2022 Updated
Guidance for Prioritizing Salmonid Stocks, Issues, and Actions for the Hood Canal Coordinating Council

December 2022

Prepared for the

Hood Canal Coordinating Council

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Purpose and Approach

This report provides updated guidance about priorities for salmonid recovery actions for the Hood Canal Coordinating Council (HCCC) and its many salmon recovery partners. It updates the guidance developed for HCCC in 2015 (Lestelle 2015) by incorporating new information and results of several analyses done since then. The updated guidance considers priorities for the many salmonid stocks across the geographic region of interest, associated issues and threats, and potential actions for addressing them.

The purpose of this report is to provide guidance to the many entities engaged in recovery and restoration work in the region related to the salmonid populations that rely on the myriad aquatic habitats in the region. These populations include some listed as threatened with extinction under the federal Endangered Species Act (ESA), as well as others in decline. HCCC is the regional recovery organization for the ESA-listed Hood Canal summer chum evolutionarily significant unit (ESU). In that role, it convenes partners and experts to develop technical guidance, advance actionable science, and prioritize actions to implement the summer chum recovery plan (HCCC 2005). Through its Lead Entity Program, HCCC also advises on recovery actions within its region related to other salmonid species besides summer chum.

The geographic region encompassed by HCCC programs includes all of Hood Canal and the adjoining watersheds and part of the eastern Strait of Juan de Fuca and adjoining watersheds out to and including Discovery Bay watersheds. HCCC also has a role extending further west to include the Dungeness watershed as part of its oversight responsibility for the summer chum recovery plan (HCCC 2005). All of these areas are considered in this updated guidance.

A substantial amount of new information has been used to inform this updated assessment. This includes nine more years of adult summer chum spawners returning to the natal watersheds, two updated population viability analyses for the summer chum subpopulations, an updated EDT modeling analysis of the 14 major summer chum historical summer chum subpopulations, an updated Skokomish Chinook salmon recovery plan, miscellaneous communications, memoranda and reports on historical and current abundances and habitat conditions for different watersheds, and updated information on habitat restoration actions that have been implemented. New information from an assessment of the use of marine nearshore habitats by summer chum fry has also been incorporated.

This report also serves to inform an up-to-date assessment of the status of habitat-related threats to the recovery of the Hood Canal summer chum ESU. Habitat-related threats are those that threaten population viability due to the destruction, modification, or curtailment of a species' habitat or range. This prioritization report necessarily needed to consider the severity of the various habitat-related issues within each of the watersheds relevant to the various salmonid stocks, including summer chum. A key part of evaluating whether an ESU warrants delisting is having an up-to-date status of threats for the ESU.

The manner in which the results are presented here is meant to provide guidance in prioritizing project proposals. Such guidance would be considered in conjunction with other information that needs to be incorporated in a project selection process. Other information would include project feasibility, project scale, and cost effectiveness, among other considerations. Results are structured in this report in a way that anticipates how they would be applied in a project selection process.

That process should be driven in a substantial way by asking three questions about a proposed project:

1. What is the priority level of the highest priority salmonid stock that would benefit from the proposed project?
2. What is the relative importance of the issue (or the priority of that issue) affecting the performance of the stock that a proposed project aims to positively affect by its implementation?
3. What is the relative importance of the action corresponding to a proposed project in its potential for redressing the targeted issue that affects the stock of interest?

The results presented in this report address each of these questions in a way that informs project proponents and the process to be used in ranking project proposals. While the logic of the progression in these questions should be evident, high priority scores on a proposed project for each question do not necessarily constitute a good project that should be advanced for funding. The merits of a proposed project need to be fully evaluated with criteria as mentioned above through the entire selection process.

It should be noted that action prioritization as presented herein fully recognizes the importance of protection (conservation) actions in salmon recovery efforts. Protection prevents future degradation while restoration remediates historical degradation. Without adequate protection measures, the effectiveness of our restoration actions can be jeopardized. Broad consensus exists that recovery efforts must integrate both protection and restoration actions. The term “restoration actions” is often used in this document in a general sense, meaning that both protection and restoration actions are being recognized.

It needs to also be recognized that assessments are an important part of recovery planning that can affect the priorities given to various restoration actions, and in some cases, to the priorities assigned to specific stocks. For this reason, some of the issues and related actions identified here are aimed at certain types of assessments. Assessments, therefore, are a valid type of restoration action, as applied herein. Specific assessments have been identified in the document—others may need to be added.

It is important to note that prioritization related to the marine nearshore environment was treated differently than it was for freshwater and natal estuarine habitats.[1] The approach applied to the marine nearshore areas does not incorporate stock-specific information due to the level of uncertainties that exist about how the different species and their many stocks are using these areas. Instead, information presented in Cereghino et al. (2012) was applied in prioritizing marine nearshore areas within the region

[1] / Freshwater habitats within a single watershed along with the stream-mouth estuary for that watershed are considered to be the natal habitats for the stocks of fish produced in that watershed, hence the importance of what can be called the natal habitats can be addressed specifically for those stocks. Other stream-mouth estuaries, i.e., those associated with other watersheds, and the entirety of the marine environment, including its nearshore, are considered to be non-natal habitats in this document. These are habitat areas used by a large mixture of fish that originate from many watersheds.

of interest to this document. Moreover, no attempt was made to prioritize between issues related to the marine nearshore and those related to freshwater and natal stream-mouth estuaries. The marine nearshore environment of the region is vitally important to all of the salmonid stocks of interest here, as are the streams and natal estuaries for the many stocks considered in this document. Treatment of the nearshore areas, therefore, deserves separate consideration.

It is noted that the fundamental approach applied in this updated version of prioritization is unchanged from the one used in 2015 with the exception that the salmonid stock prioritization is based solely on the evaluation of the author for reasons explained.

Within the watersheds and the associated natal stream-mouth estuaries, the approach is composed of three primary steps. First, all of the salmonid stocks produced in the streams within the region of interest to HCCC were identified and prioritized using a set of prioritization criteria (Section 4.0).

Second, the issues that are affecting these stocks—and that are also potentially relevant to how HCCC views prioritization and salmon recovery—were identified and described with regard to their relative importance to the stocks (Section 5.0). The relative importance of the issues was defined by how an issue is expected to affect recovery, sustainability, or some aspect of stock performance related to ecological services provided by each stock—including economic and cultural values.

The third step consisted of identifying actions that can potentially be applied to ameliorate or eliminate the effects of the issues on the stocks (Section 5.0). Each action was also described by how applicable, or important, it potentially could be in addressing the effects of the issues for each stock.

The stock priorities and the relative importance of the issues and actions to the stocks are the means for providing guidance on prioritization for prospective projects. Each of the three steps is described — specifics about criteria used in scoring and other details are given in the report sections.

The prioritization process begins with the assignment of priorities to the various stocks of interest. Modern restoration practices aim to restore physical or ecological processes within the environment that form or influence habitats, food webs, species life histories, and ultimately the performance of the biota. However, within this context, managers and recovery planners also focus efforts in a manner that take into account how we understand—or hypothesize—that certain actions are likely to affect specific fish population units (i.e., stocks as applied herein) most valued by society.

This doesn’t mean that some fish stocks are devalued in an ecological sense. It means that resources for actions are usually prioritized in ways that take into account societal values—such as ESA listings, ecological interactions of different kinds, or economic or cultural values derived by groups of people. The reality is that resources to restore (and protect) habitats are limited and decisions need to be made about how to allocate those resources. Priorities, however they are set, are used in the decision-making process.

Prioritization of Stocks

All of the salmonid stocks produced in the region of interest were identified. A stock was defined as a species (and run-type if applicable) produced in an independent watershed draining to the marine environment of interest in this document. Including all species, a total of 390 separate stocks was identified. A set of criteria for prioritization, accounting for different societal values, was formulated with each criterion on a 0-4 integer scale for each stock.

Issue and Action Framework

The second and third steps identified above for the overall prioritization procedure were encompassed into a framework used to document the rationale for various actions. It is referred to as the issue and action framework, as it links the issues to specific actions intended to remediate the effects of the issues. Thus, the framework serves to explicitly identify the logic chain for why certain actions are believed to be important for recovery or restoration (Figure 1). It also identifies the objectives—or hypotheses—associated with the actions, as well as critical uncertainties that should be recognized and sources of information used in assembling the issues and actions.

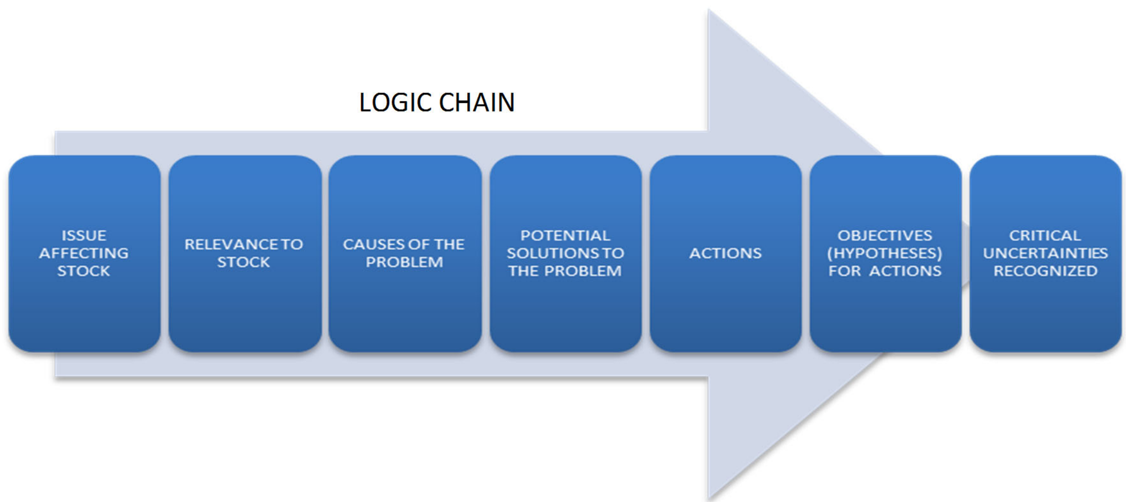

Figure 1. Logic chain captured in the issue and action framework.

Many of the primary sources of information for identifying the issues, and considering how they apply to the various watersheds, stream-mouth estuaries, and the stocks, were the watershed-specific limiting factors reports (Washington State Conservation Commission reports), recovery plans for the region, an assessment of historical changes to estuaries and other shoreforms, and aerial imagery. A variety of other watershed and species-specific reports was also employed, including three analyses on the performance status and viability of the populations and subpopulations (stocks) that comprise the Hood Canal summer chum ESU. Other key information included multiple EDT modeling analyses done over a period of years that spanned 2004 to 2022 on all of the larger rivers and streams and their stocks in the region.

Information from a recently completed report on the status and background of the Mid-Hood Canal Chinook population was also incorporated (Meridian Environmental and Mid-Hood Canal Work Group 2022). In addition, telephone and in-person interviews were made with knowledgeable individuals from across the region about specific watersheds, estuaries, and nearshore areas to gather more up-to-date information on issues believed to be affecting the stocks and the effectiveness of recovery efforts.

Once all of the issues and associated potential actions were identified and described, the task then turned to scoring each issue and action relative to each stock of interest. This was done for all stocks that had been identified except for cutthroat trout. A total of 279 stocks was used in the prioritization process here.

Issues and actions were scored by assigning a 0-4 integer score, where a value of 0 means that the issue (or action) is not applicable to the stock (or has negligible influence), whereas a score of 4 indicates very high importance or applicability. A value of 1 means low importance, a 2 means medium importance, and a 3 means high importance. Greater uncertainty in how an issue or action was regarded produced a lower score. Where compelling reasons exist that an issue is substantially affecting a watershed (and therefore a stock), I generally assigned a high score (3). Similarly, an action was scored high if compelling reasons exist that the action would substantially remediate an issue. The highest value possible (4) was assigned if compelling reasons exist that the importance of the issue, or action, is especially high, warranting special attention.

Scoring was accomplished by reviewing the various documents mentioned above (listed under sources of information in the framework tables), then drawing an informed conclusion about the relative importance of the issue or action to the stock.

Results

Results of stock prioritization are displayed visually in figures (top 80 stocks, followed by the stocks in the top two ranked groups). Tabular results are also given.

The top ten ranked stocks were:

- Skokomish River summer chum
- Salmon Creek summer chum
- Snow Creek summer chum
- Big Quilcene River summer chum
- Hamma Hamma River summer chum
- Skokomish River spring Chinook
- Dewatto River summer chum
- Dosewallips River summer chum
- Duckabush River summer chum
- Union River summer chum

The issue and action framework is presented in two parts due to its size. Table 3, which continues for multiple pages, describes the issues that were identified and related potential actions that could be taken to ameliorate or eliminate the effects of the issues on relevant stocks. Intermediate components in the logic chain presented in the framework (relevance to salmonids, causes, and solutions) are also listed or described. The issues are arranged into four groups and presented in order: (1) issues affecting freshwater habitats, (2) issues affecting natal estuaries, (3) issues affecting non-natal estuaries and the nearshore habitats, and (4) issues pertaining to the need for some type of assessment. The group into which the issue falls is listed in the upper left corner of the page where the issue begins.

The second part of the framework, which is given in Appendix B, provides the objectives (or hypotheses), uncertainties, and information sources for the issues and actions.

It is important to note that many of the issues are closely related, having similar causes and similar or, in many cases, the same solutions. Thus, some actions can be directed at several issues.

Almost all of the issues that do not pertain to assessments apply to many stocks, though to different degrees. Most of the assessment-related issues, in contrast, pertain to just a few stocks or even to a single stock.

It is noted that the framework lists issues and related actions for the marine nearshore environment, but neither the issues nor actions are scored in Sections 5.2 and 5.3. As discussed under the Approach (Section 3.0), prioritization for the nearshore is based on information contained in Cereghino et al. (2012); Section 6.0 describes how that information is applied.

2022 Updated Guidance for Prioritizing Salmonid Stocks, Issues, and Actions for the Hood Canal Coordinating Council

1.0 Introduction

This report provides updated guidance about priorities for salmonid recovery actions for the Hood Canal Coordinating Council (HCCC) and its many salmon recovery partners. It updates the guidance developed for HCCC in 2015 (Lestelle 2015) by incorporating new information and results of several analyses done since then. The updated guidance considers priorities for the many salmonid stocks across the geographic region of interest, associated issues and threats, and potential actions for addressing them.

The purpose of this report is to provide guidance to the many entities engaged in recovery and restoration work in the region related to the salmonid populations that rely on the myriad aquatic habitats in the region. These populations include some listed as threatened with extinction under the federal Endangered Species Act (ESA), as well as others in decline. HCCC is the regional recovery organization for the ESA-listed Hood Canal summer chum evolutionarily significant unit (ESU). In that role, it convenes partners and experts to develop technical guidance, advance actionable science, and prioritize actions to implement the summer chum recovery plan (HCCC 2005). Through its Lead Entity Program, HCCC also advises on recovery actions within its region related to other salmonid species besides summer chum.

The geographic region encompassed by HCCC programs includes all of Hood Canal and the adjoining watersheds and part of the eastern Strait of Juan de Fuca (SJDF) and adjoining watersheds out to and including Discovery Bay watersheds. HCCC also has a role extending further west to include the Dungeness watershed as part of its oversight responsibility for the summer chum recovery plan (HCCC 2005). All of these areas are considered in this updated guidance.

