analysis can be modified with new and improved understanding.

2.0 Channel Modifications White Paper Comments

All reviewers' comments on the Channel Modifications white paper are found in Appendix C.

2.1 Global Comments

Global Comment 1 (definitions and word usage)

- “Submechanism” and “mechanism” are used interchangeably in some places. Subsection 7.1.2.1 is a good example of this. Five submechanisms are listed then subsequently referred to as mechanisms. To add to the confusion, are sentences like the second one in Subsection 7.1.2.1.1: “*The dominant mechanism is the effect of reduced shading on solar radiation exposure.*” Mechanisms are now effects. In 7.3.1.2, paragraph 2, burial is referred to as a mechanism, whereas it is identified in Table 6-1 and referenced in many other places as a submechanism. In 7.3.5.1.1, the last sentence of the last paragraph, elevated suspended solids is referred to as an impact mechanism, whereas it, too, is a submechanism per Table 6-1 and other places. In some places “impact mechanism” or “mechanism of impact” is used when the reference is to “impact mechanism” as defined in Section 6.0. This is not consistent, however. Had it been, it would have helped the reader determine whether the meaning was as defined in Section 6.0 or one of the more common meanings of the word.
- “Pathway” is another term for which the use is confusing in this paper. “Impact pathway” is defined in Section 6.0 as the linkages shown in Figure 6-1 in which alterations to the environment can lead to impacts on the ecological function of the habitat. “Impact pathway” is not used in the white paper after Section 6.0. But “pathway” is used in many places throughout the report. Sometimes it is obviously being used with the meaning of “impact pathway.” Sometimes it is obvious that it is being used in its broader, more general meaning. Sometimes it is obvious difficult to tell which is intended.
- “Activity” and “subactivity” are not defined and are used interchangeably. For example, in Section 4.0, last paragraph, channel modification is referred to as an activity, and it would seem that this is the one activity discussed in this paper. But in the first bullet in Section 6.0 and elsewhere there is a reference to “each HPA activity,” suggesting there is more than one activity considered in this paper. Without definition, the subactivities are listed in Table 4-1—one of which is dredging. But in 6.0, paragraph 2, third sentence, dredging becomes an activity.
- Subsection 7.1.1.1 presents a confusing use of “stressor.” In the first sentence, operation of dredging equipment presents several stressors: bed

disturbance, temporary ambient light modification, etc. But then it goes on to say that bed disturbance (which is a stressor) can result in several stressors. This may make sense if it is to be understood that there can be levels of stressors or a hierarchy. A definition and consistent use would have clarified this. 7.4.3, par 1, second sentence. *“The impact mechanisms of channel creation and alignment leading to ecosystem fragmentation include altered longitudinal connectivity, altered river-floodplain connectivity, and altered hyporheic flow and exchange.”* This sentence is a good example of sloppy writing and careless use of terms and one has to try to determine the meaning. It seems to mean that “the impact mechanisms of the subactivity of channel creation and alignment that lead to ecosystem fragmentation are altered longitudinal connectivity, altered river-floodplain connectivity, and altered hyporheic flow and exchange.” If so, it should have been written that way. If this is not what it meant it should have been written so the reader can tell what it means without having to guess or try to decipher. Finally, these three alterations are not impact mechanisms, they are submechanism of the ecosystem fragmentation impact mechanism in riverine systems. In the following sentence they are again referenced as mechanisms.

Global Comment 4 (section 11)

Reviewers agreed that the discussion of mitigation is deficient for the reasons stated in Global Comment 14. Some specific comments:

- Given the potential significance of this section, it should be much more detailed (11.0).
- After much discussion on the importance of riparian plantings throughout this document, it seems like the removal of vegetation for the purpose of dredging should be addressed in this section (11.0)
- Limiting instream gravel extraction rates to the rate at which sediment is replenished by natural bedload transport processes may help preserve channel morphology, but would not address some of the other factors related to this activity that could impact aquatic ecosystems (sediment release, alteration of riparian vegetation, etc.). But doesn't continual removal of gravel at any point at the rate accrued help to ensure the stream does not stabilize, with attendant upstream and downstream effects. (11.2)
- Section 11.4 discusses the adverse effect of wood placed in the water as mitigation for channel creation and alignment activities. In earlier sections of the importance of woody debris (natural recruitment) for the system diversity was discussed. How is that different than LWM placed by a project that is allowed to move through the system?

Global Comment 8 (cumulative effects)

- This section is pretty slim. A definition of cumulative effects would help the reader understand the topic as being addressed in this section. What types of cumulative impacts are specifically being addressed in this section? What types are the most relevant for the actions addressed in this white paper? A more thorough examination of potential impacts due to the application of multiple projects or repeated projects over time should be included.
- This paragraph gives short shrift to the impact the dams on the Columbia River have had on sediment delivery. Ascribing the reduced sediment output from the river and the consequent beach erosion along a 100-mile stretch of Pacific Ocean coast solely to dredging the Columbia River navigation channel is a bit misleading. You can't blame erosion at Westport entirely on Columbia River dredging. Other factors are probably equally important. (8.1, paragraph 2)
- There are similarities between the impacts of sediment capping and beach nourishment. However, there is a major distinction in terms of the potential for the release of contaminants during sediment capping that should be considered. (8.3, paragraph 1)
- *“The greatest effects of instream gravel mining, bar scalping, and pit mining may be considered as cumulative because they may become obvious only over time and extend beyond the limits of the mining site itself.”* Effects extending beyond the activity site is not a necessary element, indicator or characteristic of cumulative effects.

Global Comment 9 (data gaps)

- A section should be added that addresses the data gaps related to cumulative effects.
- The issue of dredging drainage channels for agriculture is separate from a lack of understanding of impact levels of suspended sediment, the primary topic covered in this paragraph. Dredging of channels on agricultural land is an important enough issue that it should be treated as a knowledge gap in a separate paragraph. (10.1)
- Besides impacts to physical aquatic habitat, a very significant effect of these types of projects is often hydrologic changes and loss of water. (10.4)

Global Comment 23 (underwater noise)

An expert on effects of sound on fish reviewed the pertinent sections of the Marinas and Shipping/Ferry terminals white paper and was very critical of treatment of the subject. All seven white papers use much of the same discussion of this topic. The expert's review comments for the Marinas and Shipping/Ferry Terminals white paper are in **bold and underlined** per reviewer 5 in Appendix H. Similarly, an expert on noise reviewed Section 7.10 of the Habitat Modifications white paper. His comments are in Times New Roman Type per Reviewer 1 in Appendix F. The comments of these two reviewers should be considered generally applicable to the discussion of this topic in this white paper. See also the discussion of sound impacts in Section 5.0 Habitat Modifications.

Global Comment 25 (lost opportunity)

The white paper seems in places to say that lost opportunity is a result of habitat loss and elsewhere that it is the cause. In the second paragraph of 7.4.2, lost opportunity is the cause in the first sentence (“*Another potential impact is related to the loss of floodplain habitat due to the loss of opportunities*”) and the result in the second sentence (“*Lost opportunity impacts result from projects that adversely alter natural fluvial processes*”). In 11.4, last paragraph, it is again a result (“*The hydraulic and geomorphic modifications induced by channel creation and alignment activities can result in lost opportunity impacts*”).

In 10.1.5 is: “*Although it is recognized that lost-opportunity impacts must be mitigated to achieve no loss of habitat (WDFW 2003), currently there are no tools for universal and consistent application of the concept.*” This is a misuse of the quote from WDFW (2003). WDFW (2003) was speaking of in place-in kind mitigation for impacts on fluvial process at stream bank protection projects. Mitigation is always possible, even though it might have to be out of place and/or out of kind. WDFW (2003) acknowledges this.

In 11.4, last paragraph is: “*Mitigation for lost opportunity requires mitigation for channel processes affected by a project.*” Mitigation is needed for all impacts. This white paper is supposed to be providing mitigation methods, not just pointing out that mitigation is needed.

Relative to 7.4.2, par 2 and 3. One reviewer noted: “*Although I understand the philosophy behind mitigating for ‘lost opportunity’, requiring mitigation is not realistic in many situations. This is especially true where movement of the river system would cause damage or loss of existing public structures and put the public in harms way. The Integrated Streambank Protection Guidelines (2003)³ states “there are no current tools for universal and consistent application of the concept” (in reference to mitigating lost opportunity). It is inappropriate to reference something that is non existent in these documents. Either the statements should be removed, or clarified.*”

As noted above relative 10.1.5, this is a misuse of the quote from WDFW (2003). WDFW (2003) was speaking of in place-in kind mitigation for impacts on fluvial process at stream bank protection projects. Mitigation is always possible, even though it might have to be out of place and/or out of kind. WDFW (2003) acknowledges this.

2.2 Other Comments

1. Considerable discussion throughout this white paper deals with impacts on eelgrass and its value as fish habitat. Normally in a technical paper the genus and species

³ Otherwise referenced herein as WDFW (2203)
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would be given the first time a plant or animal is mentioned. This is not done and it is never stated which species of eelgrass is being discussed. There are two species in Puget Sound, the native *Zostera marina* and the introduced *Z. japonica*. Since the two species have distinct differences in biology and ecology, the lack of specification posed a significant problem for reviewers and detracted from the usefulness of the white paper.

2. Dikes and levees are important channel features in Washington with significant adverse impacts on some fish populations due to their construction, maintenance, and presence. Yet levees are mentioned only once in Section 7.0 and dikes not at all. Both are discussed extensively in Section 9.0. Most of that discussion is about their direct and indirect effects, rather than risk of take, which should have been in Section 7.0. Since dikes and levees are major subjects of the Shoreline Modifications white paper, in this white paper it might have been more appropriate to refer the reader there. However, given that they were discussed in Section 9, they should have been discussed in Section 7.0, especially given that most of the Section 9.0 discussion is of direct and indirect effects.
3. The last paragraph of Section 6.0: *“Based on the identification of impacts and risk of take analysis, additional recommendations (e.g., conservation, management, protection, BMPs) for minimizing project impacts or risk of take were developed,”* suggests a systematic procedure whereby that the authors will consider the identified impacts and associated risk of take analysis to design mitigation measures specifically to address them. This is misleading; the measures suggested in 11.0 are simply a hodge-podge listing (by subactivity type) of measures found in the literature. There is no attempt to link them to any specific impacts and they are not presented as the authors’ recommendations.
4. In the Fish Screens, Fish Passage, Flow Control Structures, Marinas and Shipping/Ferry Terminals, and Shoreline Modifications white papers, dredging or dredge and fill are submechanisms of the impact mechanism of construction and maintenance. In this white paper, dredging is an activity; operation of dredging equipment is an impact mechanism along with five other mechanisms. The reason for this differential treatment is not clear.