A substantial amount of new information has been used to inform this updated assessment. This includes nine more years of adult summer chum spawners returning to the natal watersheds, two updated population viability analyses for the summer chum subpopulations (Lestelle et al. 2018; Lestelle 2020), an updated EDT modeling analysis of the 14 major summer chum historical summer chum subpopulations (ICF and Biostream Environmental 2022), an updated Skokomish Chinook salmon recovery plan (SIT and WDFW 2017), miscellaneous communications, memoranda and reports on historical and current abundances and habitat conditions for different watersheds, and updated information on habitat restoration actions that have been implemented. New information from an assessment of the use of marine nearshore habitats by summer chum fry has also been incorporated.

This report also serves to inform an up-to-date assessment of the status of habitat-related threats to the recovery of the Hood Canal summer chum ESU. Habitat-related threats are those that threaten population viability due to the destruction, modification, or curtailment of a species' habitat or range. This prioritization report necessarily needed to consider the severity of the various habitat-related issues within each of the watersheds relevant to the various salmonid stocks, including summer chum. A key part of evaluating whether an ESU warrants delisting is having an up-to-date status of threats for the ESU.

Some definition of terms used in this report is needed with regard to the words “action”, “project”, and “strategy.” Throughout this document, the word “action” is meant as a type of activity that could be implemented for the purpose of ameliorating or eliminating the negative effects of an issue (or threat) on one or more salmonid stock(s) of interest. For example, riparian restoration is a type of action, intended to redress the effects of the degradation of the riparian zone resulting from logging or land conversion to other uses besides supporting native vegetation. This particular action might consist of one or more specific activities that could be implemented, such as replanting with native vegetation, removal of invasive vegetation, or other riparian silviculture practices. Use of the word “action” herein closely aligns with its use in an early PSNERP document[2] (Clancy et al. 2009).

The word “project”, in contrast, is always meant in this document to represent a specifically designed activity implemented to achieve the basic intent of one or more actions (as identified herein)—as such a project can normally be defined as an action employed over a given footprint, perhaps over a specific timeframe, to achieve a specific outcome. A riparian restoration project, for example, might be to replant with native vegetation the riparian corridor along a specified length of stream at a given location on that stream. Projects are those activities actually implemented in space and time. This document does not prioritize projects.

The word “strategy” has been used in the salmon literature in different ways, sometimes applied in the manner that “action” is used herein (as in SIT and WDFW 2010), and sometimes more broadly to represent an entire collection of actions or even projects, implemented with a particular philosophy or underlying theme to how restoration is being approached (as in Cereghino et al. 2012). Consequently, its use henceforth is avoided herein.

The manner in which the results are presented here is meant to provide guidance in prioritizing project proposals. Such guidance would be considered in conjunction with other information that needs to be incorporated in a project selection process. Other information would include project feasibility, project scale, and cost effectiveness, among other considerations. Results are structured in this report in a way that anticipates how they would be applied in a project selection process.

That process should be driven in a substantial way by asking three questions about a proposed project:

1. What is the priority level of the highest priority salmonid stock that would benefit from the proposed project?
2. What is the relative importance of the issue (or the priority of that issue) affecting the performance of the stock that a proposed project aims to positively affect by its implementation?

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[2] / PSNERP is the acronym for the Puget Sound Ecosystem Restoration Project, a multi-agency study that supported the U.S. Army Corps of Engineers’ General Investigation (GI) that evaluated problems and potential solutions of ecosystem degradation and habitat loss within Puget Sound and its estuarine and nearshore environs. It is noted that more recent PSNERP documents (e.g., Cereghino et al. 2012) use the terms “action” and “project” synonymously, with their meaning more closely aligned with how Clancy et al. (2009) used the term “project.” Clancy et al. (2009) applied the term “action” synonymously with the term “management measure”, which is how those terms are used herein.

3. What is the relative importance of the action corresponding to a proposed project in its potential for redressing the targeted issue that affects the stock of interest?

The results presented in this report address each of these questions in a way that informs project proponents and the process to be used in ranking project proposals. While the logic of the progression in these questions should be evident, high priority scores on a proposed project for each question do not necessarily constitute a good project that should be advanced for funding. The merits of a proposed project need to be fully evaluated with criteria as mentioned above through the entire selection process.

It should be noted that action prioritization as presented herein fully recognizes the importance of protection (conservation) actions in salmon recovery efforts. Protection prevents future degradation while restoration remediates historical degradation. Without adequate protection measures, the effectiveness of our restoration actions can be jeopardized. Broad consensus exists that recovery efforts must integrate both protection and restoration actions (Goetz et al. 2004; Greiner 2010; Cereghino et al. 2012). The term "restoration actions" is often used in this document in a general sense, meaning that both protection and restoration actions are being recognized.

It needs to also be recognized that assessments are an important part of recovery planning that can affect the priorities given to various restoration actions, and in some cases, to the priorities assigned to specific stocks. For this reason, some of the issues and related actions identified here are aimed at certain types of assessments. Assessments, therefore, are a valid type of restoration action, as applied herein. Specific assessments have been identified in the document—others may need to be added.

It is important to note that prioritization related to the marine nearshore environment was treated differently than it was for freshwater and natal estuarine habitats.[3] The approach applied to the marine nearshore areas does not incorporate stock-specific information due to the level of uncertainties that exist about how the different species and their many stocks are using these areas. Instead, information presented in Cereghino et al. (2012) was applied in prioritizing marine nearshore areas within the region of interest to this document. Moreover, no attempt was made to prioritize between issues related to the marine nearshore and those related to freshwater and natal stream-mouth estuaries. The marine nearshore environment of the region is vitally important to all of the salmonid stocks of interest here, as are the streams and natal estuaries for the many stocks considered in this document. Treatment of the nearshore areas, therefore, deserves separate consideration.

This document is organized into seven sections:

1. Introduction;
2. Goals;

[3] / Freshwater habitats within a single watershed along with the stream-mouth estuary for that watershed are considered to be the natal habitats for the stocks of fish produced in that watershed, hence the importance of what can be called the natal habitats can be addressed specifically for those stocks. Other stream-mouth estuaries, i.e., those associated with other watersheds, and the entirety of the marine environment, including its nearshore, are considered to be non-natal habitats in this document. These are habitat areas used by a large mixture of fish that originate from many watersheds.

3. Approach;
4. Stock Prioritization;
5. Issue and Action Framework;
6. Prioritization of Nearshore Habitat Areas; and
7. Final Comments and Application.

2.0 Goals

It is useful to identify a general set of goals here to distinguish the purpose of different types of actions. The goals recognize that salmon restoration efforts occur within a setting that has been extensively modified by man. The aim of restoration is not to restore conditions to the way they were prior to the arrival of Euro-Americans.

The terms "normative processes" and "normative function" are incorporated into this document to mean an altered system that has a balanced mix of natural and cultural features such that indigenous life histories of salmon populations can be supported at a productive level. Liss et al. (2006) described the normative ecosystem within a salmon recovery context as follows:

> "*We need a view of an ecosystem as a dynamic mix of natural and cultural features that typify modern society, but that can still sustain all life stages of a diverse and productive suite of salmonid populations if the essential ecological conditions and processes necessary to maintain the populations still exist within the ecosystem. We call this ecosystem, with its balanced mix of natural and cultural features, a 'normative' ecosystem*."

The essential element of what constitutes "normative" in this context is that the level of restored ecosystem processes and functions must be able to support and sustain productive salmon life histories that can provide both ecologically and culturally derived values.

Goals and sub-goals for restoring, protecting, and enhancing habitat conditions for the purpose of recovering salmonid species are stated below. Three goal statements are presented, one each for restoration, protection, and enhancement[4]. A fourth goal is also presented, which operates in conjunction with the other three—it recognizes that we need to improve our understanding of how salmon systems function and what the essential needs are to achieve sustainable recovery.

1. Restore normative ecological processes and functions of the region's watersheds and nearshore features associated with all of their aquatic habitats that directly or indirectly support salmonid species.

[4] / The term "enhance" is used in this document to mean the enhancement of habitat in a way that did not exist in the natural state of the watershed, as it was applied in PSNERP (see Cereghino et al. 2012, pages 54-57). It should be recognized that with the prospects of significant adverse effects of climate change on the horizon that there may need to be some form of a combination of restoration with enhancement in some situations to address some needs. The rationale for enhancement as described here is explained in Section 3.0.

   a. Restore upland landscapes, including rates of sediment delivery, land cover structure, and vegetation species composition, to support normative watershed processes, functions, and forms.
   b. Restore floodplain functions and normative patterns of connectivity and channel switching within river corridors.
   c. Restore normative fluvial geomorphic processes through the channel corridors to restore channel form and function and normative sediment processing patterns.
   d. Restore normative flow regimes to the region’s watersheds, especially in regards to rates of runoff and intermediate flood peaks.
   e. Restore accessibility of native salmonids to their historic ranges of habitat use in the region’s watersheds.
   f. Restore normative levels of nutrient loading, particularly associated with marine-derived nutrients, within the region’s watersheds.
   g. Restore estuarine and nearshore processes and habitats.

2. Protect ecological processes and functions of the region’s watersheds and nearshore features associated with all of their aquatic habitats that directly or indirectly support salmonid species.
   a. Protect floodplain corridors from further loss of connectivity between mainstem rivers and their overflow channels, side channels, and off-channels.
   b. Protect riparian corridors from further degradation by safeguarding native vegetation species, riparian forest age, and riparian forest structure.
   c. Protect water quality from further degradation from non-point and point pollution sources.
   d. Protect from further loss aquatic habitat structure, including wood structure, edge structure, and the distribution and composition of habitat types.
   e. Protect from further degradation the structural elements that contribute to nearshore habitat forming processes and associated key habitats.

3. Enhance habitat functions as needed within the region’s watersheds and nearshore features to facilitate recovery and/or safeguarding of salmonid life histories for maintaining or strengthening stock productivity, abundance, diversity, and spatial structure.
   a. Improve accessibility to off-channel habitats that have high natural inter-annual variability in accessibility, while protecting native wildlife species and abundance.
   b. Improve accessibility to habitats where the effects of climate change (such as a change in flow regime) may hinder salmonid stocks from assessing their historic range (as suspected on the South Fork Skokomish River; see SIT and WDFW 2017) (also, see recognition that such enhancement may need to be incorporated as described in Cereghino et al. 2012).

c. Provide for enhanced features in situations where degradation due to societal effects are particularly severe, as in the placement of the high dams on the North Fork Skokomish River—in that case with the implementation of various provisions of the Cushman Settlement (also, see discussion in Cereghino et al. 2012, pages 54-57).

d. Enhance key habitat functions in areas where severe habitat degradation has occurred, particularly if in the absence of such enhancement life histories would be imperiled such that recovery would become more difficult.

4. Promote improved understanding of the stocks and their habitats, and facilitate the resolution of certain issues that may hinder progress in recovery.

   a. Assess conditions of stocks or habitats where high uncertainty exists about key factors that may be affecting stock recovery.

   b. Facilitate the resolution of specific issues that constrain progress in recovery planning.

3.0 Approach

This section describes the overall approach taken to prioritization. Some details of the approach, together with results, are presented in separate sections that follow this one. Procedures applied for prioritization in the watersheds and associated natal estuaries differ from what is used in the marine nearshore area. For the nearshore, results of strategic planning from the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) are proposed; that approach is summarized at the end of this section.

It is noted that the fundamental approach applied in this updated version of prioritization is unchanged from the one used in 2015 with the exception that the salmonid stock prioritization is based solely on the evaluation of the author, as explained below.

Within the watersheds and the associated natal stream-mouth estuaries, the approach is composed of three primary steps. First, all of the salmonid stocks produced in the streams within the region of interest to HCCC were identified and prioritized using a set of prioritization criteria (Section 4.0).

Second, the issues that are affecting these stocks—and that are also potentially relevant to how HCCC views prioritization and salmon recovery—were identified and described with regard to their relative importance to the stocks (Section 5.0). The relative importance of the issues was defined by how an issue is expected to affect recovery, sustainability, or some aspect of stock performance related to ecological services provided by each stock—including economic and cultural values.

The third step consisted of identifying actions that can potentially be applied to ameliorate or eliminate the effects of the issues on the stocks (Section 5.0). Each action was also described by how applicable, or important, it potentially could be in addressing the effects of the issues for each stock.

The stock priorities and the relative importance of the issues and actions to the stocks are the means for providing guidance on prioritization for prospective projects. Each of the three steps is described briefly below—specifics about criteria used in scoring and other details are given in the report sections that follow this one.

The prioritization process begins with the assignment of priorities to the various stocks of interest. Modern restoration practices aim to restore physical or ecological processes within the environment that form or influence habitats, food webs, species life histories, and ultimately the performance of the biota (Mobrand et al. 1997; Beechie et al. 2003). However, within this context, managers and recovery planners also focus efforts in a manner that take into account how we understand—or hypothesize—that certain actions are likely to affect specific fish population units (i.e., stocks as applied herein) most valued by society.

This doesn't mean that some fish stocks are devalued in an ecological sense. It means that resources for actions are usually prioritized in ways that take into account societal values—such as ESA listings, ecological interactions of different kinds, or economic or cultural values derived by groups of people. The reality is that resources to restore (and protect) habitats are limited and decisions need to be made about how to allocate those resources. Priorities, however they are set, are used in the decision-making process.

All of the salmonid stocks produced in the region of interest were identified. A stock was defined as a species (and run-type if applicable) produced in an independent watershed draining to the marine environment of interest in this document. Including all species, a total of 390 separate stocks was identified. A set of criteria for prioritization, accounting for different societal values, was formulated with each criterion to be scored on a 0-4 integer scale for each stock.

The stock prioritization applied in the 2015 version of this report was done in January 2014 by two biologists, both of whom had extensive knowledge of the various fish populations in the region. One of the biologists authored the 2015 report and remains the author of this updated version. The second biologist was Thom Johnson, who had a long career working in the region, both for Washington Department of Fish and Wildlife (WDFW) and Point No Point Treaty Council (PNPTC). Mr. Johnson has since retired and was unavailable to participate in the updated prioritization.

Consequently, my updated stock prioritization is the one applied in this report. Substantial new information was available to be applied for this update. I note, however, that I incorporated facets of Mr. Johnson's original prioritization where I found them particularly insightful. But it bears noting that the differences in the earlier prioritization results between Mr. Johnson's and my own were relatively minor, as described in Lestelle (2015).

The second and third steps identified above for the overall prioritization procedure were encompassed into a framework used to document the rationale for various actions. It is referred to as the issue and action framework, as it links the issues to specific actions intended to remediate the effects of the issues. Thus, the framework serves to explicitly identify the logic chain for why certain actions are believed to be important for recovery or restoration (Figure 1). It also identifies the objectives—or hypotheses—associated with the actions, as well as critical uncertainties that should be recognized and sources of information used in assembling the issues and actions.

Many of the primary sources of information for identifying the issues, and considering how they apply to the various watersheds, stream-mouth estuaries, and the stocks, were the watershed-specific limiting factors reports (Washington State Conservation Commission reports), recovery plans for the region (HCCC 2005; SIT and WDFW 2010 and 2017), the assessment of historical changes to estuaries and other shoreforms (Todd et al. 2006), and aerial imagery (Google Earth). A variety of other watershed and species-specific reports was also employed, including my own work authoring or co-authoring three analyses on the performance status and viability of the populations and subpopulations (stocks) that comprise the Hood Canal summer chum ESU (Lestelle et al. 2014 and 2018; Lestelle 2020). Other key information included multiple EDT modeling analyses done over a period of years that spanned 2004 to 2022 on all of the larger rivers and streams and their stocks in the region (Lestelle et al. 2005a and 2005b; Thompson et al. 2009; SIT and WDFW 2010; ICF and Biostream Environmental 2022). Information from a recently completed report on the status and background of the Mid-Hood Canal Chinook population was also incorporated (Meridian Environmental and Mid-Hood Canal Work Group 2022). In addition, telephone and in-person interviews were made with knowledgeable individuals from across the region about specific watersheds, estuaries, and nearshore areas to gather more up-to-date information on issues believed to be affecting the stocks and the effectiveness of recovery efforts.