3.0 Fish Passage White Paper Comments

All reviewers' comments on the Fish Passage white paper are found in Appendix D.

3.1 Global Comments

Global Comment 1 (definitions and word usage)

- Though never explicitly stated, the only “activity” considered in the paper seems to be “fish passage.” But at one point there is a reference to “each of the HPA-authorized activities,” which suggests there is more than one. In places, it is obvious that activity and subactivity are used interchangeably. “Activity,” of course, has many common uses, several of which are used in this white paper. The authors sometimes use “activity type” when the reference is to the activity of fish passage, and “activity” for any of its more usual meanings. This should have been stated, but once one figures this out, the possible confusion is eliminated.
- As in all the papers, “subactivity” is not defined. They are merely listed (as specific types of fish passage facilities) in Table 6-1 and then discussed. The terms “subactivity” and “subactivity type” seem to be used interchangeably. “Subactivity” has no comparable vernacular usage (as does activity) and if the two terms are to be assumed to mean the same thing, then “type” becomes superfluous and should be dropped.
- The undefined term “exposure pathway” is introduced in Section 7.0 and used one time. It is not clear if this is meant to be “impact pathway” or something else. In 7.6.1.3.1 is “the dominant effect pathway.” It is not clear what the meaning of this term is. If it is intended to mean the most important pathway in terms of its effect, it should have been stated as such rather than to introduce a nebulous term.
- Exactly what pathways are and the relationship between pathways and mechanisms and submechanisms is never clear. Impact pathways are defined in 6.0 as the linkages in Figure 6-1 that lead from an impact to ecological functions. But often in the text the pathway is something other than the linkages. For example, in 7.6.1.2.1 Altered Water Temperature), the direct and indirect pathways by which thermal stress can occur are “. . . *direct mortality, altered migration and distribution, increased susceptibility to disease and toxicity, and altered development, spawning, and swimming speeds.*” These are not linkages, these are direct and indirect effects of altered temperature.
- The document extensively discussed suspended sediment concentration and suspended solid concentration. It is never clear if the two terms are just being used interchangeably, or if the authors are offering some distinction between the two.
- The definition of ecosystem fragmentation did not come until 7.6.1.6, after it had been extensively discussed.

Ecosystem fragmentation is one of the six impact mechanisms discussed in this white paper for each of the five subactivities. In the text in numerous places it is acknowledged that fish passage facilities are intended to provide fish passage

where none exists, either due to natural conditions or human activity. In 4.0 is the statement: *“It is recognized that fish passage facilities are intended to improve fish passage and are actually mitigation measures for adverse effects associated with flow control structures.”*

It would seem logical to acknowledge that the flow control structure (or natural barrier) is the cause of ecosystem fragmentation. But in the discussion for each of the five subactivities, the fish passage facility is blamed for the ecosystem fragmentation if it does not function perfectly forever. The authors should explain why this is ecosystem fragmentation attributable to the fish passage facility.

Consider the following comments, which probably would not have been necessary had there been a definition of ecosystem fragmentation:

“7.5.1.2, bullet 1. If a trap and haul facility is associated with a total barrier to fish passage (as stated in 7.5.1.1), is it appropriate to consider it ecosystem fragmentation attributable to the trap and haul operation if in a given year fish are not totally passed successfully? It seems that the ecosystem fragmentation is caused by the dam or other blockage. The authors need to explain why the fact that the trap and haul operation may not always perfectly mimic natural conditions should be credited with ecosystem fragmentation, and why selection that alters fish size or run timing is considered ecosystem fragmentation?”

“7.5.1.2, bullet 2. Providing fish passage via trap and haul will modify the upstream transport of allochthonous nutrients, but it will increase the movement. It is not clear how modified upstream movement of allochthonous nutrients is ecosystem fragmentation. It is also not clear how modified upstream movement of allochthonous nutrients relates to selective effects on fish (per 7.5.1.2, first sentence).”

“7.5.1.2, bullet 3 and 7.5.1.2.1. The authors should explain why the North Fork Toutle situation is considered ecosystem fragmentation attributable to the trap and haul operation. The fragmentation is caused by the sediment retention structure, which blocks upstream passage of salmonids. Why does the fact that the trap and haul operation does not perfectly correct the situation cause the trap and haul operation to be considered the cause of the ecosystem fragmentation?”

Global Comment 4 (section 11)

- In general, these recommendations do not meet the requirements set out for the authors of the white paper. It doesn't appear that "specific management recommendations for mitigation" were thoroughly explored, nor was there any attempt to "...provide numerical standards that could be used to meet varying levels of resource protection."
- "*Due to these higher maintenance requirements, trap-and-haul systems are likely to cause more environmental disturbance than fishways. . .*" (11.5) Actually, fishways may impact habitat more than trap and haul, because of associated structures. For example, consider the Ballard Locks, versus the Cedar River broodstock weir, with trap and haul. There are likely many more fish mortalities at the locks than at the Cedar River weir.
- This subsection (11.6.1) is wholly inadequate considering the vast amount of research completed on effective BMPs to date. There should be set design standards and specific BMPs identified for each subactivity.

Global Comment 8 (cumulative effects)

- There should be discussion of the cumulative effects of maintenance.
- One page on this subject is much too little.
- "The majority of the negative effects associated with fish passage activities occur as a result of two discrete impact mechanisms: construction and maintenance; and subsequent changes resulting in ecosystem fragmentation." (8.0, paragraph 3) Subsequent changes to what? Operations of weirs and trap and haul facilities can also have significant impacts, including direct mortalities and stress, resulting in delayed mortalities. That is generally not considered in this white paper.

3.2 Other comments

1. There are numerous references to other places in this white paper or in other white papers where one must look to find important information. Many are problematic. They are often not specific enough to be of much help to the reader. In 7.1.1.1, for example, the reference is simply to the 2006 Water Crossings white paper--a 200+ page document. There are many references that something may be found "above" or "below" or that something was discussed "previously" or explained "later". Since this is a 250+ page document, that is not particularly helpful.

One reviewer made the comment with respect to Subsection 7.1.1.4, par 3. "*It doesn't seem intuitive to have a section intended to describe effects on aquatic vegetation, not describe them, and reference another section (hydraulic and geomorphic modifications) for more details. At the very least it should summarize the effects and cite the literature identified in 7.1.1.5.1 relating to changes in aquatic vegetation*". In several places is the comment that another section of the white paper is "incorporated by reference as appropriate." It is unclear precisely what that means.

In 7.5.1 is found: “*Because the physical effects of dam and weir structures typically associated with the trap-and-haul subactivity type are addressed elsewhere . . .*” they are not discussed in this white paper. Where else are they discussed? Elsewhere in this paper? In another white paper? In some scientific journal? There are other similar references.

In 7.6.1.1.1, the reader is referred to 7.6.1.1.3 for effects of burial and entrainment related stressors related to equipment operation and materials placement. Nothing is discussed detail in 7.6.1.1.3. The reader here is just referred on to two other subsections.

2. It was not made clear to reviewers what aspects of fish passage would be discussed in this white paper vis a vis those that would be found in the Flow Control Structures white paper and the 2006 Jones and Stokes Water Crossings white paper.
3. The authors continually make the point that trap and haul facilities require no inwater structures and don’t discuss any impacts from such. This is not true. Even those operating in conjunction with a dam have structures for the trap and haul operation in addition to the dam. These have construction, maintenance, and operational impacts. Some trap and haul facilities have an associated fish barrier dam across the entire stream channel (e.g., Wynooche and Cowlitz). They certainly have major impacts. There are many hatchery trap and haul facilities for collecting brood stock that require significant inwater structures. Some trap and haul facilities are located at natural obstructions and there are necessarily facilities that are constructed and maintained for no other reason than the trap and haul operation.
4. In 7.0, paragraph 3, it is stated that “. . . *all fish passage type projects are considered to occur in riverine environments only,*” which is defined to include boundaries between riverine and marine and between riverine and lacustrine habitats. Some very important fish passage projects and activities that occur in lakes/reservoirs are thus excluded.
5. The potential problems associated with poor maintenance of fish ladders/fishways and culverts are not well developed. This is such a huge contemporary issue, especially with respect to culverts, that more emphasis could have been placed here.
6. Fish ladders/fishways and trap and haul operations impose stress and migration delays on migrating fish. This topic should have been addressed. The potential for injuries is discussed for fish ladders/fishways, and for trap and haul operations, but was limited to the “target” species. “Non-target” species are often trapped and hauled or at least handled and are subject to the same potential for injury.
7. In Subsection 7.3.2 the text is inconsistent in that in places it mentions that roughened channels can affect downstream transport of organic material, water, wood, and sediment. In the summary paragraph, however, the statement is that roughened channels are “relatively transparent” to the downstream movement of

these. Reviewers generally did not agree with this latter statement. They also felt that there should have been a reference to support this statement. And certainly the text should have been consistent in this regard.

8. The issue of hyporheic effects on dissolved oxygen, temperature, and nutrient cycling were inadequately addressed. Several references were listed by reviewers.
9. One reviewer offered:

“Nowhere in the document is there discussion about the impacts of soil compaction. This is an impact associated to all subactivities and both “Construction and Maintenance” and “Hydraulic and Geomorphic” modifications. Soil compaction due to heavy machinery along the channel and road prism has enormous impacts on subsurface flow pathways, and also contributes to increased sheet flow. I think the omission of this impact is significant and should be addressed.”

10. Four of the white paper discuss the concept of lost opportunity with respect to projects that are the subject of the papers. It is not clear why the topic isn't discussed in this paper as there are lost opportunities in the context of this white paper as well.
11. In Table 6-1, one of the submechanisms for ecosystems fragmentation is altered longitudinal connectivity. Later in the text (e.g., 7.1.1.6, bullet 3) it becomes lateral and longitudinal fragmentation. This needs to be consistent.
12. For some reason, in 7.1.1.6, 7.2.1.6, 7.3.1.6, and 7.4.1.6, each of which discusses the ecosystem fragmentation impact mechanism on one of the subactivity types, the first paragraph states that the subactivity can induce ecosystem fragmentation by a number of pathways. But none of them goes on to discuss how this occurs. Instead, they then list the impact submechanisms that result in ecosystem fragmentation and discuss them. Only in 7.1.1.6 are the pathways even listed. There are four of them and they overlap somewhat with the three submechanisms subsequently listed and discussed, but they are not the same. There is no apparent reason for even mentioning pathways, especially when they are just mentioned and then dropped.

4.0 Flow Control Structures White Paper Comments

All reviewers' comments on the Flow Control Structures white paper are found in Appendix E.

4.1 Global Comments

Global Comment 1 (definitions and word usage)

- At least one reviewer considered dikes and levees to be separate types of structures. Another seemed to think of them as the same thing, the two terms being interchangeable, as the authors use them. In 4.0 it is stated that “*Dikes and levees are built to maintain flows within a confined channel for flood control purposes, or are used to convert estuarine habitat into agricultural fields or freshwater habitat. . .*” This is not a definition of what they are, however, simply a statement of their purpose. In 7.3, paragraph 1, the text states that the terms are used interchangeably in the white paper, suggesting the authors consider them to be one type of structure. . .” To avoid confusion and since both terms have multiple meanings (e.g., a levee is also a boat landing place on a river), definitions would be helpful.
- This white paper presents and misuses the quote from WDFW (2003) for the definition of lost opportunity.
- The definition of outfall is unusual and not the normal definition (“ . . .utilized to move water from one place to another.”) The outfall is normally considered the point of discharge of water from the conveyance infrastructure, not the conveyance infrastructure itself. It is not clear what “other waste materials” refers to as none have been mentioned.
- The definition of dam is likewise unusual (“ . . . structures built within a stream to control flow for flood control, divert flow for irrigation, or to utilize flow for generation of hydropower”), especially in that the uses are part of the definition, rather than examples of typical use. As defined, some dams are not included: e.g., dams whose primary use might be municipal and industrial water supply dams, recreation, or navigation or fish barrier dams. It is not clear if the Cushman dams would be included or not since they divert water for generation of electricity.
- Similarly, the definition of intake and diversion structures is not inclusive because the use is part of the definition. For example, a water supply diversion would not be included.

Global Comment 4 (section 11)

- This section is strong on presenting “Best Management Practices” that are designed to minimize direct or indirect project construction impacts to listed species. However, there is little or no development of strategies (as indicated in the section title) that will truly mitigate/compensate for the incremental loss or degradation (modifications) of habitats.

- It is unrealistic and inappropriate to require use of a specific brand of monitoring or data recording equipment such as the “Silent Inspector”(11.1.1.4). There is other comparable equipment available.
- What does human health and safety have to do with minimizing impacts to fish? (11.1.1.2, bullet 4)
- One hundred percent grating could be a safety hazard depending on the structure and public use. It also increases the potential for debris to enter the water. Grating has not been demonstrated to be a significant benefit. Width, length, depth, orientation and other factors should be considered. (11.1.3 ,bullet 6)
- What would monitoring and inspection entail? Simply suggesting “monitoring” is of little meaning without some specifics.

Global Comment 8 (cumulative effects)

- The thought in the third through fifth sentences (8.0) does not seem to make sense, it isn’t clear how it relates to cumulative impacts, and doesn’t seem to be a suitable introduction to the section:

"In general, as the number of flow control structures increases in a given area, impacts will accrue that increase habitat loss, alter the flow regime, and shift the composition and diversity of species. For example, tide gates are often constructed in areas converted for agriculture. As a result, irrigation that routes diversions and runoff from fields through outfalls are (sic) likely."

The second sentence in the quote beginning with “for example” doesn’t seem at all to be an example that follows from the previous sentence. If the idea in this sentence is that tide gates are a result of conversion of areas to agriculture, that would be a secondary effect, not cumulative. And most land converted to agriculture wouldn’t have tide gates—only certain lands would. Nor is it clear how the third sentence is a result of the foregoing—or even what it means or how it relates to cumulative effects. (And shouldn’t it be “is likely” rather than “are likely?”) Irrigation doesn’t route diversions and runoff. Irrigation may result in runoff water. But a diversion is a structural system for delivering irrigation water, not dealing with the runoff that may result from irrigation. To the extent that irrigation is a result of tide gates, it would be a secondary effect, not a cumulative effect.

- The statement (8.1, paragraph 3) “. . . in the highly impounded Columbia River watershed, effects from dams high in the watershed will translate to the marine environment” needs a citation, as do several other statements in 8.0 through 8.6. The statement is not helpful from the standpoint that it makes no mention of the kinds of effects translated to the marine environment and how they are manifested. Moreover, upper watershed effects being manifested in the marine environment is not cumulative effects, but rather direct or indirect effects.

Global Comment 25 (lost opportunity)

Lost opportunity is discussed in this and two other white papers: Channel Modifications and Shoreline Modifications. Even though the authors misuse the quote from WDFW (2003) as a definition, which ties lost opportunity to hydraulic and geomorphologic changes, they do actually use this as a working definition as they also relate lost opportunity to hindrance of fish passage at a dam.

The last sentence of Section 7.1 is: *“For dams, lost opportunity impacts will occur primarily as a result of hydraulic and geomorphic modifications and ecosystem fragmentation.”* Lost opportunity is not thus restricted. Nor do the authors so restrict it since they attribute lost opportunity to hindrance of fish passage.

In 10.1.5 is:

“Although it is recognized that lost-opportunity impacts must be mitigated to achieve no loss of habitat (WDFW 2003), currently there are no tools for universal and consistent application of the concept.”

But WDFW (2003) was referring to in place-in kind mitigation and only for bank protection. Mitigation is always possible even if it is out of place and/or out of kind. WDFW (2003) acknowledged this. This is true for in place-in kind mitigation for the hydraulic and geomorphologic effects of bank projection projects, but not universally true for lost opportunity impacts.

One reviewer stated that mitigating for lost opportunity should not be discussed in the white paper because WDFW (2003) states that:

“ . . . there are no current tools for universal and consistent application of the concept.”

Others noted that WDFW (2003) relates specifically to streambank protection, as does the statement about “no current tools”—which seems to be a reference to in-place/in-kind mitigation. One can always mitigate for damage from HPA projects. Mitigation as defined by WDFW policy (and noted in the ISPG guideline) allows for out-of-place and/or out-of-kind mitigation if in-place/in-kind is not viable.

Global Comment 27 (regarding mechanisms and submechanisms)

Two major impact mechanisms related to dams are operational effects and effects from the presence of the structures. These are not listed as mechanisms. Instead hydraulic and geomorphic modifications, water quality modifications, riparian vegetations modifications, and water quality modifications are listed as impact mechanisms. For dams, especially, these are not mechanisms; they are largely effects of dam operations, but also of construction and maintenance and to a lesser extent the presence of the

structures and that is largely the way they are discussed. Ecosystem fragmentation is not a mechanism. It is largely a result of the presence of the structure and that is the way it is discussed.

Hydraulic and geomorphic alterations are said in the text (7.1.2.1) to be caused by the presence of the structure (dams in Section 7.1). But for the most part it is not the presence of the structure that causes the effects, it is the operation and that is the way it is discussed. 7.1.6. States that water quality modifications are a result of construction and maintenance of dams. This is not true. They are largely a result of operation and to a lesser extent to the presence of the structure, and that is how they are discussed.

In 6.0, paragraph 1, impacts are defined as an unnatural disturbance to the controlling factors.⁴ Hydraulic and geomorphic modifications and the other effects that are called impact mechanisms are not modifications of controlling factors. In most cases they are controlling factors per Williams and Thom (2001).

The selection of impact mechanisms does not seem to make sense—especially given the nature of the discussion of effects. Impact mechanisms include construction and maintenance activities, hydraulic and geomorphic modifications, water quality modifications, riparian vegetations modifications, water quality modifications, and ecosystem fragmentation. The last five are not mechanism, they are effects of construction, operation, and the presence of the structures, the three actual impact mechanisms, and that is the way they are discussed. Operations and the presence of the structure are not called impact mechanism though they are discussed as such and should be named. It would seem to make more sense logically and organizationally to discuss the three impact mechanisms, their direct effects, and their indirect effects with respect to each of the types of structures.

4.2 Other comments

1. One reviewer noted that the important metric of SEL (sound exposure level) for underwater sound impacts is not mentioned until Chapter 9. It is missing through the discussion of impacts in Chapter 7. The white paper references a 2006 WSDOT training manual relative to the science of noise and impacts on fishes. The manual is out of date and has been replaced.

Throughout the discussion of noise impacts on fish in Section 7.0, the authors use the metric of dBpeak to evaluate potential injury to fish. The Services, however, use a combination of dBpeak and SEL for injury. The discussion in this white paper using dBpeak is outdated. The new metrics using dBpeak and SEL should have been used.

⁴ Unfortunately, none of the white papers define impact mechanism [which is not a term used by Williams and Thom (2001)], but it would seem to make sense that the impact mechanism is what causes the impact.

All seven white papers use much of the same discussion of the effect of underwater sound. An expert on effects of sound on fish reviewed the pertinent sections of the Marinas and Shipping/Ferry terminals white paper and was very critical of treatment of the subject. The expert's comments for the Marinas and Shipping/Ferry Terminals white paper are in bold and underlined per reviewer 5 in Appendix H. Similarly, an expert on noise reviewed Section 7.10 of the Habitat Modifications white paper. His comments are in Times New Roman Type per Reviewer 1 in Appendix F. The comments of these two reviewers should be considered generally applicable to the discussion of this topic in this white paper. See also the discussion of sound impacts in Section 7.0 Marinas and Shipping/Ferry Terminals.

2. The discussion of supersaturation of oxygen and nitrogen and gas bubble disease (Subsection 7.1.6.2) seems too meager considering the magnitude of the problem and considering that it is a specific problem for several listed salmonids species. There is much recent literature that could have been reviewed and cited.
3. In places it is stated that the authors are considering worst-case scenarios. It is not clear that they actually are, however. Reviewers noted that in the worst-case scenario, the resulting risk of take would always be equal to LTTA.
4. One reviewer commented on 11.11.1, specifically regarding monitoring equipment or multi-season pre-project surveys, that care needs to be taken in requiring certain actions across the board as regulatory requirements, as this removes flexibility. (This comment, however, could apply to any regulations.) Reviewers discussed the need for regulations and the HCP to provide certainty as well as flexibility. Achieving that balance will be mandatory.
5. One reviewer noted that the Corps of Engineers recently introduced the mitigation concept of “fish benches” for levees. These are essentially flat bars adjacent to and below the level of the levee top. They act as areas of refuge from high velocity during floods. Reviewers discussed that this is a good concept, but needs to be refined in terms of elevation, width, and roughness to achieve their goal. These are noted in WDFW (2003).
6. Stranding of juvenile salmonids and other fishes downstream of a dam as a function of flow fluctuation and ramping rate is a major problem, especially with respect to hydroelectric dams, that receives scant attention. Stranding receives more attention as a function of construction area dewatering, which is a one-time problem, whereas stranding due to operation of the dam is ongoing.
7. Desiccation of salmonid redds below dams due to unnatural flow fluctuations is not mentioned.
8. Conversion of riverine habitat to reservoir habitat upstream of dams is hardly mentioned.

9. Impacts associated with fluctuating pool elevation behind dams is given little mention.

5.0 Habitat Modifications White Paper Comments

All reviewers' comments on the Habitat Modifications white paper are found in Appendix F.