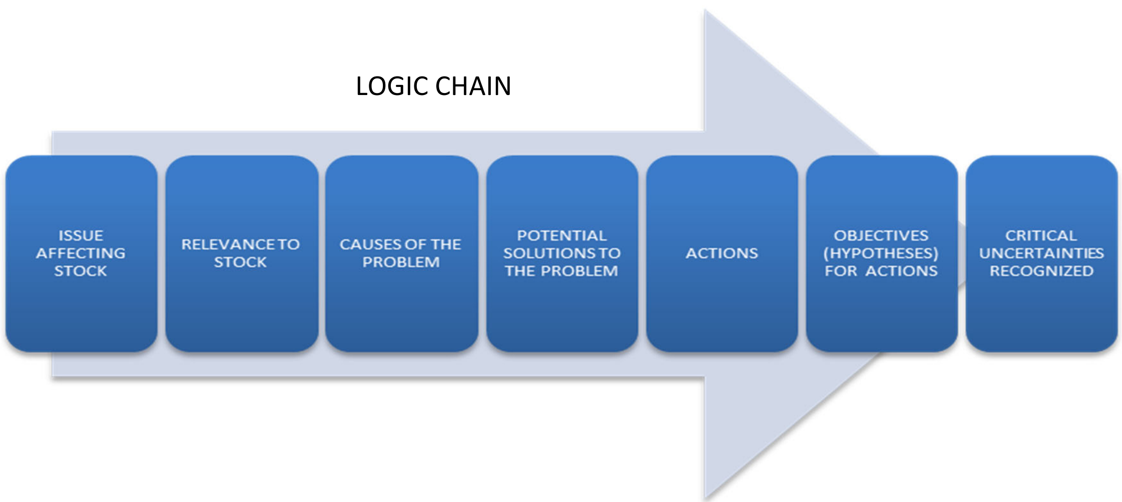

Figure 1. Logic chain captured in the issue and action framework.

Once all of the issues and associated potential actions were identified and described, the task then turned to scoring each issue and action relative to each stock of interest. This was done for all stocks that had been identified except for cutthroat trout. A total of 279 stocks was used in the prioritization process here.

Issues and actions were scored in the same manner by assigning a 0-4 integer score, where a value of 0 means that the issue or action is not applicable to the stock (or has negligible influence), whereas a score of 4 indicates very high importance or applicability. A value of 1 means low importance, a 2 means medium importance, and a 3 means high importance. Greater uncertainty in how an issue or action was regarded produced a lower score. Where compelling reasons exist that an issue is substantially affecting a watershed (and therefore a stock), I generally assigned a high score (3). Similarly, an action was scored high if compelling reasons exist that the action would substantially remediate an issue. The highest value possible (4) was assigned if compelling reasons exist that the importance of the issue or action is especially high, warranting special attention.

Scoring was accomplished by reviewing the various documents mentioned above (listed under sources of information in the framework tables), then drawing an informed conclusion about the relative importance of the issue or action to the stock.

Many issues and actions were given the same score for different species produced in the same watershed, but not for all issues and actions. Some differences are expected to exist between species or run-types, even given the coarse scale that scoring of issues and actions was done at. An example of a clear difference that I assume exists in how an issue would affect the two run-types of the same species (e.g., fall and summer chum) is seen in how I scored the importance of the flow regime issue in the Big Quilcene River. A water withdrawal in this river by the City of Port Townsend (taken upstream of the anadromous zone in the river) could be expected to impact the low flow characteristics of the river to some extent. Because of the different river-entry timing of the two chum run-types, with summer chum primarily entering the river when flows are lowest, the impact of the water withdrawal should be greatest on summer chum. The water diversion likely has little or no effect on spawning effectiveness of fall chum, which enter the river and spawn when flows are typically much higher.

The approach applied to prioritize restoration efforts within the marine nearshore area of the region differs from what was described above for use in the watersheds and, to a large extent, within associated natal estuaries. The nearshore area of primary interest to HCCC, stretching from the Union River in southern Hood Canal to the mouth of the Dungeness River, is part of the vast Puget Sound estuarine complex. While the region of interest to this document is somewhat less diverse in physical and biological characteristics than the entirety of Puget Sound, it nonetheless encompasses an exceedingly large and complex ecosystem.

Much greater uncertainty exists about how the many salmonid stocks of interest to HCCC use the marine area and its nearshore zone compared to their use of freshwater habitats within the natal watersheds. Various studies done through the years, dating back to the 1970s (e.g., Salo et al. 1980; Simenstad et al. 1980), have shed some light on how the Hood Canal nearshore system is used by juvenile salmonids, including several conducted more recently (e.g., Greene et al. 2012; Daubenberger et al. 2013; Fletcher et al. 2013; Daubenberger et al. 2017; Tuohy et al. 2019). Questions about the relative importance of the many nearshore habitats remain, however.

It bears noting that while a relatively good understanding exists about the general importance of stream-mouth estuaries to each of the salmonid species in focus herein (e.g., Simenstad et al. 1982), including by summer chum (Lestelle et al. 2005), information reported by Tuohy et al. (2019) seems to conflict with patterns of summer chum production observed in recent years within Hood Canal and the SJDF. Tuohy et al. (2019) suggests that river mouth delta habitats are not used to much extent by summer chum juveniles within the mid-Hood Canal region and that the juveniles instead seem to rely more on certain features of the nearshore environment more distant from the natal stream delta-related habitats. However, patterns of summer chum production in the region in recent years provide strong evidence that natal stream-mouth estuaries that have been extensively restored are supplying significant benefits to summer chum performance—supporting a view that the natal stream-mouth estuaries, including delta-related habitats, are key habitats to the recovery of the species. Tuohy et al. (2019) recognized that uncertainties existed in their study.

For these reasons, I have identified in this document an on-going need to perform additional assessment work within the marine nearshore, including within stream-mouth estuaries and related delta-habitats of the region. This need is listed as an issue under assessments relevant to recovery planning for the various stocks in Section 5.0.

Despite these uncertainties, significant information exists for assigning some degree of prioritization to the many marine shoreline features in the region by drawing on extensive work done through PSNERP. PSNERP's mission was to support an Army Corps of Engineers' (ACOE) General Investigation (GI) to evaluate problems and potential solutions of ecosystem degradation and habitat loss within the Puget Sound complex. PSNERP's central task was to assess conditions within Puget Sound, formulate an approach to restoring (to some extent) its ecosystem, and recommend restoration projects for selection as part of a plan that the ACOE intended to submit to Congress for funding. A plan was subsequently submitted to Congress in 2016. That plan gave a high priority—in fact, the highest within the Puget Sound complex—to restoration of the Duckabush river-mouth estuary (https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp).

In carrying out its mission, PSNERP developed extensive information about the shorelines and shoreforms for the entirety of Puget Sound, including all of Hood Canal and the SJDF.[5] Most significantly, PSNERP formulated a strategic approach for restoring (to some extent) the physiographic processes within an adaptive management framework for the Puget Sound ecosystem (described in Cereghino et al. 2012). These processes, where they still adequately function (i.e., where they have not been so severely degraded by shoreline armoring and shoreline filling, among other activities), serve to form, shape, and maintain the diversity of nearshore habitats used by salmonids, as well as in supporting their food webs.

PSNERP's approach recognized that all nearshore shorelines could be classified into four different kinds of features: river deltas, beaches, barrier embayments, and coastal (or shoreline) inlets. These four distinct types of features are maintained by natural processes and function in different ways on the landscape. Each sustains a unique set of ecosystem services. Moreover, each has been subjected to distinct patterns of human settlement, modification, and use.

PSNERP identified individual landscape sites, identifiable by specific landscape process-based characteristics, within each of the four kinds of features along the shorelines. The numbers of specific sites enumerated within Hood Canal for each type of feature, as well as the total number in Puget Sound, are listed below:[6]

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[5] / The extensive library of PSNERP information can be found at https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/technical-resources

[6] / Cereghino et al. (2012) provides the breakout of sites for the four types of shoreline features for each Puget Sound subbasin, of which Hood Canal is one and the SJDF is another. I only show here the number of shoreline sites for Hood Canal and not for the rest of the area of interest to this report outside Hood Canal—the numbers of shoreline sites outside Hood Canal were not readily available to be listed here.

Kind of shoreline feature	No. of sites in Hood Canal	No. of sites in Puget Sound
Major delta	5	16
Beaches	72	744
Barrier embayments	64	518
Coastal inlets	23	266

For each site within each kind of shoreline feature, PSNERP assessed what it called "site potential" based on the size and complexity of the site under the premise that the larger and more complex sites would have a greater potential for delivering ecosystem services. A site's potential was assumed to remain latent in the geomorphology of a site, and potentially would be restorable despite degradation, given sufficient will and resources. PSNERP's analysis of site potential was used to bin the range of values into groups—from low to high site potential. This was done for the entirety of the Puget Sound complex.

PSNERP then assessed the level of degradation for each landscape site and used this to classify each site into one of three types of recommended action for the purpose of strategic restoration planning. Sites that are least degraded are recommended as candidates for protection (i.e., where no actual restoration work is needed). Sites that have only been moderately degraded would be candidates for some type of restoration work—these are sites where typically the greatest opportunities would exist to regain resilient and self-sustaining ecosystem services through restoration. In contrast, attempts to restore sites that are severely degraded would typically be very costly and face higher risk of failure—these sites would be candidates for what PSNERP called enhancement actions. Enhancement actions would not be aimed at restoring physical processes because key processes are so severely degraded there. Instead, some types of actions might be needed at these sites to enhance certain critical habitat functions (such as to assist migrating salmon) or to alleviate urbanization effects (such as stormwater pollution). In particular, PSNERP recognized that enhancement actions might be needed to increase overall ecosystem resilience to potential future climate change impacts.

The results of identifying all landscape sites by their site potential, then by their level of degradation, were used by PSNERP to assign each site to one of six different categories. Each category identifies the general type of recommended action (protection, restoration, or enhancement) and an initial priority level (Figure 2).

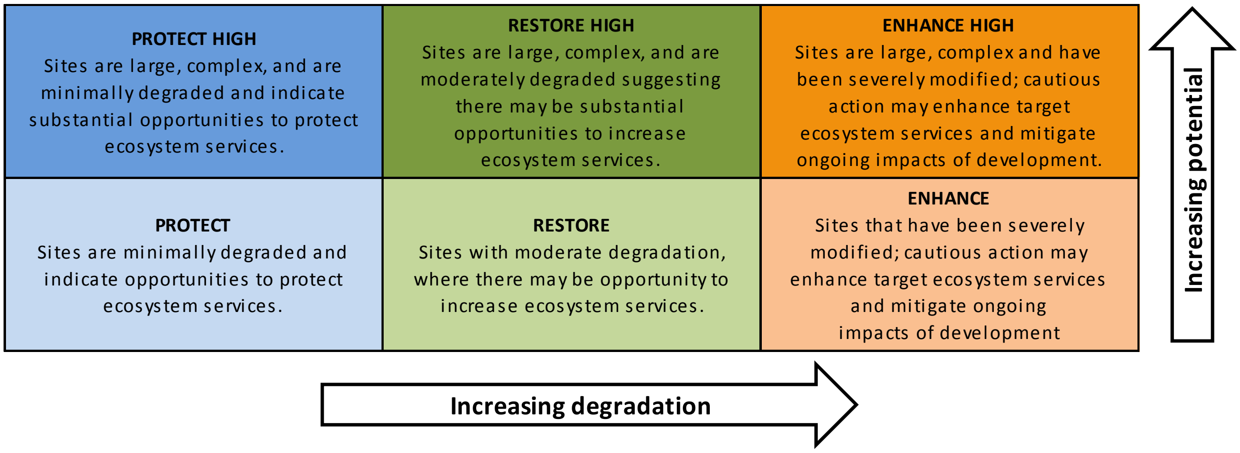


Figure 2. Six categories for initially recommending whether a shoreline site is most suited for protection, restoration, or enhancement and its level of priority for action (high or low) based on site potential and the extent of degradation that has occurred at the site. Color coding is used to indicate the site recommendation on the strategy maps (see Section 6.0). The recommendations are meant to provide a broad approach to nearshore site management. Taken from Cereghino et al. (2012).

In addition to identifying all shoreline sites to these initial six categories for potential future actions, PSNERP (Cereghino et al. 2012) also identified potential risk factors associated with each site. The factors were meant to provide information to planners about possible future impacts due to population growth and related development, which could compromise protection and restoration efficiency or effectiveness within a site. Risk factors included scale of marina development, position of breakwater or jetty development within a drift cell, the presence of active railroad lines, parcel density, and predicted future development of the nearshore zone or the upstream watershed. Risk factors as given in Cereghino et al. (2012) were based to a large extent on human population growth projections and associated changes in land cover in different watersheds that have been made for the entire Puget Sound region over the next 60 years as derived by Bolte and Vache (2010).

I employed the information on risk factors contained in Cereghino et al. (2012) to formulate a means to score potential nearshore projects in conjunction with the categories seen in Figure 2 (see Section 6.0).

4.0 Salmonid Stock Prioritization

The prioritization of all salmonid stocks known or likely to have been produced historically in each of the watersheds of the region is presented in this section.

4.1 Stocks

A stock was defined to be the salmonid species, and run-type if relevant, that was historically produced within an independent watershed draining to the marine environment.[7] All of the stocks were identified for this process in January of 2014 based on information contained in the Salmonid Stock Inventory

[7] / Recovery planning for the Hood Canal summer chum ESU uses the term "subpopulation" as the basic demographic unit instead of "stock" with the exceptions being the Quilcene subpopulation (Big and Little Quilcene combined) and the Snow-Salmon subpopulation (Snow and Salmon combined). The term "subpopulation" is not used in this report.

(SaSi) reports, limiting factors reports for the region (WSCC reports), the recovery plans for the region, and through discussion between the author and Thom Johnson, an employee of the PNPTC at the time (since retired). The inventory identified a total of 390 stocks.

Subsequent to the initial identification of stocks, cutthroat trout were excluded because they dwell in nearly every stream of almost any size in the region and they generally scored at or near the very bottom in the prioritization process. Moreover, they essentially add no useful information to this process and would swell the size of the figures and tables substantially if included. Excluding cutthroat trout leaves a total of 279 stocks that were prioritized, both in Lestelle (2015) and in this current version.

Table 1 lists all stocks used herein sorted by species, and run-type if relevant, and arranged from north to south with regard to their natal watershed. It is noted that Salmon and Snow Creek summer chum were each identified as a stock, as well as Big Quilcene and Little Quilcene summer chum. Keeping these demographic units separate for prioritization provides helpful information that recognizes different issues at the scale applied here.

Extirpated stocks are also identified, if the extirpation was relatively recent (as in the case of some of the summer chum stocks) or if some type of reintroduction effort has been initiated (e.g., certain summer chum stocks and Skokomish spring Chinook and sockeye) or might be reasonably considered.

It is noted that Chinook stocks in the Dosewallips, Duckabush, and Hamma Hamma rivers have not been identified to run-type because of continued uncertainty about the historical characteristics of the Chinook salmon that inhabited those rivers. Meridian Environmental and Mid-Hood Canal Work Group (referred to herein as Meridian [2022]) recently reported the results of a review and analysis of what is known about the historical Chinook in those rivers. Their findings were inconclusive about the historical run-type. The findings from that work have been incorporated into the prioritization being reported on in this current report. The most relevant conclusion from that analysis was that the historical stocks, if they were naturally sustained, were small; if a reintroduction effort was to be undertaken, it would likely be unsuccessful at recreating a sustainable population. Consequently, no reintroduction effort is currently being contemplated by the co-managers. The co-managers have submitted the Meridian (2022) report to NMFS for its review.

The order of the species listed in Table 1 is as follows:

- Chum – fall
- Chum – summer
- Coho
- Steelhead – winter
- Steelhead – summer
- Chinook – fall
- Chinook – spring
- Chinook – run-type? (these are the three Mid-Hood Canal Chinook stocks)
- Pink
- Sockeye
- Char

Table 1. List of stocks, showing stock code, species and run-type, natal watershed, and sub-region where the natal watershed is located. Stocks are sorted by species and run-type and ordered from north to south. The table is continued for several pages.

Stock code	Species and run-type	Natal watershed	Sub-region
Dunge_FChum	Chum - fall	Dungeness R	Eastern SJDF
JohnN_FChum	Chum - fall	Johnson Cr N	Eastern SJDF
Contr_FChum	Chum - fall	Contractors Cr	Eastern SJDF
Salmo_FChum	Chum - fall	Salmon Cr	Eastern SJDF
Snow_FChum	Chum - fall	Snow Cr	Eastern SJDF
Chima_FChum	Chum - fall	Chimacum Cr	Admiralty Inlet
Ludlo_FChum	Chum - fall	Ludlow Cr	Admiralty Inlet
Un0190_FChum	Chum - fall	Unnamed 17.0190	Admiralty Inlet
Littl_FChum	Chum - fall	Little Boston Cr	Hood Canal
Middl_FChum	Chum - fall	Middle Cr	Hood Canal
Marth_FChum	Chum - fall	Martha John Cr	Hood Canal
Gambl_FChum	Chum - fall	Gamble Cr	Hood Canal
Shine_FChum	Chum - fall	Shine Cr	Hood Canal
Nords_FChum	Chum - fall	Nordstrom Cr	Hood Canal
Thorn_FChum	Chum - fall	Thorndyke Cr	Hood Canal
Camp_FChum	Chum - fall	Camp Discovery Cr	Hood Canal
Tarbo_FChum	Chum - fall	Tarboo Cr	Hood Canal
Donov_FChum	Chum - fall	Donovan Cr	Hood Canal
LQuil_FChum	Chum - fall	Little Quilcene R	Hood Canal
BQuil_FChum	Chum - fall	Big Quilcene R	Hood Canal
India_FChum	Chum - fall	Indian George Cr	Hood Canal
Spenc_FChum	Chum - fall	Spencer Cr	Hood Canal
Marpl_FChum	Chum - fall	Marple Cr	Hood Canal
Turne_FChum	Chum - fall	Turner Cr	Hood Canal
Dosew_FChum	Chum - fall	Dosewallips R	Hood Canal
2nd U_FChum	Chum - fall	2nd Unnamed N of Walker Cr	Hood Canal
UnWalk_FChum	Chum - fall	Unnamed N of Walker Cr	Hood Canal
Walke_FChum	Chum - fall	Walker Cr	Hood Canal
Pierc_FChum	Chum - fall	Pierce Cr	Hood Canal
Ducka_FChum	Chum - fall	Duckabush R	Hood Canal
McDon_FChum	Chum - fall	McDonald Cr	Hood Canal
Fulto_FChum	Chum - fall	Fulton Cr	Hood Canal
Schae_FChum	Chum - fall	Schaerer Cr	Hood Canal
Waket_FChum	Chum - fall	Waketickeh Cr	Hood Canal
Hamma_FChum	Chum - fall	Hamma Hamma R	Hood Canal
Jorst_FChum	Chum - fall	Jorsted Cr	Hood Canal
EaglS_FChum	Chum - fall	Eagle Cr S	Hood Canal
Lilli_FChum	Chum - fall	Lilliwaup Cr	Hood Canal
LLill_FChum	Chum - fall	Little Lilliwaup Cr	Hood Canal
Sund_FChum	Chum - fall	Sund Cr	Hood Canal
Mille_FChum	Chum - fall	Miller Cr	Hood Canal
Clark_FChum	Chum - fall	Clark Cr	Hood Canal
Finch_FChum	Chum - fall	Finch Cr	Hood Canal
Hill_FChum	Chum - fall	Hill Cr	Hood Canal
Potla_FChum	Chum - fall	Potlatch Cr	Hood Canal
Un0218_FChum	Chum - fall	Unnamed 16.0218	Hood Canal
Un0217_FChum	Chum - fall	Unnamed 16.0217	Hood Canal
Un0216_FChum	Chum - fall	Unnamed 16.0216	Hood Canal
Un0215_FChum	Chum - fall	Unnamed 16.0215	Hood Canal
Skoko_FChum	Chum - fall	Skokomish R	Hood Canal
BBend_FChum	Chum - fall	Big Bend Cr	Hood Canal
Twan_FChum	Chum - fall	Twanoh Cr	Hood Canal
TwanF_FChum	Chum - fall	Twanoh Falls Cr	Hood Canal
Happy_FChum	Chum - fall	Happy Hollow Cr	Hood Canal
Holyo_FChum	Chum - fall	Holyoke Cr	Hood Canal
SpLak_FChum	Chum - fall	Springbrook Lakewood Cr	Hood Canal
Sprin_FChum	Chum - fall	Spring Cr	Hood Canal
Kinma_FChum	Chum - fall	Kinman Cr	Hood Canal
Jump_FChum	Chum - fall	Jump Off Joe Cr	Hood Canal
Un0376_FChum	Chum - fall	Unnamed 15.0376	Hood Canal
LAnde_FChum	Chum - fall	Little Anderson Cr	Hood Canal
BBeef_FChum	Chum - fall	Big Beef Cr	Hood Canal
LBeef_FChum	Chum - fall	Little Big Beef Cr	Hood Canal
Seabe_FChum	Chum - fall	Seabeck Cr	Hood Canal
Un0403_FChum	Chum - fall	Unnamed 15.0403	Hood Canal

Stock code	Species and run-type	Natal watershed	Sub-region
Stavi_FChum	Chum - fall	Stavis Cr	Hood Canal
Boyce_FChum	Chum - fall	Boyce Cr	Hood Canal
Hardi_FChum	Chum - fall	Harding Cr	Hood Canal
Ander_FChum	Chum - fall	Anderson Cr	Hood Canal
Thoma_FChum	Chum - fall	Thomas Cr	Hood Canal
Dewat_FChum	Chum - fall	Dewatto R	Hood Canal
LDewa_FChum	Chum - fall	Little Dewatto Cr	Hood Canal
Rends_FChum	Chum - fall	Rendsland Cr	Hood Canal
Calde_FChum	Chum - fall	Caldervin Cr	Hood Canal
Tahuy_FChum	Chum - fall	Tahuya R	Hood Canal
Shoof_FChum	Chum - fall	Shoofly Cr	Hood Canal
LShoo_FChum	Chum - fall	Little Shoofly Cr	Hood Canal
Cady_FChum	Chum - fall	Cady Cr	Hood Canal
North_FChum	Chum - fall	Northshore Nursery Cr	Hood Canal
Stims_FChum	Chum - fall	Stimson Cr	Hood Canal
Sunds_FChum	Chum - fall	Sundstrom Cr	Hood Canal
LMiss_FChum	Chum - fall	Little Mission Cr	Hood Canal
BMiss_FChum	Chum - fall	Big Mission Cr	Hood Canal
Union_FChum	Chum - fall	Union R	Hood Canal
Dunge_SChum	Chum - summer	Dungeness R	Eastern SJDF
Jimmy_SChum	Chum - summer	Jimmycomelately Cr	Eastern SJDF
Salmo_SChum	Chum - summer	Salmon Cr	Eastern SJDF
Snow_SChum	Chum - summer	Snow Cr	Eastern SJDF
Chima_SChum	Chum - summer	Chimacum Cr	Admiralty Inlet
LQuil_SChum	Chum - summer	Little Quilcene R	Hood Canal
BQuil_SChum	Chum - summer	Big Quilcene R	Hood Canal
Dosew_SChum	Chum - summer	Dosewallips R	Hood Canal
Ducka_SChum	Chum - summer	Duckabush R	Hood Canal
Hamma_SChum	Chum - summer	Hamma Hamma R	Hood Canal
Lilli_SChum	Chum - summer	Lilliwaup Cr	Hood Canal
Finch_SChum	Chum - summer	Finch Cr	Hood Canal
Skoko_SChum	Chum - summer	Skokomish R	Hood Canal
BBeef_SChum	Chum - summer	Big Beef Cr	Hood Canal
Ander_SChum	Chum - summer	Anderson Cr	Hood Canal
Dewat_SChum	Chum - summer	Dewatto R	Hood Canal
Tahuy_SChum	Chum - summer	Tahuya R	Hood Canal
Union_SChum	Chum - summer	Union R	Hood Canal
Dunge_Coho	Coho	Dungeness R	Eastern SJDF
Meado_Coho	Coho	Meadowbrook Cr	Eastern SJDF
Coope_Coho	Coho	Cooper Cr	Eastern SJDF
Cassa_Coho	Coho	Cassalery Cr	Eastern SJDF
Gieri_Coho	Coho	Gierin Cr	Eastern SJDF
Bell_Coho	Coho	Bell Cr	Eastern SJDF
JohnN_Coho	Coho	Johnson Cr N	Eastern SJDF
Dean_Coho	Coho	Dean Cr	Eastern SJDF
Jimmy_Coho	Coho	Jimmycomelately Cr	Eastern SJDF
Chick_Coho	Coho	Chicken Coop Cr	Eastern SJDF
EaglN_Coho	Coho	Eagle Cr N	Eastern SJDF
Contr_Coho	Coho	Contractors Cr	Eastern SJDF
Salmo_Coho	Coho	Salmon Cr	Eastern SJDF
Snow_Coho	Coho	Snow Cr	Eastern SJDF
Chima_Coho	Coho	Chimacum Cr	Admiralty Inlet
LGoos_Coho	Coho	Little Goose Cr	Admiralty Inlet
Piddl_Coho	Coho	Piddling Cr	Admiralty Inlet
Ludlo_Coho	Coho	Ludlow Cr	Admiralty Inlet
Un0190_Coho	Coho	Unnamed 17.0190	Admiralty Inlet
Hawks_Coho	Coho	Hawks Hole Cr	Hood Canal
Littl_Coho	Coho	Little Boston Cr	Hood Canal
Middl_Coho	Coho	Middle Cr	Hood Canal
Marth_Coho	Coho	Martha John Cr	Hood Canal
Gambl_Coho	Coho	Gamble Cr	Hood Canal
Toddh_Coho	Coho	Toddhunter Cr	Hood Canal
Bones_Coho	Coho	Bones Cr	Hood Canal
Shine_Coho	Coho	Shine Cr	Hood Canal
Nords_Coho	Coho	Nordstrom Cr	Hood Canal
Thorn_Coho	Coho	Thorndyke Cr	Hood Canal
Un0167_Coho	Coho	Unnamed 17.0167	Hood Canal
Fishe_Coho	Coho	Fisherman Harbor Cr	Hood Canal
Camp_Coho	Coho	Camp Discovery Cr	Hood Canal
Tarbo_Coho	Coho	Tarboo Cr	Hood Canal

Stock code	Species and run-type	Natal watershed	Sub-region
Un0126_Coho	Coho	Unnamed 17.0126	Hood Canal
Un0123_Coho	Coho	Unnamed 17.0123	Hood Canal
Donov_Coho	Coho	Donovan Cr	Hood Canal
LQuil_Coho	Coho	Little Quilcene R	Hood Canal
BQuil_Coho	Coho	Big Quilcene R	Hood Canal
India_Coho	Coho	Indian George Cr	Hood Canal
DevLak_Coho	Coho	Devil's Lake Cr	Hood Canal
Spenc_Coho	Coho	Spencer Cr	Hood Canal
Marpl_Coho	Coho	Marple Cr	Hood Canal
Turne_Coho	Coho	Turner Cr	Hood Canal
Dosew_Coho	Coho	Dosewallips R	Hood Canal
2nd U_Coho	Coho	2nd Unnamed N of Walker Cr	Hood Canal
UnWalk_Coho	Coho	Unnamed N of Walker Cr	Hood Canal
Walke_Coho	Coho	Walker Cr	Hood Canal
Un0439_Coho	Coho	Unnamed 16.0439	Hood Canal
Pierc_Coho	Coho	Pierce Cr	Hood Canal
Ducka_Coho	Coho	Duckabush R	Hood Canal
McDon_Coho	Coho	McDonald Cr	Hood Canal
Fulto_Coho	Coho	Fulton Cr	Hood Canal
Schae_Coho	Coho	Schaerer Cr	Hood Canal
Waket_Coho	Coho	Waketickeh Cr	Hood Canal
Hamma_Coho	Coho	Hamma Hamma R	Hood Canal
Jorst_Coho	Coho	Jorsted Cr	Hood Canal
EaglS_Coho	Coho	Eagle Cr S	Hood Canal
Lilli_Coho	Coho	Lilliwaup Cr	Hood Canal
LLill_Coho	Coho	Little Lilliwaup Cr	Hood Canal
Sund_Coho	Coho	Sund Cr	Hood Canal
Mille_Coho	Coho	Miller Cr	Hood Canal
Clark_Coho	Coho	Clark Cr	Hood Canal
Finch_Coho	Coho	Finch Cr	Hood Canal
Hill_Coho	Coho	Hill Cr	Hood Canal
Potla_Coho	Coho	Potlatch Cr	Hood Canal
Un0218_Coho	Coho	Unnamed 16.0218	Hood Canal
Un0217_Coho	Coho	Unnamed 16.0217	Hood Canal
Un0216_Coho	Coho	Unnamed 16.0216	Hood Canal
Un0215_Coho	Coho	Unnamed 16.0215	Hood Canal
Skoko_Coho	Coho	Skokomish R	Hood Canal
BBend_Coho	Coho	Big Bend Cr	Hood Canal
Twan_Coho	Coho	Twanoh Cr	Hood Canal
TwanF_Coho	Coho	Twanoh Falls Cr	Hood Canal
Un0130_Coho	Coho	Unnamed 14.0130	Hood Canal
Happy_Coho	Coho	Happy Hollow Cr	Hood Canal
Holyo_Coho	Coho	Holyoke Cr	Hood Canal
SpLak_Coho	Coho	Springbrook Lakewood Cr	Hood Canal
Dever_Coho	Coho	Devereaux Cr	Hood Canal
Sprin_Coho	Coho	Spring Cr	Hood Canal
Kinma_Coho	Coho	Kinman Cr	Hood Canal
Jump_Coho	Coho	Jump Off Joe Cr	Hood Canal
Catta_Coho	Coho	Cattail Cr	Hood Canal
DevHol_Coho	Coho	Devils Hole Cr	Hood Canal
Un0376_Coho	Coho	Unnamed 15.0376	Hood Canal
LAnde_Coho	Coho	Little Anderson Cr	Hood Canal
JohnS_Coho	Coho	Johnson Cr S	Hood Canal
BBeef_Coho	Coho	Big Beef Cr	Hood Canal
LBeef_Coho	Coho	Little Big Beef Cr	Hood Canal
Seabe_Coho	Coho	Seabeck Cr	Hood Canal
Un0403_Coho	Coho	Unnamed 15.0403	Hood Canal
Stavi_Coho	Coho	Stavis Cr	Hood Canal
Boyce_Coho	Coho	Boyce Cr	Hood Canal
Hardi_Coho	Coho	Harding Cr	Hood Canal
Ander_Coho	Coho	Anderson Cr	Hood Canal
Thoma_Coho	Coho	Thomas Cr	Hood Canal
Dewat_Coho	Coho	Dewatto R	Hood Canal
LDewa_Coho	Coho	Little Dewatto Cr	Hood Canal
Rends_Coho	Coho	Rendsland Cr	Hood Canal
Brown_Coho	Coho	Browns Cr	Hood Canal
Calde_Coho	Coho	Caldervin Cr	Hood Canal
Tahuy_Coho	Coho	Tahuya R	Hood Canal
Shoof_Coho	Coho	Shoofly Cr	Hood Canal
LShoo_Coho	Coho	Little Shoofly Cr	Hood Canal