5.1 Global Comments

Global Comment 1 (definitions and word usage)

The term “key member,” referring to large woody debris, is used several times without definition.

Global Comment 4 (section 11)

- Use of fabric barriers will not buffer sound transmission into the underwater environment. You would need to have a substantial density change between the water and the fabric to achieve any reduction in noise levels. I would suggest removing this statement. There is also no mention of other mitigation strategies such as the use of pile caps. (11.1.1.1 bullet 4)
- This paper is for impacts to ESA species. Why is there reference to “protect human health and safety”? (11.1.2, bullet 4)
- Assuring that added LWD will not mobilize during flood events seems to be in conflict with much of the text. This sounds like all LWD placed in the system “needs to be secured otherwise it is a detriment”. Yet throughout this paper and the others, natural requirement of LWD (which would not be secured) is a key element of a diverse system. (11.3, paragraph 2).
- There should be some discussion about the issues of eelgrass loss and the cause of those losses. In many cases, degraded water quality (turbidity, nutrients) have caused the losses and attempts to restore eelgrass will fail unless these root causes are first corrected. It's an issue of source control.

Global Comment 8 (cumulative effects)

The discussion of cumulative effects is more extensive than for the other six white papers; reviewers remain critical, however. Specific points raised by reviewers include:

- The authors state that they are assessing the cumulative effects of each subactivity type. This is not true for beaver dam removal (8.1) where it is discussed in the context of elimination of other barriers as well.
- There was no assessment of the cumulative effects on HCP species. At best there was a nebulous statement such as: “*Consequently, the cumulative impacts of beach nourishment may be positive for some fish species. . .*” The last sentence of 8.9 is: “. . . if large-scale eelgrass planting were to occur, there would be substantial gains in several of the HCP species.” At the very least, the authors could tell what species might benefit.

- There is no discussion of threshold levels that might be important.
- Some of the discussion is simply about direct effects and mitigation.
- In the second paragraph of Section 8.0, the authors make the point that the majority of negative impacts associated with habitat modifications occur during the construction period. Reviewers did not generally agree with this. This might be true for acute project impacts, but long term chronic effects of habitat modification can be much more destructive—especially for ill-conceived projects.
- The statement in 8.1, paragraph 1, regarding humans unintentionally mitigating for a part of the negative effects of beaver dam removal is of doubtful validity. The authors do not make a case or give a reference for the contention that the construction of dams mitigates for the removal of beaver dams and reduction of numbers of beavers. Beaver dams tend to be in smaller tributaries, many in the upper watershed, whereas dams are more likely to be constructed in mainstem rivers or larger tributaries.
- Section 8.3 does not address cumulative effects from spawning substrate augmentation, but simply discusses the issue and states it may need to be an ongoing effort. What are the impacts of continually augmenting a system?
- In 8.8 is the statement:

“Given the limited number of HPAs issued and the relatively limited number of documented impacts of created reefs, it is unlikely that cumulative impacts of this subactivity are significant in Washington waters.”

- It would be very useful to have some information, even qualitative, for all the subactivities as to the number of projects of the various types and their spatial distribution. That quantitative information is available from WDFW.
- Perhaps the majority of *acute* negative impacts occur during construction, but long-term chronic effects of a bad habitat modification project can be much more destructive. (8.0, paragraph 2)
 - There is little or no attempt to related cumulative effects to impact on HCP species. For example, in 8.8 it is stated that a sufficient number of artificial reefs would cause a shift from soft-substrate to hard-substrate organisms. But there is no discussion of what that means to HCP species. In 8.9, the text states that large-scale eelgrass planting would be a substantial benefit to several HCP species. Which species? In 8.7, for which species would the cumulative effects of beach nourishment be positive? You seem to be suggesting that the effects for some would be negative. Which species? In 8.8, what would be the effect on HCP species of the shift from soft-substrate to hard-substrate organisms?
 - As stated earlier, a comparison between man-made impoundments and beaver dams may not be appropriate unless qualified in some way. A citation is needed. (8.1)
 - Most of this section, particularly the second paragraph is simply discussing direct effects, not cumulative effects. Some is a discussion of mitigation. (8.2)

Global Comment 23 (underwater noise)

- There is no discussion of Sound Exposure Level (SEL). Since that is one of the criteria for hearing damage and one of the interim threshold criteria proposed it should be mentioned along with dBpeak and RMS.
- Transmission loss is more appropriately defined as the combination of geometric and linear losses than the reduction of the intensity of the acoustic pressure wave as it propagates, or spreads, outward from a source. (7.10.5.1, Paragraph 3)
- There should be some discussion about the use of the linear component of transmission loss (aside from the Nedwell model) that allows for the incorporation of linear components beyond about 1000 meters.

Global Comment 25 (lost opportunity)

- Lost opportunity is discussed as an effect of the activities in this and three other white papers. It is discussed here under ecosystem fragmentation, but it is not consider a submechanism of ecosystem fragmentation as it is in the Shoreline Modifications white paper. The term is undefined in this white paper, but it is clear the authors are depending on the erroneous definition found in the Shoreline Modifications white paper as the topic is discussed only in relation to hydrologic and geomorphologic impacts. Lost opportunities are not restricted thus, however.

In 7.1.1.3, last sentence is:

“ ‘Lost-opportunity’ impacts result from projects that adversely alter natural fluvial processes important to the ongoing creation of fish and wildlife habitats (WDFW 2003).”

This is a misuse of the quote from WDFW (2003). Lost opportunity impacts are not restricted to those that alter fluvial processes. WDFW (2003) was discussing stream bank protection and impacts on fluvial processes. This was not meant to be a statement of the only types of lost opportunity.

In 10.1.5 is:

“Although it is recognized that lost-opportunity impacts must be mitigated to achieve no loss of habitat (WDFW 2003), currently there are no tools for universal and consistent application of the concept.”

This is a misuse of the quote from WDFW (2003). WDFW (2003) was speaking of in place-in kind mitigation for impacts on fluvial process at stream bank protection projects. Mitigation is always possible, even though it might have to be out of place and/or out of kind. WDFW (2003) acknowledges this.

11.1.6. “Mitigation for lost opportunity requires mitigation for channel processes affected by a project.” Mitigation is needed for all impacts. This white paper is supposed to be providing mitigation methods, not just pointing out that mitigation is needed.

Global Comment 27 (regarding mechanisms and submechanisms)

In this white paper, dredging is not considered an activity, mechanism, or submechanism as it is in the other papers. It is given minimal discussion even though common for certain of the subactivities discussed. It is mentioned under the construction activities impact mechanism for beach nourishment as sometimes being a source of materials, but there is no discussion of impacts of dredging. It is also mentioned under the water quality modifications submechanism for beach nourishment as posing a risk of resuspending pollutants. In 7.10.6.2 a study of dredging in the Similkameen River is cited as evidence that dredging has no effect on adult mussels. Though not even mentioned in the discussion of the effects of artificial reef construction, in 9.8.1.1 it is stated that dredging may produce water quality stressor that create the potential for take. It is not clear, given this, why dredging and its effects aren't discussed under artificial reefs in Section 7.0. Dredging is commonly a part of the subactivity of in-channel/off-channel habitat creation/modifications and wetland creation/restoration/enhancement. Dredging is not mentioned relative to these activities either.

5.2 Other comments

1. Considerable discussion throughout this white paper deals with impacts on eelgrass and its value as fish habitat. Normally in a paper such as this the genus and species would be given the first time a plant or animal is mentioned. This is not done and it is never stated which species of eelgrass is being discussed. Since there are two species in Puget Sound (the native eelgrass (*Zostera marina*) and the introduced *Z. japonica* with distinct biology and ecology), this posed a significant problem for reviewers and detracted from the usefulness of the white paper.
2. In addition to not distinguishing between the two species of eelgrass, the white paper is too “eelgrass-centric,” downplaying the other 600+ species of marine algae, including kelp. It also does not cover the upper beach plant community—“spit/berm” vegetation. This community is unique and highly susceptible to being impacted. It also erroneously refers to eelgrass as the dominant nearshore macrophyte. This is not true if one considers marine algae. While eelgrass is extremely important in nearshore marine areas, other plants are important as well. The paper seems to carry the message that the nearshore marine areas should consist solely of eelgrass. Reviewers believed that a mosaic of eelgrass, algae, and non-vegetated areas is important. While eelgrass meadows are productive and may be the most productive in some respects, they are not in all—for example, photosynthetic primary productivity.
3. Section 7.5.1.4.1 makes the point that riparian vegetation removal increases stream productivity—though reviewers felt that this is not as universally true as

- the authors seem to suggest—and ignored the other functions of a healthy riparian area. However, in Section 11.0, numerous measures are proposed to protect riparian vegetation from being affected: require buffers and setbacks, work in the channel rather than the riparian area, prohibit removal of riparian vegetation, etc. This is an internal inconsistency; if I increases stream productivity, why would you mitigate it?
4. Section 7.5.1.4 should discuss removal of riparian vegetation by chemical means, as this is a common activity. The chemicals and surfactants used have a whole suite of issues and stressors associated with them.
 5. Salt marshes are generally not covered, but should have been.
 6. In several places, the authors use surrogates for fish to discuss impacts. For example, in 7.10.7 a study of predation on frogs (tadpoles) is extended to HCP species. In 7.10.2.1.3, effects of suspended solids on rainbow smelt and Atlantic herring is similarly used. Such comparisons may be valid, but the authors need to be careful to establish that validity. They generally did not do so in this white paper.
 7. Similarly, the effect of small dam removal was discussed as equivalent to beaver dam removal without explaining why this was warranted. Also, they need to establish some basis or provide a reference for the contention in 8.1 that:

“The reduction in hydraulic and resource retention provided by beaver impoundments has been partially counter-balanced by the impounding of the nation’s waterways for resource extraction and recreational purposes.”

It is not readily apparent that beaver dams and artificial impoundments are comparable, especially given that beaver dams are primarily in smaller streams whereas dams are more apt to be in larger streams.

6.0 Fish Screens White Paper Comments

All reviewers' comments on the Fish Screens white paper are found in Appendix G.

WDFW disagrees that there is adequate evidence that the types of geomorphic modifications as detailed by Herrera in Subsection 7.2.5 and Subsections 7.2.5.1 and 7.2.5.1.1 through 7.2.5.1.4 would result from fish bypasses. Reviewers were specifically asked to state their opinion on the validity of this portion of the white paper. Reviewers agreed with WDFW that the geomorphic modifications would not rise to the level of those described in the white paper.