Stock code	Species and run-type	Natal watershed	Sub-region
Cady_Coho	Coho	Cady Cr	Hood Canal
North_Coho	Coho	Northshore Nursery Cr	Hood Canal
Stims_Coho	Coho	Stimson Cr	Hood Canal
Sunds_Coho	Coho	Sundstrom Cr	Hood Canal
LMiss_Coho	Coho	Little Mission Cr	Hood Canal
BMiss_Coho	Coho	Big Mission Cr	Hood Canal
Union_Coho	Coho	Union R	Hood Canal
Dunge_WSth	Steelhead - winter	Dungeness R	Eastern SJDF
Meado_WSth	Steelhead - winter	Meadowbrook Cr	Eastern SJDF
Coope_WSth	Steelhead - winter	Cooper Cr	Eastern SJDF
Cassa_WSth	Steelhead - winter	Cassalery Cr	Eastern SJDF
Gieri_WSth	Steelhead - winter	Gierin Cr	Eastern SJDF
Bell_WSth	Steelhead - winter	Bell Cr	Eastern SJDF
JohnN_WSth	Steelhead - winter	Johnson Cr N	Eastern SJDF
Jimmy_WSth	Steelhead - winter	Jimmycomelately Cr	Eastern SJDF
Salmo_WSth	Steelhead - winter	Salmon Cr	Eastern SJDF
Snow_WSth	Steelhead - winter	Snow Cr	Eastern SJDF
Chima_WSth	Steelhead - winter	Chimacum Cr	Admiralty Inlet
Marth_WSth	Steelhead - winter	Martha John Cr	Hood Canal
Gambl_WSth	Steelhead - winter	Gamble Cr	Hood Canal
Shine_WSth	Steelhead - winter	Shine Cr	Hood Canal
Thorn_WSth	Steelhead - winter	Thorndyke Cr	Hood Canal
Tarbo_WSth	Steelhead - winter	Tarboo Cr	Hood Canal
Donov_WSth	Steelhead - winter	Donovan Cr	Hood Canal
LQuil_WSth	Steelhead - winter	Little Quilcene R	Hood Canal
BQuil_WSth	Steelhead - winter	Big Quilcene R	Hood Canal
Spenc_WSth	Steelhead - winter	Spencer Cr	Hood Canal
Dosew_WSth	Steelhead - winter	Dosewallips R	Hood Canal
Pierc_WSth	Steelhead - winter	Pierce Cr	Hood Canal
Ducka_WSth	Steelhead - winter	Duckabush R	Hood Canal
Hamma_WSth	Steelhead - winter	Hamma Hamma R	Hood Canal
EaglS_WSth	Steelhead - winter	Eagle Cr S	Hood Canal
Lilli_WSth	Steelhead - winter	Lilliwaup Cr	Hood Canal
Skoko_WSth	Steelhead - winter	Skokomish R	Hood Canal
LAnde_WSth	Steelhead - winter	Little Anderson Cr	Hood Canal
BBeef_WSth	Steelhead - winter	Big Beef Cr	Hood Canal
Seabe_WSth	Steelhead - winter	Seabeck Cr	Hood Canal
Stavi_WSth	Steelhead - winter	Stavis Cr	Hood Canal
Ander_WSth	Steelhead - winter	Anderson Cr	Hood Canal
Dewat_WSth	Steelhead - winter	Dewatto R	Hood Canal
LDewa_WSth	Steelhead - winter	Little Dewatto Cr	Hood Canal
Rends_WSth	Steelhead - winter	Rendsland Cr	Hood Canal
Tahuy_WSth	Steelhead - winter	Tahuya R	Hood Canal
LMiss_WSth	Steelhead - winter	Little Mission Cr	Hood Canal
BMiss_WSth	Steelhead - winter	Big Mission Cr	Hood Canal
Union_WSth	Steelhead - winter	Union R	Hood Canal
Dunge_SSth	Steelhead - summer	Dungeness R	Eastern SJDF
Dosew_SSth	Steelhead - summer	Dosewallips R	Hood Canal
Ducka_SSth	Steelhead - summer	Duckabush R	Hood Canal
Skoko_SSth	Steelhead - summer	Skokomish R	Hood Canal
Skoko_FChin	Chinook - fall	Skokomish R	Hood Canal
Dunge_SChin	Chinook - spring	Dungeness R	Eastern SJDF
Skoko_SChin	Chinook - spring	Skokomish R	Hood Canal
Dosew_Chin	Chinook – run-type?	Dosewallips R	Hood Canal
Ducka_Chin	Chinook – run-type?	Duckabush R	Hood Canal
Hamma_Chin	Chinook – run-type?	Hamma Hamma R	Hood Canal
Dunge_Pink	Pink	Dungeness R	Eastern SJDF
LQuil_Pink	Pink	Little Quilcene R	Hood Canal
BQuil_Pink	Pink	Big Quilcene R	Hood Canal
Dosew_Pink	Pink	Dosewallips R	Hood Canal
Ducka_Pink	Pink	Duckabush R	Hood Canal
Hamma_Pink	Pink	Hamma Hamma R	Hood Canal
Lilli_Pink	Pink	Lilliwaup Cr	Hood Canal
Skoko_Pink	Pink	Skokomish R	Hood Canal
Dewat_Pink	Pink	Dewatto R	Hood Canal
Tahuy_Pink	Pink	Tahuya R	Hood Canal
Union_Pink	Pink	Union R	Hood Canal
Skoko_Sock	Sockeye	Skokomish R	Hood Canal
Dunge_Char	Char	Dungeness R	Eastern SJDF
BQuil_Char	Char	Big Quilcene R	Hood Canal

Stock code	Species and run-type	Natal watershed	Sub-region
Dosew_Char	Char	Dosewallips R	Hood Canal
Ducka_Char	Char	Duckabush R	Hood Canal
Hamma_Char	Char	Hamma Hamma R	Hood Canal
Skoko_Char	Char	Skokomish R	Hood Canal

4.2 Stock Prioritization

To guide the procedure used to prioritize the stocks, Lestelle (2015) developed a set of statements or premises based on consideration of principles of conservation biology, policy-type comments from members of the HCCC Board in meetings leading up to the 2014 prioritization task, discussions with HCCC salmon recovery partners in several meetings prior to prioritization, and recognition of the values placed on differed species and run-types by both the tribal and non-tribal communities. These statements—or premises—follow; I note that these premises have not been changed for this current prioritization version:

1. Higher priority for recovery actions should be directed at stocks that are in greatest need of habitat improvements based on long-term trends in abundance, risk of further loss or risk of suffering from low abundance demographic effects, and their current status relative to historical performance. ESA-listed stocks are to be given higher priority over non-listed stocks.

2. Higher priority should be given to stocks that are not supported by hatchery production aimed at harvest augmentation; however, hatchery practices may be employed for reintroduction or for short-term supplementation to offset demographic effects.

3. Higher priority should be given to stocks that would contribute the most to the abundance of the species in the region, if those stocks benefited from restoration actions or other related activities.

4. Higher priority should be given to stocks that would contribute the most to population diversity in the region – these might be considered as key stocks that would amplify diversity.

5. Higher priority should be given to stocks for which information on performance and limiting factors is most certain, i.e., greater uncertainty exists about the need for restoration and its potential outcome for stocks having a high level of uncertainty about status and limiting factors.

6. Higher priority should be given to stocks where the certainty of success associated with projects is higher than for stocks with unknown or less certainty of success.

7. Higher priority should be given to stocks that likely have a higher ecological significance to the stability and vitality of terrestrial and aquatic ecosystems.

8. Higher priority should be given to stocks that are biologically more unique in the Hood Canal and eastern SJDF region, Puget Sound region, or the Pacific Northwest compared to other stocks in these areas—this considers the extent of loss in life history and genetic diversity that would occur if a stock was extirpated or opportunities for reintroduction and recovery become even more difficult.

9. Higher priority should be given to stocks that have special importance to either the tribal cultures within the Hood Canal and eastern SJDF region or to non-tribal cultures in the same region.
10. Higher priority should be given to stocks that provide the greatest direct or indirect economic benefits to the communities within the Hood Canal and eastern SJDF region or in nearby communities.

Lestelle (2015) used these premises to formulate a set of scoring criteria, which was used to score each stock (Table 2). The criteria are grouped, based on similarity, into three groups (designated in Table 2). Scoring for each criterion employed a 0-4 integer scale, with a 0 having no effect on prioritization and a 4 meaning the highest priority for that criterion.

As part of the original prioritization, two biologists, the author of the 2015 report and Thom Johnson of PNPTC, each having extensive knowledge of the watersheds and salmonid populations within the region, working independently scored all of the stocks using the criteria in Table 2. Scores for the criteria within a group were averaged to obtain the group score; group scores were then added to obtain the overall stock score. The stock scores obtained by each biologist were then averaged to obtain the final score for the stock (results are displayed in Appendix A in Lestelle [2015]). It bears noting that the differences in the prioritization results between Mr. Johnson's and my own were relatively minor, as described in Lestelle (2015).

Table 2. Stock scoring criteria grouped into three groups.

Group	Stock Scoring Criteria	
1	**Stock status (expected or known)**	
	Score	Description
	0	Comparable to historic abundance and stability or unknown
	1	Diminished abundance but stable over long-term, or not ESA listed BUT extirpated
	2	Long-term decline, heightened concern; or ESA listed and extirpated but no plans currently to reintroduce
	3	Abundance small and in long-term decline; species of concern; or extirpated with reintroduction scheduled
	4	ESA listed and not extirpated, or ESA listed with reintroduction in progress or slated for reintroduction
1	**Hatchery contributions (or effects)**	
	Score	Description
	0	Unknown or not relevant
	1	Stock is entirely supported by hatchery production that occurs for purpose of harvest augmentation
	2	Stock has a high degree of support from hatchery production occurring for harvest augmentation
	3	Modest level of hatchery contribution from hatchery production for harvest, or routine supplementation required
	4	No hatchery support, or short-term hatchery practices in place for reintroduction or to reduce demographic effects
1	**Certainty of knowledge about status and limiting factors**	
	Score	Description
	1	Low certainty
	2	Intermediate certainty
	3	High certainty
	4	Very high certainty
1	**Certainty of success with focused actions (may take into account knowledge of limiting factors and evidence for past success)**	
	Score	Description
	1	Low certainty
	2	Intermediate
	3	High certainty
	4	Very high certainty

Group	Stock Scoring Criteria	
2	**Role in Species Abundance**	
	Score	Description
	0	Unknown
	1	Minor role in the abundance of the species within the region
	2	Intermediate role in the abundance of the species within the region
	3	Major role in the abundance of the species within the region
	4	Especially large role in the abundance of the species within the region
2	**Role in Species Diversity (also considers spatial structure and effects of asynchrony)**	
	Score	Description
	0	Unknown
	1	Minor role in the diversity of the species in region or beyond region
	2	Intermediate role in the diversity of the species in region or beyond region
	3	Major role in the diversity of the species in region or beyond region
	4	Especially significant (key) role in the diversity of the species in the region or beyond region
2	**Biological uniqueness**	
	Score	Description
	0	Unknown
	1	Little or no particular unique characteristics believed to exist
	2	Diverse life histories known/suspected to exist providing an intermediate level of uniqueness
	3	Recognized unique life histories and/or genetic characteristics
	4	Recognized as highly unique (rare) life histories and/or genetic characteristics
2	**Ecological significance (considers benefits to ecosystem, e.g. added nutrients and/or food resources with timing of presence)**	
	Score	Description
	0	Unknown
	1	Small component of aquatic community; likely low significance
	2	Intermediate or widely variable component of aquatic community--considered to have intermediate significance
	3	Large component of aquatic community; likely high significance or likely a keystone species
	4	Likely keystone species having especially unique habitats within watershed
3	**Tribal cultural significance**	
	Score	Description
	0	Unknown
	1	Low significance known to exist to tribal culture
	2	Average significance to tribal culture
	3	Higher significance than most salmon runs
	4	Especially high significance to tribal culture
3	**Non-tribal social significance**	
	Score	Description
	0	Unknown
	1	Low significance expected to non-tribal society
	2	Average significance
	3	Higher than average significance
	4	Especially high significance to non-tribal culture
3	**Economic significance**	
	Score	Description
	0	Unknown
	1	Low relative significance
	2	Intermediate relative significance
	3	High relative significance
	4	Very high relative significance

My updated stock prioritization, using new information since 2015, is the one applied in this report. Substantial new information was available to be applied for this update. The new information that particularly affected the updated stock prioritization results included the following considerations:

- Most of the Hood Canal and SJDF summer chum stocks have continued to strengthen, which has resulted in increased optimism that delisting may be possible within the foreseeable future;
- The Skokomish summer chum stock has rebounded significantly and is now considered to be robust in its performance—its historical abundance was likely large; recent habitat restoration efforts in the lower river and stream-mouth estuary have likely been a major factor in the rebound and more restoration work is planned;
- A historical Dungeness summer chum stock is now believed to have existed and its abundance was likely substantial—a reintroduction effort is being planned; substantial habitat restoration work is occurring in the lower river;
- Habitat within the Dewatto watershed is in good condition and should support a sustainable summer chum stock in this river; a reintroduction effort is under consideration;
- Within the Salmon-Snow Creek complex, habitat remains significantly degraded in Snow Creek and in its stream-mouth estuary and is impacting summer chum performance there; a combined, integrated effort to reconnect Snow Creek to Salmon Creek, replace the Hwy 101 bridges, and restore the stream-mouth estuary could be expected to substantially boost summer chum production in the system;
- Stream habitat conditions within Tahuya River remain significantly degraded, which is likely keeping the summer chum stock from rebounding; there is a need to address the sources of the degradation;
- Design and planning work for a major restoration action continues to move forward for the lower Big Quilcene River and associated stream-mouth estuary, which would likely have significant benefits to the associated summer chum subpopulation; it is noted that this subpopulation has been the most productive population component in Hood Canal in many years and this action could be expected to further boost its productivity and capacity;
- Reintroduction of spring Chinook and sockeye salmon in the North Fork Skokomish River is underway and establishment of brood stock returning runs in the river is proving successful; habitat restoration efforts continue in various parts of the Skokomish River system;
- Design and planning work continues to move forward to restore the Duckabush stream-mouth estuary; this effort, which would be especially beneficial to summer chum, was assigned a high priority for implementation across the entirety of the Puget Sound complex by PSNERP (see https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp). Work is still occurring to secure funding for the bridge and causeway replacement project.

As noted in Section 3.0 (Approach), I also incorporated facets of Mr. Johnson's original prioritization where I found them particularly insightful.

Results of stock prioritization are displayed in Figure 3 (top 80 stocks) and Figure 4 (top two groups). I used the results to group the stocks into six groups based on the visual pattern of where shifts in the stock scores appeared most evident. Tabular results are given in Appendix A.