It also appears that the authors discount the significance themselves: (1) in 11.3.4, paragraph 1, last sentence "*On this basis, the extent of hydraulic and geomorphic modification is expected to be quite limited, and there are no specific recommendations for fish screens,*" and similarly (2) by the risk of take rating of "Insignificant or Discountable" for hydraulic and geomorphic modifications in Tables 9-1 and 9-2.

6.1 Global Comments

Global Comment 1 (definitions and word usage)

- The undefined terms "integrated bypass system" and "integrated bypass channel" are used. The meaning of these is unclear. Integrated bypass system is used only one time and not until Section 9.2 (bullet 4), where it is stated that they may have "more extensive effects" (apparently than screens without an integrated bypass system. Similarly, integrated bypass channel is used one time, in the data gaps section (10.2).
- Nor are "bypass system" and "bypass channel" defined. Mostly they seem to be unused interchangeably, but in 4.1.1.2 is the statement: "*This type of screen system commonly does not require an associated bypass channel (although it often includes some form of bypass system),*" which indicates the two are something different. In places both terms seem to include the channel that carries water to the off-channel screen and the channel that carries bypass water back to the stream channel. Diversion channel would more usually be considered the channel that carries water to the off-channel screen (and perhaps beyond) and the bypass channel would carry the return water from the screen back to the stream or other body of water.
- The term "base flow" is used several time. It seems to mean the streamflow in the channel at a point of diversion, but this is not clear. In the normal lexicon related to stream flow, the term baseflow has a specific meaning that is obviously not what is intended here. In places, they seem to mean that baseflow is the instream flow at the point of diversion, but this is not clear.
- "Screen" or "fish screen" is used in different ways and leads to confusion. See footnote 1 in Section 6.2.

- The definition of ecosystem fragmentation (which doesn't come until 9.2.4, after the topic has been extensively discussed) is rather unique as discussed Global Comment 1 in Section 1.5. In most places in this white paper, however, ecosystem fragmentation is discussed per the more normal definition.

Global Comment 4 (section 11)

- The authors seem to not be aware that NMFS and WDFW have screen criteria that have to be met, though there is one reference in the text to criteria in Washington state. A basic mitigation strategy should be to, at a minimum, meet these criteria, which were developed primarily for salmonids, and consider the needs of any other species that might be present.
- Infiltration galleries have not been reliable and their design is, adequately covered by NMFS guidelines. (11.2.1, bullet 1 “*Guidance criteria for the siting, design, and operation of infiltration gallery screens are currently lacking.*”)
- The paper pronounces “*Any adverse effects on habitat conditions should be addressed with appropriate mitigation.*” How is this generic statement tied to any impact mechanism? Just what should this mitigation be? This section is supposed to make specific mitigation recommendations. (11.3.4, paragraph 5) This section goes on to suggest that an appropriate tool to determine what's needed is Moberg's EDT. Moberg's EDT does not provide any useful strategy to mitigate the effects of fish screens.
- The White Paper states (11.1.1, paragraph 1): “A primary issue that limits the operational effectiveness of fish screens is the fact that a significant proportion of fish screen designers have no training or experience in this unique bio-engineering field.” There is no basis for this statement and it is not true. There are several engineering consultants with decades of experience. Further, numerous minor and major screens in Washington are designed by WDFW and the U.S. Bureau of Reclamation (BOR). Both agencies have experts with literally decades of experience in designing, constructing, and maintaining fish screens and assessing their performance. Moreover, it does not matter much how much experience a designer might have. All screen proposals must meet WDFW and/or NOAA requirements and personnel responsible for reviewing and approving proposals have sufficient relevant experience to evaluate them.

Global Comment 8 (cumulative effects)

- Shouldn't this read “. . . cumulative impacts associated with **construction** effects . . .” rather than operational effects? (8.0, par 3, last sentence) It doesn't seem to make sense as is.
- The last sentence of this last paragraph is hard to understand:

“The cumulative effects of fish screens are likely to be small relative to the combined effects of multiple water withdrawals on habitat capacity and productivity.”

Why is such a comparison even considered? How is it relevant? The important thing generally isn't how great one effect is as compared to another; it's simply the magnitude of the effect of the impact under consideration. Or in the case of fish screens, since they are mitigation measures, it might be the impacts of the situation with and without the screen. Or perhaps the effect of a specific fish screen as compared to a perfectly functioning state of the art fish screen. Furthermore, the purpose of fish screens is protection of fish at water diversions and has nothing to do with habitat capacity and productivity; the potential for properly designed and functioning fish screens to adversely impact habitat capacity and productivity is minor.

- The last sentence (of Section 8.0) is hard to understand: “. . . the cumulative effects of fish screens are likely to be small relative to the combined effects of multiple water withdrawals on habitat capacity and productivity.” Why is such a comparison even considered? How is it relevant? Fish screens are designed to mitigate some of the effects of water withdrawals. Isn't obvious that mitigation measures would have less impact than the structures whose effects they are to mitigate? Furthermore, the purpose of fish screens is protection of fish at water diversions and has nothing to do with habitat capacity and productivity; and their potential for adversely impacting habitat capacity and productivity is minor.

Global Comment 9 (data gaps)

- Contrary to the data gap statement, there are well-established screen design criteria that work very well to protect all life stages of anadromous fish species. Testing of other species using screens designed to the anadromous fish screen criteria typically shows that the criteria are successful in protecting other HCP species. (10.0)
- The data gap identified (10.0, bullet 4) certainly is not supportable at least in the case of anadromous salmonid species. That fish screens are effective is demonstrated by the 98-100% survival rate of screens appropriately designed and built.
- This is not a valid data gap; (10.0, bullet 3) there are well-established criteria that are effective for the purpose of designing fish screens. .
- The statement: “... *despite policy directives dictating the widespread implementation of fish screens on agricultural diversions, relatively few studies have attempted to evaluate their effectiveness at maintaining or increasing population abundance and productivity*” does not identify a data gap as written. Regardless, there are many such studies. Furthermore, screens are not intended to maintain or increase population abundance and productivity, they are an action designed to mitigate some of the adverse effects of water diversion.
- This section implies that fragmentation of habitat may result from fish screen installation. Reviewers didn't agree, because off-channel screens are installed once water is diverted from the system. It is the diversion that fragments the

habitat, not the screen, which actually serves to mitigate effects. It is not appropriate to suggest that research on this topic is required.

- The first sentence refers to the flow control structure and shoreline modifications. Elsewhere, too, in this section the discussion is of the diversion or withdrawal. It is the screen that should be the subject here. It is not clear how most of the discussed effects constitute ecosystem fragmentation.
- Relative to 10.3.2.2, fourth bullet, this is not a totally accurate statement of a data gap. For salmonids there are numerous such studies; none have proven successful. Relative to non-salmonids, the statement is true.
- Lack of useful design criteria across the range of environmental types and conditions where screens are employed is listed as a major data gap. This is not true with respect to salmonids, which are the major—but certainly not only--fishes of concern at most screens. However, testing of other species has shown the design criteria generally protects them as well.
- With respect to item 4 in 10.0, this is not a data gap for salmonids. Survival at properly designed, constructed, and maintained screens is 98 to 100%. This would seem to qualify as an effective tool.
- The statement in 10.0 paragraph 3 about determining the most appropriate screen design criteria for a given life stage and occurrence of HCP species is not supported by the text. Nor is this true for anadromous fish species and some other HCP species--there are well-established criteria that are effective for the purpose of designing fish screens.
- Contrary to the contention in 10.0, paragraph 6, there are numerous reports of studies that measure the effectiveness of screens designed with NMFS or WDFW criteria in agricultural diversions. Also contrary to the implications in that paragraph, fish screens are not intended to maintain or increase population abundance and productivity. Their purpose is simply to avoid and minimize fish mortality at water diversions.

6.2 Other comments

1. Reviewers felt that there were so many errors, omissions, misinterpretations and other indications that the authors were unfamiliar with fish screening issues that the white paper is of little value.
2. Although it is clear they do not always, if ever, do so, the authors state:
“However, to fully assess the effects of fish screens⁵, a comparison is made

⁵ Here and elsewhere in this white paper the authors consistently state that they are considering screens or fish screens, e.g., executive summary, introduction, objectives etc. In the executive summary, for example, is the sentence: *“For the purpose of this white paper, the effects of fish screens are considered limited to those effects imposed by the screen only.”* This is not true and is contrary to the fact that they also consider the effects of the bypass system. A bypass system might be considered an integral part of a “fish screening system” for off-channel screens, but it is not part of a “fish screen.” There are many places in the white paper where screens or fish screens are referenced. Sometimes it seems to mean screen only, sometimes it means screening system or screen and bypass system, and sometimes you can’t tell. They should use “screen” when they mean only the screen, and “screening system” or “screen and bypass” otherwise.

between a stream with a flow control structure⁶ and unaltered channel conditions. To assess impact mechanisms, resulting stressors, and biological responses to those stressors, the environmental baseline is considered the unaltered channel condition prior to installation of the structure (i.e., the channel prior to diversion or in-channel system development)."

The wording of the first sentence is nebulous and the meaning is unclear. It seems to mean the comparison is between a stream with a flow control structure on the one hand and a control stream with unaltered channel. But this does not seem to even make sense as a premise for considering the impacts of fish screens. If the authors actually compared a stream with a flow control structure to an unaltered channel, they in fact would be simply considering the effect of the diversion structure. As stated, how does this even consider screens (and bypass systems at all)? Screens and bypass systems are not mentioned in the statement. Is it to be assumed that the authors meant the comparison is between a diversion, screen and bypass system and a control stream? Ambiguities hamper understanding throughout the white paper.

3. To be useful, this paper needs to include specific design criteria such as screen opening sizes, approach velocities, bypass flows, etc. that are applicable for each stage of development of the species to be protected per the NMFS and WDFW criteria. There is no mention of which species are to be protected and how they will be screened.
4. In 4.1.1.1 and other locations, the reference to the most recent NMFS design guidance is no longer current and the document is no longer draft.
5. Regarding 4.1.3.1, par 1, there are limits per NMFS (2008) as to allowable flow amounts and site conditions for passive screens. This paragraph and the following figures seem to imply that the two (self-cleaning and passive debris clearing) are somewhat interchangeable and equivalent in application. This is not so.
6. A description of the guidelines and criteria that constitute the basis for design of juvenile fish screens should have been included in 4.1, paragraph 1. Without this description and assessment of design criteria and guidelines, effects of the screen design can't be addressed and are probably more consequential than other impacts described throughout the white paper. For example, if an approach velocity of 3 ft/sec is used in screen design instead of the WDFW/NOAA criterion of 0.4 ft/sec, most fry-sized salmonids will be killed by the screen. This section should describe each element used in screen design, and the basis for each element.

⁶ The use of "flow control structure" here and throughout the white paper is troublesome. The term is never defined, but the authors do refer to the Flow Control Structures white paper and it appears that the structures there are what they mean by the term. In that white paper are considered dams, weirs, dikes and levees, outfalls, intakes and diversions, and tide gates. The only one that is really considered in this white paper is intakes and diversions. They should use this term instead of the more inclusive "flow control structures," which can lead to confusion. For example, in the first sentence of the above quote it sounds like they are going to compare all the named flow control structures, instead of just intakes and diversions.

Without this design basis described, it is meaningless to raise arguments that screens designed for anadromous salmonid protection may have adverse effects on other HCP species.

7. The authors, in numerous places, discuss pumped bypass systems as if they are common. They are not. In fact, reviewers know of no such systems in Washington. Depending on the design, a pumped bypass has a great deal of uncertainty and risk for fish safety during passage and NMFS screening criteria specifically preclude them.
8. Several what should have been impact submechanisms are not identified or assessed—e.g., inadequate screen and bypass maintenance (mechanical repair and operational issues); inadequate bypass flow; improper conditions at the bypass outfall; predation at the screen, in the bypass or at the bypass outfall; dewatering the bypass canal and subsequent entrapment in the screen approach bay; attraction of upstream-migrating salmonids to bypass outfalls; inability of small bypass pipes to pass adult fish. These are substantial omissions and reflects on the credibility of the analysis.
9. In 7.2.5.1.1, paragraph 1 it is stated that the bypass flow may represent 1% to 10% of the base flow and in paragraph 2 and in 7.5.1.2, paragraph 6, from 5% to 10 %. (Base flow is not defined, but from the previous sentence it appears that this is intended to mean stream flow at the point of diversion) This is a gross exaggeration. Bypass flow would normally not be more than about 5% of the diverted flow, not the base flow.
10. In 7.2.5.1.1 it is stated that bypass flow in many cases represents the majority or entirety of bypass channel flow. This statement makes no sense. The bypass channel is normally considered the channel beyond the fish screen returning to the stream or other body of water. The bypass flow would almost always be 100% of the flow in the bypass channel (except maybe in the rare case where the bypass channel picked up some groundwater or surface drainage).
11. In 7.2.6.2 and elsewhere, two references [Close (1998) and Kemp et al.(2006)] are used in a misleading manner and/or mischaracterized.
12. Reviewers generally disagreed with the rating of a high risk of take for most salmonids for most of the various impact mechanisms.
13. It is unclear how the risk of take ratings were assigned. Some do not make sense. For example, in Table 9-1 leopard dace are at high risk for three of the impact mechanisms in lacustrine environments, and at low to high risk in Table 9-2. But according to Table 5-1, they are only found in rivers and streams. Similarly for margined sculpins and mountain suckers, and others. Conversely, Umatilla dace are said to be stream residents, but are rated as at high risk in lacustrine environments. Green sturgeon are shown in Table 9-1 and 9-2 as not occurring in freshwater, contrary to the information in Table 5-1. Why do chinook salmon have a high likelihood of take from screen operations in marine environment, but coho have a low risk?
14. A primary objective given the authors by WDFW was to *“Use this scientific information to estimate the circumstances, mechanisms, and risks of incidental take potentially or likely to result from the construction, operation, and maintenance of fish screens.”* This objective was not met. There is a large body

- of information regarding screen evaluations that was not cited. It would have been valuable for weighing the benefits of fish screens relative to the minor risks that the paper emphasizes, with poor rationale. The few references that were used for this purpose were reports more properly used for ancillary information, not estimates of mortality and injury at screens. Of over 400 citations provided, only about 14 are really relevant to effects of fish screens on HCP species.
15. As is common among the seven white papers, there is little or no information about the size, scale and distribution of projects. Nor does the extent of discussion of impacts necessarily relate to the potential significance of the impact. For example, in this white paper there is extensive discussion of the effects of pile driving and underwater “noise” (most of which is copied from other white papers without attribution); but pile driving is rarely employed in construction of fish screens. Similarly, there is extensive discussion of the potential effects that screens might have on stream hydraulics and geomorphic processes. Yet in Table 9-1 and 9-2 and 11.3.4, the importance of these potential effects is discounted. This is also the case for potential water quality modifications from screen operation, and other topics.
 16. Approach velocity of water on screens is the most important parameter for consideration when designing a fish screen. But there is no discussion of this or the ramifications of exceeding approach velocity criteria.
 17. An expert on effects of sound on fish reviewed the pertinent sections of the Marinas and Shipping/Ferry terminals white paper and was very critical of treatment of the subject. All seven white papers use much of the same discussion of this topic. The expert’s review comments for the Marinas and Shipping/Ferry Terminals white paper are in bold and underlined per reviewer 5 in Appendix H. Similarly, an expert on noise reviewed Section 7.10 of the Habitat Modifications white paper. His comments are in Times New Roman Type per Reviewer 1 in Appendix F. The comments of these two reviewers should be considered generally applicable to the discussion of this topic in this white paper. See also the discussion of sound impacts in Section 5.0 Habitat Modifications.
 18. Throughout Section 7.0 and in 9.0, effects (of, for example, maintenance, dewatering, travel, etc.) on fish in the bypass channel are discussed many times. In most, if not all, of these cases, the effect on fish in the diversion channel above the screen is identical but never mentioned. Perhaps this is because the authors erroneously refer to the channel delivering water to the screen and the channel leading bypass water back to the stream collectively as the bypass channel. This is incorrect terminology.
 19. The authors are extremely sloppy in dealing with the terms “mechanism” and “submechanism” in Section 7.0, using them interchangeably and . . .
 - Riparian vegetation modifications and ecosystem fragmentation are not listed in Table 6-1 as impact mechanisms for in-channel screens, but both are named and discussed as such in the text.

- In 7.1.1 and 7.2.1, noise and visual and physical disturbance is listed and discussed as a construction-related submechanism. It is not listed as such in Table 6-1.
- Equipment operation and materials placement is listed as a submechanism in Table 6-1, but it is not discussed as such in the text (7.1.1).
- 7.2.1. As in 7.1.1, noise and visual and physical disturbance is listed and discussed as a construction-related submechanism. It is not listed as such in Table 6-1. Equipment operation and materials placement is listed in Table 6-1 as an impact submechanism, but not in the text. It is discussed under the noise submechanism.
- 7.2.3. The impact submechanism under the water quality modifications mechanism are entirely different from what is listed in Table 6-1.
- 7.2.5.1. An impact submechanism not listed in Table 6-1 or discussed in 7.1.5 is introduced—altered habitat complexity
- 7.2.6. One submechanism in Table 6-1 is omitted from the bulleted list (modified upstream transport of allochthonous nutrients), but in the text in this section it is discussed under altered lateral and longitudinal connectivity. One submechanism is introduced that is not in Table 6-1 (altered lateral habitat complexity).

20. In the first paragraph of Section 4.0 is a sentence that is confusing:

“The white paper focuses specifically on the impact mechanisms and related stressors caused by the construction, maintenance, and operation of these subactivity types . . .”

But construction and maintenance is an impact mechanism; so this seems to be saying that the impact mechanism of construction, maintenance, and operation causes impact mechanisms and stressors—i.e., impact mechanisms cause impact mechanisms--whatever that means.

21. Throughout the white paper, ecosystem fragmentation is presented as being an effect of fish screens. In fact, however, it is the diversion or diversion structure that causes the fragmentation. This is acknowledged in the Flow Control Structures white paper (Section 7.1). The screen serves to mitigate for some of the habitat fragmentation effects, not cause them.

7.0 Marinas and Shipping/Ferry Terminals White Paper Comments

All reviewers' comments on the Marinas and Shipping/Ferry Terminals white paper are found in Appendix H.

7.1 Global Comments

Global Comment 1 (definitions and word usage)

The authors of this white paper never state what the activity types are, nor can one intuit or interpret what they are. The two subactivities are marinas and shipping/ferry terminals, so it would seem to make sense that there be only the one activity of marinas/terminals. But there are numerous references to the “activities” addressed in this white paper or to “each activity” or to “marina/terminal activity types,” suggesting there are more than one. In 9.1.1, pile driving is referenced as an activity, but not an “activity type;”⁷ so it is not clear if this is one of the activities. Vessel operation, channel work area dewatering, dredging, are also referenced as “activities,” but it is unclear if these are the activity types in the white paper—it seems unlikely. In the second paragraph of 9.6 is: *“The impact mechanisms and risk of take associated with the construction of these specific project activity types are discussed in Herrera (2007a), the Shoreline Modifications white paper.”* There is no antecedent to “these” in the sentence so that doesn't help. The activities in the Shoreline Modifications white paper seem to be jetties, breakwaters, groins, and bank barbs; they are never named, however, so one can't be sure. It is hard to imagine how one is supposed to get the precise sense of this white paper without proper definition of terms and with their careless use.

Global Comment 4 (section 11)

- This section consistently fails to address compensation and only sporadically addresses avoidance measures/strategies. Since minimization and mitigation are requirements of the ESA, not including compensation measures may result in the failure of WDFW's efforts to obtain a HCP.
- Similarly to other sections of this document, the measure listed here targets fish and primarily salmonids. There is little attention given to fish other than salmonids and virtually none to shellfish.
- This section overlooks measures associated with avoiding and minimizing effects from bulkheads, breakwaters and fill.
- While this section frequently calls for assessing impacts, it fails to state how the assessments will be used to avoid and minimize impacts to covered species and their habitat.

⁷ Generally in this and other white papers, the authors seem to use “activity” when they are using the word in one of its common meanings, and “activity type” otherwise. They are not consistent in this, however, and that can't be relied upon.

- Based on hydroacoustic monitoring during use of a bubble curtain on ferry terminal pile driving projects, the minimum amount of attenuation with a bubble curtain is usually 9 dB. Requiring 15 dB attenuation at all times may not be necessary; sometimes a lower attenuation provides the required protection. In addition, 15 dB has seldom been achieved in Washington State. (11.4.1, bullet 1)
- Fabric barriers or cofferdams, by themselves, provide no sound attenuation. They need to be coupled with a bubble curtain. (11.1.4, bullet 4)
- In 11.0 it is stated that: “This analysis assumes that all marinas/terminals are conditioned under HPA authority pursuant to the Hydraulic Code (RCW 77.55) and their associated rules (WAC 220-110), as well as applicable local, state, or federal regulations.” First, there is only a hodgepodge listing of potential mitigation measures from published sources, with no attempt at any kind of analysis. If the assumption really was that projects were conditioned with the rules of WDFW and other authorities, many of the items listed would not be there as they are requirements of the listed authorities.
- Instruction from WDFW to the authors included that the white papers must provide **specific** management recommendations and numeric standards wherever possible to meet different levels of resource protection (e.g., take avoidance, no net loss, minimal impact). Virtually no numeric standards are presented and many of the recommendations are so general as to be of little value. As just one example, 11.1.5 calls for establishment of science-based protocols for fish removal and exclusion from work areas. These exist, why aren’t they listed?