The top ten ranked stocks were:

- Skokomish River summer chum
- Salmon Creek summer chum
- Snow Creek summer chum
- Big Quilcene River summer chum
- Hamma Hamma River summer chum
- Skokomish River spring Chinook
- Dewatto River summer chum
- Dosewallips River summer chum
- Duckabush River summer chum
- Union River summer chum

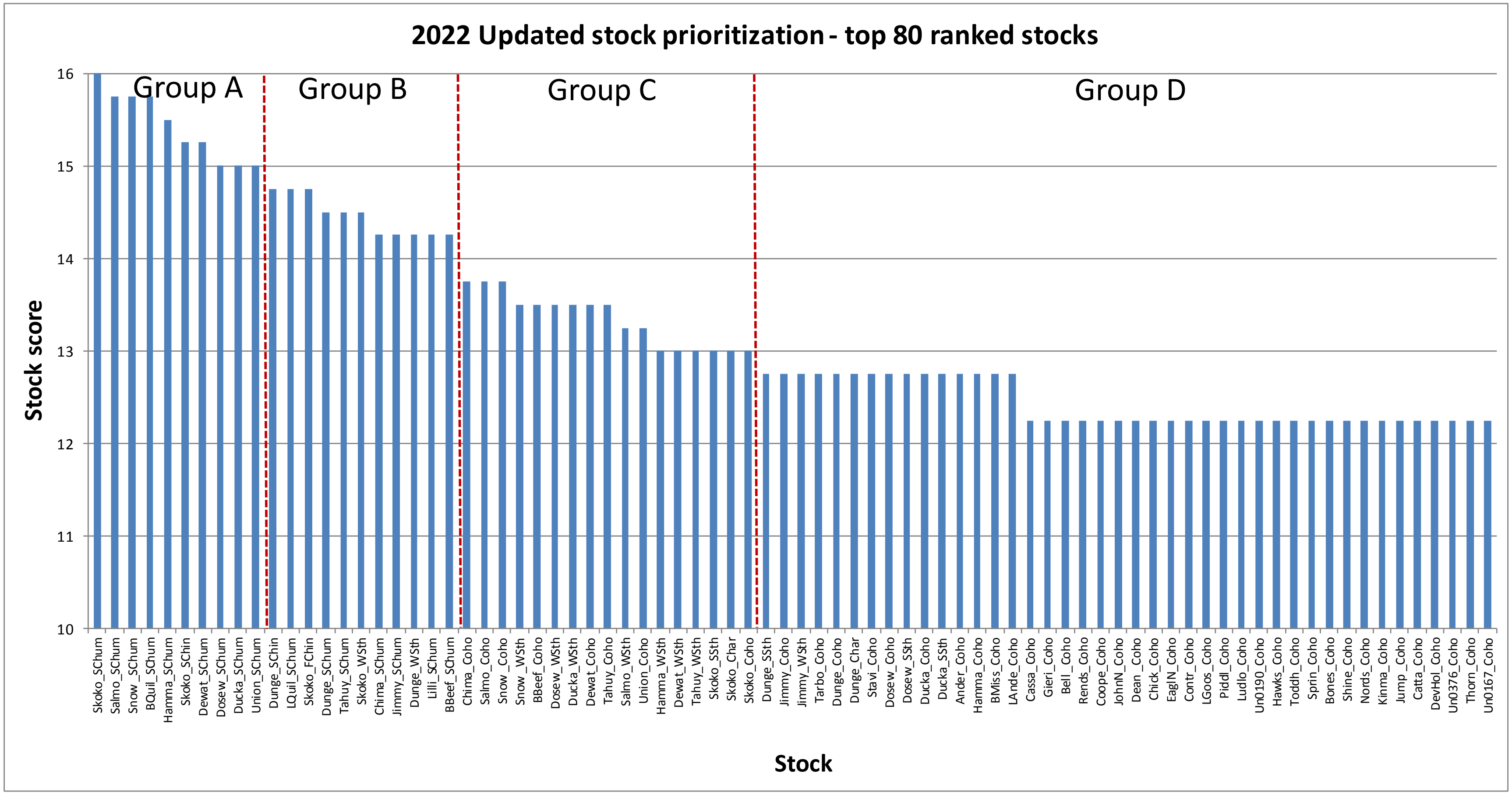


Figure 3. Updated stock prioritization results with the top four groups identified. See Appendix A for a complete list of stock prioritization results.

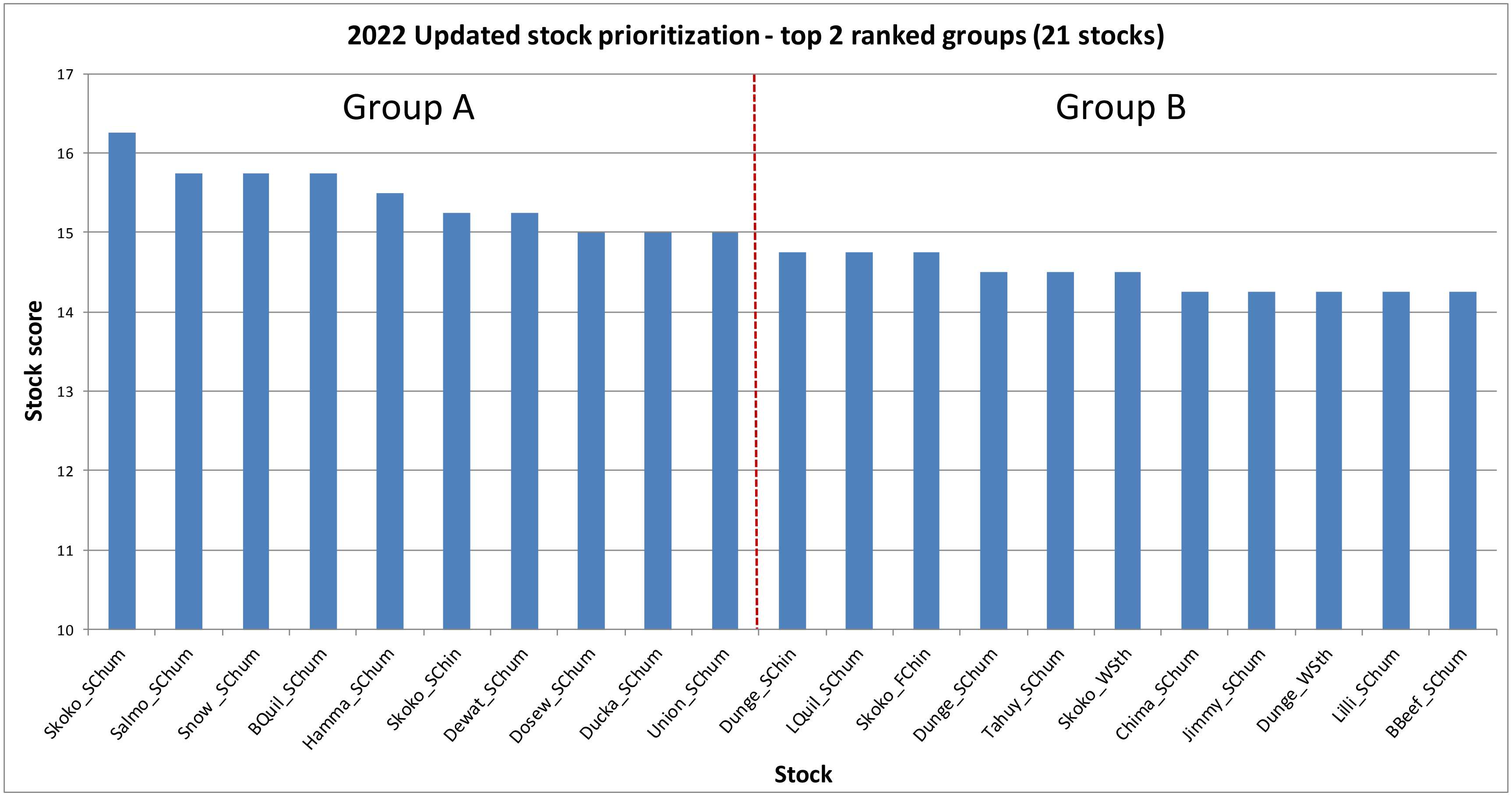


Figure 4. Updated stock prioritization results with the top two groups identified. See Appendix A for a complete list of stock prioritization results.

5.0 Issues and Actions

This section presents the issue and action framework (Section 5.1), followed by the scoring results for the issues affecting the stocks (Section 5.2), and then followed by the scoring results for actions related to the stocks (Section 5.3).

5.1 Framework

The issue and action framework is presented in two parts due to its size. Table 3, which continues for multiple pages, describes the issues that were identified and related potential actions that could be taken to ameliorate or eliminate the effects of the issues on relevant stocks. Intermediate components in the logic chain presented in the framework (relevance to salmonids, causes, and solutions) are also listed or described. The issues are arranged into four groups and presented in order: (1) issues affecting freshwater habitats, (2) issues affecting natal estuaries, (3) issues affecting non-natal estuaries and the nearshore habitats, and (4) issues pertaining to the need for some type of assessment. The group into which the issue falls is listed in the upper left corner of the page where the issue begins.

The second part of the framework, which is given in Appendix B, provides the objectives (or hypotheses), uncertainties, and information sources for the issues and actions. Appendix C provides a table listing just issues, giving the reader a more condensed version for ease of referencing issues. Similarly, Appendix D provides a table listing just actions, arranged alphabetically, and giving the reader a more condensed version of the list of actions to facilitate lookup.

It is important to note that many of the issues are closely related, having similar causes and similar or, in many cases, the same solutions. Thus, some actions can be directed at several issues.

Almost all of the issues that do not pertain to assessments apply to many stocks, though to different degrees. Most of the assessment-related issues, in contrast, pertain to just a few stocks or even to a single stock. It is noted that one of the actions listed is actually not a single action, this being the action referred to as the Cushman Settlement. This is actually a suite of many actions, all directed through the Cushman Settlement in the Skokomish River watershed. I included it here not for the sake of applying results to project prioritization, but instead to highlight its relative importance within this framework, helping to illustrate the full scope of work needed for restoration and recovery across the region.

Two other actions that are listed also pertain to only one watershed; these are referred to as the Dungeness Rule and the Dungeness Water Exchange. These actions pertain to the use of surface water or groundwater for agricultural irrigation and for new water uses to meet needs associated with increased development in the Dungeness watershed. Effects of climate change have become clearly evident in this watershed as drought conditions have worsened over the past decade. Innovative actions to improve climate resiliency in this watershed are highlighted here.

It should be noted that the framework lists issues and related actions for the marine nearshore environment, but neither the issues nor actions are scored in Sections 5.2 and 5.3. As discussed under the Approach (Section 3.0), prioritization for the nearshore is based on information contained in Cereghino et al. (2012); Section 6.0 describes how that information is applied.

Table 3. Issue and action framework. Issues are presented in four categories, in this order: freshwater habitats, natal estuarine habitats, non-natal and nearshore habitats, and assessments. See Appendix B for a second part of the framework, identifying objectives (hypotheses), uncertainties, and information sources.

<u>Freshwater Habitat:</u> *Large stream channel conditions*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Large river channels in the region have lost structural and habitat diversity compared to their historical condition to varying extents depending on river, resulting in changes in channel stability, changes in substrate stability, loss of pool habitat and other habitat types, and coarsening of channel substrates (or fining of substrates in some cases), and in one river (Skokomish R.), a major increase in flood frequency now exists due in part to extreme aggradation (a buildup in the streambed due to sediment deposition) that has occurred. Aggradation has also been significant in the lower Dungeness and Big Quilcene rivers. In the most altered reaches of these rivers, historical pool-riffle morphology has devolved into plane-bed morphology with elongated riffle/glide sections; also channel sinuosity and total channel length have been reduced (with corresponding losses in habitat diversity and quantity). <u>Affected watersheds:</u> Dungeness, Quilcene, Dosewallips, Duckabush, Hamma Hamma, Skokomish rivers.	▪ Loss of adult migration, spawning, incubation, and juvenile salmonid habitat quality (manifested in the frequency, stability, and structure of habitats) and quantity. ▪ Loss of side channel habitats, which are particularly important for spawning and rearing by young juveniles. ▪ Increased egg to fry mortality due to channel scour or sediment deposition. ▪ Increased mortality of young fry due to loss of refuge habitat. ▪ Increased mortality during summer and winter rearing stages due to loss of high quality habitats. ▪ Juvenile stranding in dewatered channels. ▪ Loss in food diversity and quantity for juvenile salmonids. ▪ Declines in fish population performance at all freshwater life stages and over the entire life cycle, thereby reducing the probability of long-term sustainability or recovery.	▪ Removal of large and small wood jams within the active channel migration zone (CMZ). ▪ Stream channel straightening or channelization. ▪ Constriction of the active high flow channel by roads, bridges, dikes, levees, or bank armoring. ▪ Increases (from various land uses) or decreases (due to a dam) in sediment loading to the stream. ▪ Changes in the flow regime, particularly in the frequency, duration, and level of high flow events, which is caused by various land and water use patterns. ▪ Disconnection from the river's floodplain or in the water and/or sediment storage capacity of the floodplain. ▪ Gravel mining from the channel or the river bars. ▪ Logging or clearing within the riparian zone.	▪ Enlarge CMZs and restore normative meander patterns by reducing channel and flow constrictions and restoring channel migration zones. ▪ Restore normative large wood complexes to the active channel and the active CMZ, and where appropriate, promote the recreation of stable vegetated islands. ▪ Restore normative flow regime characteristics by reducing the rate of storm runoff associated with impervious surfaces and wholesale clearcut logging. ▪ Restore connections to floodplains that provide for increased sediment storage and flood capacity. ▪ Restore a normative flow regime in dammed rivers (Skokomish R.).	▪ <u>Channel pattern:</u> Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern. ▪ <u>CMZ:</u> Enlarge existing active channel migration zone (CMZ) (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ <u>Cushman Settlement:</u> Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration. ▪ <u>Large wood:</u> Construct engineered log jams (ELJs) or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands. ▪ <u>Invasives:</u> Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ <u>Protect riparian:</u> Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ <u>Restore riparian:</u> Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ <u>Sediment deposits:</u> Strategically address key sediment deposits that constrict channel, limit flood capacity, or promote channel instability as part of an overall approach to restoring normative channel function. ▪ <u>Streambank structure:</u> Implement streambank remediation measures if determined consistent with providing for normative channel pattern, structure, or function, as well as

Freshwater Habitat: ***Large stream channel conditions***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
				natural erosion rates and patterns (see Technique 12 in Cramer 2012). This may involve removal of hard bank armor and replacement with soft bank protection material more conducive to normative channel function and structure. It is noted that bank protection measures done as "restoration" are often inconsistent with process-based habitat restoration and may worsen channel conditions for salmonid habitat – careful planning is needed.