Global Comment 8 (cumulative effects)

- This section is very weak, but evaluating cumulative effects properly probably requires that they be addressed in a separate white paper that can more fully describe the environmental baseline, past and current activities, and how future actions (not just terminals and marinas) will likely affect conditions.
- The cumulative effects section is too general. It tells the reader about general trends but it does not get into any detail. The WDFW should have plenty of historical data on HPAs they have issued and have some idea of what is being permitted. So I think it would be valuable to make an effort to try and put down some numbers of what will be effects. Whether that is a total area or number of fish or some other metric that is measurable. At a minimum there should be some information on the number and spatial distribution of marinas.
- “To the extent that under-dock environments block light transmission, they pose the risk of diminishing prey resources and triggering behavioral changes of HCP species.” (8.2, paragraph 1, sentence 3) Under-dock environments don’t block light transmission—the dock blocks light to the under-dock environment.
- “Haas et al. (2002) also identified extensive impacts of ferry terminals that pose habitat fragmentation effects.” (8.2, paragraph 1) The purpose of this

section to elucidate what the cumulative effects are. This statement does not do that and is of little value. The cumulative effects should have been discussed, especially since they are extensive.

- There is no definition of what the authors are considering to be cumulative effects, and the discussion is so minimal and general as to be of little value. A significant portion of the section discusses how cumulative effects might be assessed, rather than detailing what is known. Much of the discussion is simply of direct effects, without tying that to cumulative effects. Instructions to the authors from WDFW include: “*The white papers must also quantify, or otherwise characterize, the cumulative impacts of multiple projects of a single type. . .*” In this white paper, the discussion is in terms of cumulative effects of each of the impact mechanisms, not the suite of impact mechanisms associated with marina construction and maintenance.

Global Comment 9 (data gaps)

Data gaps overlooked include:

- Presence/absence of specific types of habitats across the landscape.
- Post dredging re-colonization rates for benthic infauna and submerged vegetation.
- Discharge quantities/rates associated with vessel maintenance and operations.
- Quantification of threshold light levels for impacts to submerged vegetation.
- Effects associated with modification of lacustrine riparian vegetation.

7.2 Other comments

1. In six of the white papers, ecosystem fragmentation is an impact mechanism. In this white paper, however, it is presented as both an effect of the operation of impact mechanisms or submechanisms, and also as a mechanism. It is not clear why it is a mechanism in some white papers and an effect in others. In 7.6.1.2, ecosystem fragmentation is an effect of strong currents that preclude movement of some fish. In 7.6.3.2.1, it is the result of temperature gradients that block migration. In 9.6.1.2 and 9.6.3.2, however, ecosystem fragmentation is presented as a mechanism that can lead to alterations in sediment supply and substrate conditions—i.e., an effect that has secondary effects.
2. Section 4.0 contains: “*WAC sections identified for analysis in this white paper are listed in Table 4-1.*” There is no analysis of the WACs in the white paper, simply a listing in Table 4-1 of those that apply.
3. The authors consistently fail to link the stated effects on the environment to impact on proposed HCP species. They also consistently fail to extrapolate from the stated effects on one species, often salmonids, to other potential HCP species. Invertebrates are particularly ignored. Lack of consistent linkage between activities, environmental effects, and impact on species proposed for coverage is a critical weakness of the document. In some places, the authors simply state that

there will be effects, without stating what they are or even if they will be beneficial or detrimental (e.g., 7.4.2.4.1).

4. Section 7.1 on the direct and indirect impacts of construction and maintenance activities has several significant omissions: several associated mechanisms such as pile installation by vibratory hammer and deck replacement, mortality as a result, disturbance of fish slime coat, entrainment of invertebrate larvae, effects from overcovering of invertebrate larvae, permanent loss of habitat due to maintenance dredging, indirect food web effects from loss of invertebrates, and other.
5. The authors seem not to understand the meaning of some key terms in the discussions on underwater sound, casting doubt on their knowledge of the subject and validity of the analysis and usefulness of the white paper in regard to this topic. Reviewers' conclusion was that the authors are not very knowledgeable in this topic.⁸ Some of the more important reviewer point are noted here. See Appendix H for all comments.

- For example, in 7.1.1.1, dBpeak is give as the instantaneous maximum sound pressure level; it actually is the highest instantaneous **absolute** value.
- RMS (root mean square) is given as the square root of the total sound pressure energy divided by the impulse duration; rather, it is the square root of the mean of the squares of all the measured sound pressures in the signal. There is no time component.
- In several places there is a reference to “derivative of dBpeak”; none of the reviewers know what that means. “Amplitude” is used at least once in place of “wave length.”
- It was incorrectly stated that hydrophones measure sound pressure. They are sensors that detect and transduce pressure into electrical voltages, which are converted into pressures or decibels.
- In 7.1.1.1, second paragraph, is “. . . *the sound pressure level at which injury from barotraumas may occur. . .*” Barotraumas do not cause injury, they are injuries.
- In 7.1.1.1 paragraph 2. Noise attenuates over distance as the pressure wave moves away from the source, not as the “receptor” moves away. The receptor perceives this transmission loss, but does not cause it.
- 7.1.1.1, paragraph 2. Sound does not transmit effectively in shallow water due to the “frequency”, not the amplitude. See Rogers and Cox 1988
- In 7.1.1.1, paragraph 2 it is stated that sound does not travel around obstructions. On the contrary, sound will travel around and through relatively small objects, such as piles.

⁸ It is acknowledged, however, that the science of effects of underwater sound is difficult, complex, and rapidly evolving.

- In 7.1.1.1, paragraph 5, it is erroneously stated that the “spreading loss model” is more conservative over shorter distances from a pile being driven.
- The term dB is often used without qualifying if it is dBpeak or dBrms. Without the qualification, the information is meaningless.
- Ambient noise is expressed in places as dBpeak; it should be dBrms.
- SEL (sound exposure level) is SEL is referenced to $1\mu\text{Pa}^2\cdot\text{sec}$, not $1\mu\text{Pa}^2/\text{sec}$ as stated in 7.1.1.2.2, paragraph 4.
- “Ambient” has a specific meaning with respect to sound. The authors misuse the term in this entire discussion. (For example in 7.1.1.2.2., par 4.) Ambient noise is defined by ANSI (American National Standards Institute) as “All-encompassing sound at a given place, usually a composite of sounds from many sources near and far.” As such, peak pressure is a poor representation of ambient noise, which should be expressed as rms pressure.
- “Percussive” and “impulsive” were erroneously used interchangeably throughout the white paper.
- 7.1.1.2.2, par 5. In sentence beginning with “For example, high-gradient . . .”--lakes and rivers do not produce the type of noise impacts addressed here --humans do.
- The section does not address the effects of noise/vibrations on larval live history stages of the HCP species. For example, vibrations are known to affect incubating salmon eggs and suspected of affecting the eggs in gravid female salmon.
- 7.1.1.1, par 1, sentence beginning “The RMS level represents. . .”) Because hydrophones have different polarities (positive pressure may result in a positive or negative voltage), dBpeak, when used for pile driving, is actually the instantaneous maximum *absolute value* of the sound pressure. Also, RMS is the square root of the mean of the squares of all the measured sound pressures in the signal--not the square root of the total sound pressure energy divided by the impulse duration. There is no time component. Suggest you look up the definition to make sure you get it right.
- 7.1.1.1, par 1. The Services have recently adopted new criteria, a combination of peak and SEL for injury. The new metrics (but using old thresholds) are discussed in Subsection 9.1.1, so you should make this consistent. This entire section should be rewritten with the peak/SEL criteria for injury instead of the peak only.
- 7.1.1.1, par 2, first sentence. Noise attenuates over distance as the “pressure wave” moves away from the source, not as the “receptor” moves away. The receptor perceives this transmission loss, but does not cause it.
- 7.1.1.2.1, par 2, last sentence. The different hammers produce different waveforms, not “changes in pressure waveforms”.

- 7.1.1.2.2, par 2. Are these dB levels peak or rms? At what distance from the vessel? These are very important parameters that play a role in the risk of exposure and the response of the fish. Without them, this information is meaningless.
 - 7.1.1.2.2, par 3. "...these noise measurements...are indicative of the level of noise levels that could be produced by project construction and operation." This makes no sense. Construction-related noises are generally more intense than those produced by normal day-to-day activities, so what is the basis for this statement?
6. One of the most bothersome issues is that in numerous places, key referenced papers did not say what was attributed to them. This is particularly acute in the underwater sound discussion, but also occurs elsewhere in the white paper and casts doubt on reliability of the entire document. These include Vagle (2003), Nedwell et al. (1993), Stadler (2007) (which was mischaracterized several times in different ways), Amoser and Ladich (2005), Popper and Fay (1973 and 1993), Chen et al. (1993), and Hastings et al. (1996). Other studies were applied in ways not warranted.
 7. Four of the white paper discuss the concept of lost opportunity with respect to projects that are the subject of the papers. It is not clear way that isn't discussed in this paper as there are lost opportunities associated with marinas and shipping/ferry terminals as well.
 8. The statement that incidental take must be avoided and/or minimized is incomplete and incorrect. Both the Endangered Species Act (Section 10(2)(B)(ii)) and the HCP Handbook state that conservation plans must minimize and mitigate affects to the maximum extent possible. Mitigation itself is a 3 step process that starts with avoidance of impacts, moves to minimizing impacts that could not be avoided, and finally requires appropriate compensation for any remaining unavoidable adverse affects. This (and the other) white paper emphasizes minimization measures with minimal attention to avoidance and virtually none to compensation for unavoidable impacts. For WDFW to be successful in its pursuit of a HCP for the HPA program it must clearly address avoidance, minimization and compensation.
 9. In 7.4.2.2 the statement that riparian buffers widths of 100 to 300 ft may be necessary to provide full ambient temperature regulation is confusing. What is being considered the ambient temperature...the temperature in the shade, on the beach, above the water, or in the water? The use of a blanket statement for buffers is misleading unless you provide some indication of the type, size, and density of the plant community you are considering. The study of Chen et al. cited here discusses temperature change in riparian areas in an old growth forest and is not very relevant to the topic of this white paper.