<u>Freshwater Habitat:</u> ***Small stream channel conditions***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Many small streams that flow directly to the marine environment, as well as small streams tributary to the major river channels in the region, have lost structural and habitat diversity compared to their historical condition, resulting in changes in channel stability, changes in substrate stability, loss of pool habitat and other habitat types, and coarsening of channel substrates (or fining of substrates in some cases). Depending on the types of factors operating on the channel and the valley and geology characteristics, the channel may also be downcut (entrenched or incised) or it may be aggraded (e.g., much of the Tahuya River and the lower portion of Big Beef Creek) in response to alterations. <u>Affected watersheds:</u> All streams smaller than the Hamma Hamma River in the region to varying extents.	▪ Loss of adult migration, spawning, incubation, and juvenile salmonid habitat quality (manifested in the frequency, stability, and structure of habitats) and quantity. ▪ Loss of side channel habitats, which are particularly important for spawning and rearing by young juveniles. ▪ Increased egg to fry mortality due to channel scour or sediment deposition. ▪ Increased mortality of young fry due to loss of refuge habitat. ▪ Increased mortality during summer and winter rearing stages due to loss of high quality habitats. ▪ Juvenile stranding in dewatered channels. ▪ Loss in food diversity and quantity for juvenile salmonids. ▪ Declines in fish population performance at all life stages and over the entire life cycle, thereby reducing the probability of long-term sustainability or recovery.	▪ Removal of large and small wood jams and/or beaver dams (or caused by beaver eradication with their activities ending) within the high flow channel. ▪ Stream channel straightening or channelization. ▪ Constriction of the active high flow channel by roads, bridges, dikes, levees, or bank armoring. ▪ Increases (from various land uses) or decreases (due to a dam) in sediment loading to the stream. ▪ Changes in the flow regime, particularly in the frequency, duration, and level of high flow events, which be caused by various land and water use patterns. ▪ Disconnection from the river's floodplain or in the water and/or sediment storage capacity of the floodplain. ▪ Gravel mining from the channel or the river bars. ▪ Logging or clearing within the riparian zone	▪ Restore normative CMZs and meander patterns by reducing channel and flow constrictions and restoring channel migration zones. ▪ Restore normative large wood complexes to the active channel and the active CMZ, and where appropriate, promote the recreation of stable vegetated islands. ▪ Restore normative flow regime characteristics by reducing the rate of storm runoff associated with impervious surfaces and wholesale clearcut logging. ▪ Restore connections to floodplains that provide for increased sediment storage and flood capacity. ▪ Restore a normative flow regime in dammed rivers (Skokomish R.).	▪ <u>Channel pattern:</u> Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern. ▪ <u>CMZ:</u> Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ <u>Large wood:</u> Construct ELJs or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands. ▪ <u>Invasives:</u> Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ <u>Protect riparian:</u> Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ <u>Restore riparian:</u> Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ <u>Sediment deposits:</u> Strategically address key sediment deposits that constrict channel, limit flood capacity, or promote channel instability as part of an overall approach to restoring normative channel function. ▪ <u>Streambank structure:</u> Implement streambank remediation measures if determined consistent with providing for normative channel pattern, structure, or function, as well as natural erosion rates and patterns (see Technique 12 in Cramer 2012). This may involve removal of hard bank armor and replacement with soft bank protection material more conducive to normative channel function and structure. It is noted that bank protection measures done as "restoration" are often inconsistent with process-based habitat restoration and may worsen channel conditions for salmonid habitat – careful planning is needed.

Freshwater Habitat: ***Large stream floodplain conditions***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Major parts of the floodplains of large river channels in the region have been disconnected from the active channels within the alluvial valleys due to various channel and flood control measures. To a large extent, these floodplains have been converted to agriculture, rural residential lands, or urbanized areas (as in the lower Dungeness valley). These changes have resulted in loss of flow capacity in the high flow channel and natural floodways, exacerbating peak flow conditions and promoting greater channel scour, localized channel aggradation or degradation, leaving less diversified and more unstable in-channel habitat conditions. In addition, loss of floodplain connectivity has reduced sediment storage capacity within the floodways, further promoting aggradation and instability. Losses in off-channel habitats and stable side channel complexes have also resulted. Affected watersheds: Dungeness, Quilcene, Dosewallips, Duckabush, Hamma Hamma, Skokomish rivers.	▪ Loss in floodplain function can significantly degrade in-channel conditions, which in turn, can adversely affect adult migration, spawning, incubation, and juvenile salmonid habitat quality (manifested in the loss of frequency, stability, and structure of habitats) and quantity. ▪ Loss in floodplain function and its corresponding effects on active channel conditions can diminish fish food diversity and quantity. ▪ Loss of side channel habitats can result, which are particularly important for spawning and rearing by young juveniles. ▪ Loss of off-channel habitats will occur, most important for summer and winter rearing of juvenile coho, though juvenile Chinook can also use these habitats. ▪ Features that limit floodplain connectivity affect the quantity and quality of aquatic habitat through direct manipulations to habitat as well as indirect effects on channel processes. ▪ All of these changes reduce fish population performance at various life stages and over the entire life cycle, thereby reducing the probability of long-term sustainability or recovery.	▪ Stream channel straightening or channelization, which can act to disconnect the active channel from its floodplains. ▪ Channel control measures, such as dikes, levees, and other types of bank armoring, which act to disconnect the active channel from its floodplains. ▪ Conversion of forested floodplains to agriculture, rural residential areas, and urban settings create strong needs to control river channels and protect private property from flooding and channel migration. ▪ Drainage and filling of overflow channels, off-channel ponds, and wetlands and marshes located on the floodplains occur to convert these areas to other uses besides ecological ones.	▪ Restore connections to floodplains that provide for increased sediment storage and flood capacity. ▪ Enlarge CMZs and restore normative meander patterns by reducing channel and flow constrictions and restoring channel migration zones. ▪ Restore normative flow regime characteristics by reducing the rate of storm runoff associated with impervious surfaces and wholesale clearcut logging. ▪ Restore connections to floodplains that provide for increased sediment storage and flood capacity. ▪ Acquire floodplain lands and restore ecological functions of those lands.	▪ Beaver management: Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management. ▪ CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Transportation infrastructure: Improve or remove transportation infrastructure within floodplains to restore more normative channel and floodplain function and connectivity. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Protect floodplains: Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides. ▪ Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here.

<u>Freshwater Habitat:</u> *Small stream floodplain conditions*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The floodplains of many small streams and rivers in the region have been heavily altered and/or disconnected from the active channels by the placement of roads and driveways, land conversion, streambank protection measures, and other land use practices. These changes have contributed to changes in flow characteristics in these streams (increasing peak flows and decreasing summer low flows), sediment loading and processing, wood structure within the channels, pool-riffle composition, distribution and abundance of off-channel habitats (ponds, alcoves, wetlands, and backwaters), among other changes. <u>Affected watersheds:</u> All streams smaller than the Hamma Hamma River in the region.	▪ Loss in floodplain function can significantly degrade in-channel conditions, which in turn, can adversely affect adult migration, spawning, incubation, and juvenile salmonid habitat quality (manifested in the loss of frequency, stability, and structure of habitats) and quantity. ▪ Loss in floodplain function and its corresponding effects on active channel conditions can diminish fish food diversity and quantity. ▪ Loss of side channel habitats can result, which are particularly important for spawning and rearing by young juveniles. ▪ Loss of off-channel habitats will occur, most important for summer and winter rearing of juvenile coho, though juvenile Chinook can also use these habitats. ▪ All of these changes reduce fish population performance at various life stages and over the entire life cycle, thereby reducing the probability of long-term sustainability or recovery.	▪ Stream channel straightening or channelization, which can act to disconnect the active channel from its floodplains. ▪ Channel control measures, such bank armoring, which act to disconnect the active channel from its floodplains. ▪ Conversion of forested floodplains to agriculture, rural residential areas, and urban settings create strong needs to control river channels and protect private property from flooding and channel migration. ▪ Drainage and filling of overflow channels, off-channel ponds, and wetlands and marshes located on the floodplains occur to convert these areas to other uses besides ecological ones.	▪ Restore connections to floodplains that provide for increased sediment storage and flood capacity. ▪ Enlarge CMZs and restore normative meander patterns by reducing channel and flow constrictions and restoring channel migration zones. ▪ Restore normative flow regime characteristics by reducing the rate of storm runoff associated with impervious surfaces and wholesale clearcut logging. ▪ Restore connections to floodplains that provide for increased sediment storage and flood capacity. ▪ Acquire floodplain lands and restore ecological functions of those lands.	▪ <u>Beaver management:</u> Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management. ▪ <u>CMZ:</u> Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ <u>Transportation infrastructure:</u> Improve or remove transportation infrastructure within floodplains to restore more normative channel and floodplain function and connectivity. ▪ <u>Invasives:</u> Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ <u>Protect floodplains:</u> Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides. ▪ <u>Restore floodplains:</u> Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features. ▪ <u>Restore riparian:</u> Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here.

Freshwater Habitat: ***Access to instream habitats***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The ability of juvenile and adult salmonids to swim upstream to access spawning grounds and rearing areas is vital to salmonid recovery and long-term sustainability. Poorly designed or deteriorating culvert and bridge installations, as well as other barriers to upstream passage, can block or impede passage of juvenile and/or adults. In some cases, large beaver dams can also hinder or block upstream migrants, particularly migrant juvenile salmonids. In addition, while high waterfalls act to completely block upstream passage, smaller waterfalls and especially steep cascades can act as partial barriers to some species and life stages, particularly during certain seasons; SIT and WDFW (2010 and 2017) identified the South Fork Skokomish gorge cascades as an example of such a partial barrier, one that is being made worse by climate change. Affected watersheds: All streams and rivers in the region are affected to varying degrees.	▪ Fish passage barriers block or limit access to upstream habitats that were used historically by a species, resulting in reduced population abundance due to loss in available habitat (quantity of habitat; Cramer 2012). ▪ Fish passage barriers can alter the spatial structure and life history diversity of a population, thereby potentially impacting its long-term sustainability.	▪ Poorly designed culvert installations can cause perched outfalls or result in excessively high velocities during elevated flows, resulting in passage restrictions. ▪ Poorly designed culvert installations, particularly those with flat bottoms, can have particularly shallow water flowing through, thereby limiting the ability of fish to pass through. ▪ Old culverts can collapse or become plugged, restricting fish access. ▪ Old culverts on small streams with rusted and leaking bottoms can restrict passage due to limited flow during base flow. ▪ Collapsed and debris-jammed old stringer bridge crossings can restrict fish access. ▪ Adult passage at natural falls that allow upstream passage during high flows, such as during spring runoff, may become greater barriers if climate change reduces spring-time runoff (SIT and WDFW 2010).	▪ Remove stream crossing structures on abandoned or closed roads. ▪ Redesign and rebuild stream crossing structures to accommodate flows and fish passage. ▪ Alter partial barriers to fish passage that are subject to the effects of climate change and associated changes in the flow regime to maintain connectivity along the river as it supported fish populations historically.	▪ Beaver dams: Install and periodically maintain "beaver deceiver" devices in priority areas prone to extensive damming by beavers where upstream salmonid migrations likely are restricted, or install juvenile fish ladders structures using corrugated plastic pipe (as done by the Pacific Coast Salmon Coalition) in sites where warranted. ▪ Natural barrier: Assess passage effectiveness at potential partial natural barriers if a salmon recovery effort might be hindered by limited passage, or if climate change can be expect to worsen passage effectiveness (such as at the South Fork Skokomish R. gorge cascades), and as deemed warranted, implement remedial measures to improve passage. ▪ Road crossings: Periodically evaluate stream crossing structures for passage effectiveness, maintain crossing structures consistent with BMPs, remove crossing structures on closed or abandoned roads, replace or upgrade outdated structures on a priority basis..

Freshwater Habitat: *Access to off-channel habitats*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The availability and accessibility of off-channel habitats (ponds and wetlands) are important determinants of the performance of some salmonid populations. Man-made structures or large beaver dams can block or hinder movements to these habitats of juvenile salmonids for seasonal rearing. Re-opening, improving accessibility, or by increasing the availability and quality of off-channel habitats can be effective ways to improve salmonid population performance for certain species. It is recognized that beaver dams and associated ponds are critical features of many lowland streams and provide important fish habitat, so care must be taken in attempting to improve fish passage in these areas. Affected watersheds: All streams and rivers in the region are affected to varying degrees but this issue is mainly applicable in low gradient reaches and stream valleys.	▪ Issue is primarily important to juvenile coho and cutthroat, which move into off-channel habitats as fry in late spring for summer rearing and as fingerlings in fall and early winter for overwintering (Lestelle 2007). ▪ Issue is generally less important to juvenile Chinook and steelhead, though off-channel habitats can be used by these species when the habitats are in close proximity to the mainstem river and during high flow events. ▪ Survival and growth of coho are especially high in off-channel habitats during winter; population performance can be especially high when coho have good access to abundant off-channel habitats, as is the case in some Kitsap Peninsula watersheds (e.g., Big Beef Cr., Dewatto R., and Tahuya R.). ▪ Accessibility and likelihood of juvenile coho salmon finding these habitats is a habitat quality characteristic, though these habitats also provide important habitat quantity (Lestelle 2009).	▪ The small channels or swales connecting off-channel ponds and wetlands to the main stream can be blocked by road fills or poorly designed culverts and other crossing structures. (Ponds and wetlands can be dry during summer, making them inconspicuous when roads were built, or even to technicians doing culvert inventories.) ▪ Filling and drainage of wetlands, not uncommon in the past, has reduced their availability. ▪ Large beaver dams—particularly old, inactive ones—can block access to juvenile coho attempting to enter off-channel habitats, or these structures can prevent emigration of smolts during spring, thereby land-locking the fish. ▪ Invasive reed canary grass can choke small, shallow connecting channels between ponds and wetlands and main stream channels.	▪ Restore, enhance, and maintain good access between main stream channels and off-channel ponds and wetlands where road structures impede passage. ▪ Enhance accessibility to off-channel habitats where accessibility can be impeded naturally by beaver dams or by the invasive reed canary grass. ▪ Restore and/or create new off-channel habitats as opportunities might exist.	▪ Beaver dams: Install and periodically maintain "beaver deceiver" devices in priority areas prone to extensive damming by beavers where upstream salmonid migrations likely are restricted, or install juvenile fish ladders structures using corrugated plastic pipe (as done by the Pacific Coast Salmon Coalition) in sites where warranted. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Off-channel access: Inventory off-channel habitats and assess connectivity between swales/egress channels and main stream channels. ▪ Off-channel habitat: Improve off-channel habitats by deepening and/or adding habitat structure where opportunities exist, or create new off-channel habitats where opportunity and favorable conditions exist by dredging, blasting, and/or installation of channel flow controls on small floodplain streams to create ponds (e.g., Cederholm et al. 1988; Pacific Coast Salmon Coalition). ▪ Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features.

<u>Freshwater Habitat:</u> *Riparian conditions*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Riparian zones in all watersheds within the region have been impacted to varying degrees by a wide variety of land and water-use activities, which include logging and all types of land clearing and land conversion to support societal needs. These activities have removed or altered the riparian plant communities, modified riparian soil conditions and other associated land and water features, and disrupted natural ecological cycles, all of which affect how riparian zones function in support of salmonid populations. The current condition of riparian zones in the Hood Canal and eastern SJDF region varies greatly, ranging from areas with virtually no function to support salmonids to other areas (relatively few) having pristine (or close to it) conditions. <u>Affected watersheds:</u> All streams and rivers in the region are affected to varying degrees.	▪ The ecological health of streams is closely linked to the watershed landscape by the biotic and physical-chemical properties of the riparian zone (Naiman et al. 2005 – this citation applies to all below also). ▪ Riparian zones affect stream and shoreline shading, influencing stream temperature, dissolved oxygen, and plant species composition (e.g., invasives) along the shorelines—all of which affect salmonid performance and habitat use. ▪ Riparian zones affect water quality by trapping suspended and fine sediments and pollutants. ▪ Riparian zones store water during high flows—to be released slowly to the stream over time. ▪ Riparian zones stabilize streambanks and help maintain channel stability and bank cover for fish. ▪ Riparian zones add leaf matter and wood for the stream, providing both nutrients and structure to stream ecosystems. ▪ All of these functions directly and indirectly affect salmonids.	▪ Wide scale logging of old-growth forests, including riparian forests, in every watershed in the region over the past 150 years; logging continues to various degrees within existing riparian forests. ▪ Land conversion within the riparian corridors of rivers and streams in the valleys of nearly every watershed in the region, has turned riparian forested corridors into agriculture areas, rural residential areas, road systems, and urban areas (such as in the Dungeness valley and in the lower Union R.). ▪ Use of off-road vehicles within riparian corridors. ▪ Construction of dikes and levees and bank hardening with rip-rap. ▪ Growth and spread of invasive plant species such as Japanese knotweed and reed canary grass, which affect the growth and survival of native vegetation within the riparian corridor and can choke seasonal channels within the corridor.	▪ Promote diverse old-growth characteristics of riparian forests by expanding buffer widths where possible, or use of active management practices (e.g., thinning, planting, and shrub and herb control) to accelerate achievement of desired conditions within the riparian corridor. ▪ Eradication of Japanese knotweed and management of reed canary grass. ▪ Control beaver populations to limit their adverse effects on riparian corridors that are in the process of being restored to more normative conditions.	▪ <u>Beaver management:</u> Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management. ▪ <u>Invasives:</u> Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ <u>Protect riparian:</u> Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ <u>Restore riparian:</u> Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here.