10. 7.6.3.1 inaccurately states that altered wave energy, current velocities, nearshore/littoral circulation, groundwater inputs, sediment supply and substrate composition, and others are processes that are unique to lacustrine systems. This is not true and the authors should present a holistic discussion of such processes, pointing out differences if and where they occur for riverine, lacustrine and marine systems.
11. In Section 9.1.1, par 7, the statement that “*Underwater construction noise associated with these facilities....resulting only in temporary disturbance*” is totally unsupported by the available data. Fish are known to have been killed, in Puget Sound, by piles as small as 24 inches, a size often used in marinas. Small piles can easily exceed the cumulative SEL threshold and must be considered, on a case-by-case basis.
12. This is the only one of the seven white papers that does not address the issue of ecosystem or habitat fragmentation. Marinas have potential to cause this effect as do the activities in the other 6 white papers.

8.0 Shoreline Modifications White Paper Comments

All reviewers' comments on the Shoreline Modifications white paper are found in Appendix I.

8.1 Global Comments

Global Comment 1 (definitions and word usage)

- “Activity” and “subactivity” are not defined, nor are what are being considered as activities and subactivities specifically listed. In 6.0, paragraph 3, is *found* “. . . the activity (e.g., jetty installation) typically varies significantly . . .” So jetty is here being considered an activity. Earlier in 6.0 one finds “Table 6-1 identifies the mechanisms of impact that are known to be associated with jetties, breakwaters, groins, and bank barbs.” One would then logically assume that these three structure types are the activities discussed in the paper. In 9.1, however, jetties, breakwaters, and groins and bank barbs are mentioned and then referenced as “*these three subactivity types.*” But it is not clear here if these are the only three subactivity types. In 9.2.2 these three are referenced as “*all three subactivity types,*” suggesting that they are the only three. But by the end of the paper, one still does not know if jetties, breakwaters, and groins and barbs are activities or subactivities, since they are called both in different places, and if there are others. Simple definition of the terms and listing of activities and subactivities would remove much confusion. As it is, much of the discussion of effects and risk of take is somewhat nebulous.
- “Ecosystem fragmentation” is not defined, nor is “habitat fragmentation,” the two terms being used interchangeably. It is not clear exactly what the authors consider these two terms to mean. In Table 6-1 ecosystem fragmentation is an impact mechanism. In the text, however, the discussion of habitat fragmentation is as an effect of shoreline changes and altered current velocity, shoreline s, hypsometry, temperature gradients, etc. In the subsection of ecosystem fragmentation entitled habitat loss and fragmentation (e.g., 7.1.1.6.1) it is often not clear whether the discussion is of habitat loss or habitat fragmentation. At times it appears that the authors consider them to be the same thing; but habitat loss is not necessarily habitat fragmentation.
- It is not clear what is considered “nearshore” and “offshore”.

Global Comment 4 (section 11)

- Sediment bypass (11.1) is a potential strategy for addressing some of the adverse impacts of jetties on longshore sediment transport – but such operations are complex and raise many environmental issues regarding the trapping, removal, and subsequent placement of sediment – none of which are even alluded to here.
- The proposal that jetties might be constructed with engineered logjams or other wood structures (11.1) is not substantiated. It is difficult to imagine this, even in fairly protected settings, let alone in the more energetic environments where

jetties would normally be constructed. The comparison to groins in riverine settings does not seem appropriate.

- “During passive fish removal, fish removal by seining is recommended before resorting to electrofishing...”. (11.4.3) Electrofishing and seining are not passive fish removal techniques.
- The notion that breakwater slopes should mimic natural beach slopes (11.2) does not make sense, at least in any conventional concept of a breakwater. Even if it did, such a recommendation would lead to structures with enormous footprints and the associated effects of that, as would the recommendation to avoid simple geometric designs.
- It is unfortunate that there is not more discussion of alternative breakwater designs (11.2), including floating structures and pile supported structures that allow circulation and fish passage below them, as has been used at Bell Harbor in Seattle.

Global Comment 8 (cumulative effects)

- Much of the discussion in the subsections of Section 8.0 is about direct or indirect effects rather than cumulative effects. For example, see 8.2 and 8.4. No thresholds are provided or discussed. The only reference to them is in Section 8.1 where it merely says that none have been established in the literature.

Global Comment 9 (data gaps)

- “*Nearly all of the modifications associated with shoreline development can be attributed to jetties*” (10.1.1) is unfounded. Jetties are used primarily for navigational channels and marinas, so how does this relate to other shoreline development, such as residential development?
- I don’t believe the three “data gaps” identified is either a good representation, or the best representation of data gaps. Nor does this list address data gaps specific to each of the stressors. There is a general lack of data quantifying the various impacts associated with jetties. (10.1.1)
- Even a list of specific data gaps would be helpful. (10.2)

8.2 Other Comments

1. Instructions to the authors from WDFW include: “*The white papers must also quantify, or otherwise characterize, the cumulative impacts of multiple projects of a single type and at what point cumulative impacts may reach the level of take.*” The discussion, however, is in terms of the cumulative effects of each of the mechanisms and/or submechanisms individually, not the suite of mechanisms or submechanisms associated with multiple projects of the same type. The section is organized by impact mechanism, not project type.

In this white paper, however, cumulative effects are discussed strictly by submechanism in 8.1, not the suite of effects of associated with a project type.

Much of the discussion in 8.2, 8.3, and 8.4, especially but elsewhere also, deals more with direct and indirect effects (especially 8.4) and does not explicitly deal with cumulative effects at.

There is no discussion about the point at which cumulative effects may reach the level of take--either in this section or in Section 9.0.

2. In the last paragraph of Section 6.0 is “Based on the identification of impacts and risk of take analysis, additional recommendations (e.g., conservation, management, protection, BMPs) for minimizing or mitigating project impacts or risk of take were developed and are presented in Section 11.” This indicates there will be a systematic analysis of impacts and risk of take and mitigation measures specifically recommended to address them. There is nothing in Section 11 that suggests that this occurred. The authors make no recommendations. They primarily simply list measures found in the literature for jetties, breakwaters, and groins and bank barbs as a whole—not for any specific impact of any of them.
3. An expert on effects of underwater sound on fish reviewed the pertinent sections of the Marinas and Shipping/Ferry terminals white paper and was very critical of treatment of the subject. All seven white papers use much of the same discussion of this topic. The expert’s review comments for the Marinas and Shipping/Ferry Terminals white paper are in **bold and underlined** per reviewer 5 in Appendix H. Similarly, an expert on noise reviewed section 7.10 of the Habitat Modifications white paper. His comments are in Times New Roman Type per Reviewer 1 in Appendix F. The comments of these two reviewers should be considered generally applicable to the discussion of this topic in this white paper. See also the discussion of sound impacts in Section 5.0 Habitat Modifications.
4. Lost opportunity is considered a submechanism of ecosystem fragmentation for the marine, lacustrine, and riverine environments Table 6-1). In the text, however, it is referenced as an impact (effect) of breakwaters, jetties, groins and bank barbs, not as an impact submechanism.

It is stated in 7.2.6.1.3 that:

“Lost-opportunity impacts result from projects that adversely alter natural nearshore processes important to the ongoing creation of fish and wildlife habitats.”

In 7.3.2.6.3, for riverine environments, the statement is altered to address “natural fluvial process” instead of nearshore processes. But in both cases, the authors go on to discuss that when the structure interferes with migration of fish and shellfish that this also constitutes lost opportunity, which does not fit with either statement

that lost opportunities result from impact to natural shoreline or fluvial processes. So they do not use their own definition.

5. The subject of Subsection 7.1.2.3 is riparian vegetation, yet much of the discussion deals with emergent vegetation, not riparian vegetation.
6. 7.1.2.6. The first sentence in 7.1.2.6 is that sockeye salmon are the HCP species primarily affected by shoreline development. Sockeye only occur in seven lakes in Washington and only a small percentage spawn on lakeshore areas. Given this and the plethora of HCP fish and shellfish species that are found in lakes and are more widely distributed throughout the state, the statement about sockeye salmon impact is suspect. This would more likely be true if restricted to those seven lakes where sockeye occur than as an overall statement.
7. Throughout this white paper work area dewatering in freshwater and marine areas are treated as if the activity and the effects are the same. While there are some similarities, there are also some significant differences, such as the volume of water to be dealt with, tidal action, and potential wave energy in marine environments. In addition, desiccation is a critical factor for most marine organisms, many of which are difficult, if not virtually impossible to remove without physical damage/mortality. Because of these differences, dewatering in many (if not most) marine settings is much more difficult, potentially leading to greater impacts. These differences need to be noted and addressed in the white paper.
8. There is a substantial amount of information on how altering vegetation affects hydrology, including filtering out sediments and chemical contaminants, soil stability, etc. Yet, the discussion of this in 7.1.1.3.4 is one paragraph of two sentences, a poor representation of the amount of information available on this topic and its importance.
9. Subsection 7.1.1.5 states that

“the buffering capacity of seawater is such that the impacts on pH from concrete placement and other leachable building materials are expected to be small...and are not addressed further in marine environments discussion.”

The authors cite an article to support this statement. In contradiction of this statement, however, there is extensive treatment of the subject in 7.1.1.5.5.

10. As the authors acknowledge, artificial reefs in Washington (and elsewhere) are generally placed in much deeper water and have different goals than the structures that are the subject of this paper. They need to establish the validity of using information from studies of artificial reefs as a surrogate for the

subject structures. They also need to acknowledge the concomitant permanent loss of productive benthic habitat.

11. Often the authors overlook some of the indirect effects of facilities and activities that will be associated with many of the subject structures. For example, a breakwater will likely support additional modifications such as the creation of a boat basin and/or other overwater structures and their activities, construction, maintenance, and operation.
12. The authors do not discuss the potential for vegetation disturbance or loss associated with access to and the installation and maintenance of jetties, groins, or barbs, many of which are likely to be installed from land.
13. Much of the data gaps discussion is too general to be of much value. For example in 10.1.2: *“Because there are few jetties in fresh water, and likely few to be constructed due to the relatively weak demand for them, information regarding any environmental impacts on HCP species stands as a data gap.”* This statement is fine as far as it goes, but what do the authors identify as the key or critical or most important information needed to fill this gap? The first sentence in Section 10.0 states that this will be identified. *“Also absent are studies of the differing degree of impacts from different types of common modifications that would be equivalent to a groin or barb.”* But just what is the specific information that is most needed?

Some of it deals not with data gaps, but what is known (and should have been included in Section 7.0)--for example, paragraph 1 of Subsection 10.2.1.

Post-review meeting participants generally agreed that the data gaps section was not comprehensive and did not very well represent the important data gaps.

One wonders why the authors did not systematically note and list specific data gaps as they discussed effects in Section 7.0. Rather it seems for the most part to list data gaps noted in the various studies consulted in preparation of this white paper—or perhaps something that happened to occur to them during the preparation of the white paper.

In 10.1.1, the statement that *“Nearly all of the modifications associated with shoreline development can be attributed to jetties”* is unsupported and not logical.

9.0 References

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