Freshwater Habitat: *Sediment supply, transport, and storage*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Erosion and sediment transport by rivers are natural watershed processes that shape stream channels and floodplains, as well as associated habitats and aquatic biota, including salmonid populations. The sediment supply is produced from ongoing land erosion (e.g., landslides), as well as from the recapture of sediments (due to channel migration and avulsions) previously stored in flood plains and streambanks. Prior to the rapid alteration of watersheds by Euro-Americans, sediment transport from rivers was generally in equilibrium with sediment supply. Watershed alterations and management have disrupted the natural process, resulting in changes (often very significant ones) to the supply, storage, and transport of sediments. These changes had led to increased fine sediments levels within spawning gravels, channel and habitat instability, and in some cases, to severe channel aggradation (as in the Skokomish, Dungeness, and Quilcene rivers). The active channel width of the Tahuya River mainstem also appears to have increased significantly over the past 25 years, suggesting substantial aggradation. <u>Affected watersheds:</u> All streams and rivers in the region are affected to varying degrees. The North Fork Skokomish River is affected by dam construction and operations – see Issue Dams and Reservoirs.	▪ Increased sediment supply over levels typically found in old-growth forests or conditions prior to the modern era of watershed development results in increased mortalities of salmonid embryos and juveniles during egg incubation and overwintering life stages (Bjornn and Reiser 1991; Cederholm et al. 1987). ▪ Increased sediment supply can cause channel aggradation (buildup of sediment in the channel), resulting in egg smothering, shallowing of pools and riffles (even dry channels), channel braiding, and greater habitat instability, thereby reducing population performance (SIT and WDFW 2010). ▪ Decreased sediment supply below dams can cause channel incision and loss of suitable spawning habitat for salmonids.	▪ Runoff from road building and vehicular traffic on gravel roads increases sediment delivery to streams. ▪ Landslides associated with roads and clearcutting increases sediment delivery. ▪ Blowouts and slides associated with large road fills and undersized culverts. ▪ On-going erosion associated with old road drainage networks due to failed culverts and unmaintained ditches. ▪ Runoff from agricultural fields and farming activities increases sediment delivery. ▪ Removal of old-growth LWD and wood jams during historic logging and subsequent channel clearing activities, resulting in increased channel instability and recapture of stored sediments. ▪ Runoff from land clearing for land conversion, including road building. ▪ Altered flow regimes due to land uses, causing greater streambank erosion and recapture of stored sediments from past glaciation, resulting in streambed aggradation and greater instability of the channel. ▪ Dam construction and associated operations resulting in altered flow regimes and changes in sediment transport processes.	▪ Continue to improve forest management practices to reduce sediment yields from roads, clearcuts, and from areas prone to landslides. ▪ Close and obliterate unneeded roads. ▪ Continue to upgrade and improve BMPs for managing sediment yield from all types of land uses. ▪ Improve opportunities for public education on ways of controlling sedimentation. ▪ Improve knowledge and understanding about sources of sediment produced in the watershed. ▪ Re-creation of normative flow regime in the NF Skokomish R. through change in how flows are regulated at Cushman Dam ▪ Regulation of high flows at Cushman Dam to promote channel scour and facilitate return to more normative conditions	▪ <u>Large wood:</u> Construct ELJs or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands. ▪ <u>Non-forest roads:</u> Assess conditions of existing non-forest road systems that might contribute sediments, identifying risk levels for sediment contributions, and implement identified remedial measures. ▪ <u>Non-road sediment:</u> Assess non-road related sediment sources that contribute sediments, identifying risk levels for sediment contributions to adjacent streams, and implement remedial measures. ▪ <u>Protect riparian:</u> Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ <u>Restore riparian:</u> Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ <u>Road Maintenance and Abandonment Plans (RMAP):</u> Complete the development of Road Maintenance and Abandonment Plans on all forest lands, and implement steps for upgrading, maintaining, or decommissioning of roads and road crossings. ▪ <u>Watershed analysis:</u> Prepare watershed analysis of the primary watershed processes that are affecting a watershed of concern if such analysis has never been done, or prepare an updated analysis if warranted. Such analysis will provide a landscape perspective for assessing the sediment budget, including rates of sediment supply and transport. Remedial measures can be formulated accordingly. ▪ <u>Streambank structure:</u> Implement streambank remediation measures if determined consistent with providing for normative channel pattern, structure, or function, as well as natural erosion rates and patterns (see Technique 12 in Cramer 2012). This may involve removal of hard bank armor and replacement with soft bank protection material more conducive to normative channel function and structure. It is noted that bank protection measures done as "restoration" are often inconsistent with process-based habitat restoration and may worsen channel conditions for salmonid habitat – careful planning is needed.

__Freshwater Habitat:__ ***Sediment supply, transport, and storage***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
				▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration.

Freshwater Habitat: *Flow regime characteristics*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The rapid conversion of old-growth forests to young, managed stands, combined with extensive road networks, in many watersheds of the region altered to varying extents characteristics of the natural flow regime. Subsequently, land conversion in the lower valleys of most watersheds have caused further changes to flow regimes as lands were cleared and converted to agriculture, rural-residential areas, commercial properties, military installations, and urbanized areas. All of these changes have increased the amounts of impervious surfaces, thus changing runoff rates and patterns. The flow regimes in certain rivers have also been altered by dams and reservoirs (e.g., the Skokomish River) and water diversions for irrigation and other development (e.g., in the Dungeness River). In both the Skokomish and Dungeness rivers, the flow regimes have also been significantly altered due to loss of floodplain function, diking and levees, aggradation in the main river channels, and in the Dungeness River, by groundwater pumping associated with development. Attributes of the flow regime include flow magnitude, duration, timing, frequency and rate of change. The flow regime is a key driver of ecological riverine processes and associated habitat features. Changes in precipitation patterns associated with climate change are also affecting runoff patterns in the watersheds and altering flow regime characteristics. This	▪ Life history patterns and associated life stage survivals of stream dwelling salmon are strongly affected by characteristics of the flow regime in a stream system (Poff et al. 1997). ▪ Peak flow intensity, runoff duration, and rate of change in flows during storm events can adversely affect egg to fry survival, emergent fry survival, and juvenile overwintering survival (Shuett-Hames and Adams 2003; Seiler et al. 2004; Weinheimer et al. 2017). ▪ Diminished low flows in late summer or early fall as a result of changes in the flow regime will generally reduce the number of coho salmon smolts (and probably steelhead smolts) produced from tributary streams (Smoker 1953; Lestelle et al. 1993; Seiler 1999).	▪ Extensive road networks through managed forests increase rate of runoff, which can produce greater instability of streams. ▪ Replacement of old-growth forests with managed forests of much younger stands. ▪ Land clearing and land conversion creating greater amounts of impervious surfaces in the watershed, altering runoff patterns and rates. ▪ Diking and levees along the river channels to prevent flooding onto the floodplains, thereby increasing the rate and height of flood runoff in the main channel. ▪ Water withdrawals from the surface water of channels for the purpose of irrigation, domestic and industrial use, and hydropower generation (these have occurred in the Dungeness, Big and Little Quilcene, Skokomish, and Union rivers). ▪ Groundwater pumping to support agricultural or residential development (as in the Dungeness River).	▪ Promote diverse stand age in the managed forest to age a mixture of hydrologic maturity on the landscape. ▪ Reduce the footprint of roads in the managed areas of watersheds wherever possible. ▪ Restore connections to floodplains that provide for increased flood capacity. ▪ Enlarge CMZs and restore normative meander patterns by reducing channel and flow constrictions. ▪ Restore normative flow regime characteristics by reducing the rate of storm runoff associated with impervious surfaces. ▪ Acquire floodplain lands and restore ecological functions of those lands. ▪ Creation of artificial off-channel reservoirs to augment late-summer instream flows. ▪ Re-creation of normative flow regime in the NF Skokomish R. through change in how flows are regulated at Cushman Dam.	▪ Channel pattern: Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern. ▪ CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration. ▪ Decommissioning: Decommission or remove roads of little use on public lands, or ones whose services can be provided on alternative roads. ▪ Dungeness Rule: Implement provisions of the Dungeness water rule adopted by WDOE in 2012. To the extent possible, purchase water credits from the water bank for protecting late summer low flows in the Dungeness River. Expand the rule to other areas of the Dungeness watershed as needed to ensure that minimum flows are maintained in the Dungeness River. ▪ Forest maturity: Manage for an increase in hydrologic maturity (older-age stands) of forested lands to the extent possible using incentives on private lands or through policy change on public lands. ▪ Protect floodplains: Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides. ▪ Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features. ▪ Road Maintenance and Abandonment Plans (RMAP): Complete the development of Road Maintenance and Abandonment Plans on all forest lands, and implement steps for upgrading, maintaining, or decommissioning of roads and road crossings. ▪ Runoff BMPs: Adopt or improve (i.e., update as needed) requirements for BMPs related to storm runoff management on agricultural, residential, commercial, or urbanized lands, including all transportation corridors that

Freshwater Habitat: *Flow regime characteristics*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
has become especially evident in the Dungeness watershed where the frequency and severity of droughts have increased. Affected watersheds: All streams and rivers in the region are affected to varying degrees. The North Fork Skokomish River is affected by dam construction and operations – see Issue Dams and Reservoirs. The Dungeness watershed is particularly vulnerable to climate change effects that are increasing the frequency of drought. See the issue below on Climate Change.				produce pollutants, promoting greater increases in storm-water infiltration using various methods and greater capacity for storm-water detention or retention. ▪ Water rights: Purchase water rights in the Dungeness watershed and dedicate the water for environmental-related flow in the Dungeness River. ▪ Water storage with creation of off-channel reservoirs: Create off-channel water storage reservoirs that would be filled during winter and spring high flow runoff and then used to augment late summer instream flows. The proposed Dungeness Off-Channel Reservoir Project offers a storage concept that has broad support by state, local, and tribal officials in the Dungeness valley (see Anchor 2022).

Freshwater Habitat: *Water quality*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Runoff from lands where all types of land management practices can be sources of different types of pollutants, including fine sediment and various types of chemicals and heavy metals. Runoff from highways and well-traveled roads are particular sources of substances of concern. Urbanized areas, where parking lots and densely populated areas, are also known sources of pollutants, and particularly the pollutant 6PPD-quinone, which results from the wear of vehicular tires on highways, roads, and parking lots (e.g., McIntyre et al. 2021; Brinkmann et al. 2022). Logging and land conversions are major sources of increased sediments to streams and rivers. Loss of high quality riparian zones also causes elevated stream temperatures and sometimes reductions in dissolved oxygen, both of which reduce water quality. Affected watersheds: : Many of the streams and rivers in the region are affected to varying degrees with reduced water quality.	▪ Elevated stream temperatures can negatively affect salmonid population performance by limiting growth, prompting juvenile redistribution in search of cool water refuges, or in severe cases, direct mortality. ▪ Low DO levels in late summer and early fall when flows are at seasonal lows can adversely affect population performance by limiting growth or causing direct mortality. ▪ Increased sedimentation reduces habitat quality and can cause increased mortality or stress in certain life stages. ▪ Small amounts of chemical pollutants can adversely affect the physiology or behavior of both juvenile and adult salmonids, leading to stress, mortality, reduced homing to spawning areas, or reproductive success. This has been found to be particularly an issue for coho salmon as a result of runoff from areas with high street density and parking lots; residue from rubber tires that contains the chemical 6PPD-quinone is highly toxic to adult coho; recent research also shows toxicity to rainbow/steelhead trout while chum salmon are asymptomatic to the pollutant.	▪ Large scale clearcutting affects micro-climate of stream systems and can elevate water temperatures. ▪ Loss of riparian trees along streams can directly lead to elevated water temperatures. ▪ Increased water temperatures, combined with low flows and high levels of organic material, can result in diminished DO levels. This condition can be particularly severe in off-channel habitats and wetlands, and when flows are extremely low. ▪ Runoff from roads, highways, and parking lots are sources of chemical pollutants, and particularly the chemical 6PPD-quinone. ▪ Runoff from residential and agricultural areas is a source of pesticides.	▪ Continue to improve forest management plans to promote more diverse stand age across the landscape (i.e., avoid cutting huge contiguous land parcels at the same time). ▪ Promote diverse stand age in the managed forest. ▪ Restoration of riparian corridors having old-growth characteristics. ▪ Research continues on finding solutions to the pollutant 6PPD-quinone that is a result of the wear of vehicle tires on highways, roads, and parking lots. ▪ Improved measures to capture runoff from sites likely to contain pollutants and routing into infiltration areas. ▪ Improved education of the public on sources of pollutants and how the public can help to reduce these sources.	▪ Protect riparian: Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ Runoff BMPs: Adopt or improve (i.e., update as needed) requirements for BMPs related to storm runoff management on agricultural, residential, commercial, or urbanized lands, including all transportation corridors that produce pollutants, promoting greater increases in storm-water infiltration using various methods and greater capacity for storm-water detention or retention. Studies show that 6PPD-quinone's toxic effects can be reduced or prevented through best practices for stormwater management, including certain green infrastructure installations that filter polluted stormwater through mixtures of soils and sand (SAM 2017; Puget Soundkeeper 2022). Research is also underway to alter chemical composition used in the manufacture of rubber tires.

Freshwater Habitat: ***Marine-derived nutrient loading and characteristics***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Some streams in the region have likely undergone reductions in marine-derived nutrients compared to their historical levels. This decline in nutrient levels (oligotrophication) has largely been man-caused as a result of the depletion of salmon populations due to harvesting and habitat loss and degradation. (Some systems have naturally relatively low nutrient levels—in these cases, they have often been reduced to even lower nutrient levels.) Oligotrophic ecosystems are nutrient-poor and are characterized by low annual rates of biotic production. The goal of nutrient supplementation (restoration) to is to increase the biological productivity of streams, riparian areas, upland areas, and estuaries by returning the nutrients originally supplied by anadromous fish carcasses back to the anadromous spawning zone of streams. Ideally, the ecosystem functions formerly supported by naturally spawning anadromous salmonids will be restored. Restoring this functionality will require restoring terrestrial and aquatic plant and animal communities in addition to anadromous fish. Affected watersheds: All streams where salmon spawning escapements are typically small.	▪ Dissolved nutrients are a critical component of salmon ecosystems. ▪ Loss of key nutrients in aquatic systems reduce the primary and secondary productivity of those systems, thereby affecting fish production—this has been demonstrated in many salmon ecosystems of the Pacific Northwest and Alaska. ▪ Reduced nutrient levels in salmon ecosystems diminish the carrying capacity of streams. ▪ Reduced nutrient levels can also adversely affect salmon population productivity (survival measured at low population density) due to severe reductions in quality of prey species.	▪ Man-related changes to the environment can reduce the amount key nutrients, including those that are marine-derived, needed by productive salmon ecosystems. ▪ Man-caused reasons for oligotrophication are drainage of wetlands, acidification, deforestation, and reductions in naturally spawning salmon. ▪ Salmon are an important conveyor of ocean nutrients to the watersheds where they were spawned. Their death after spawning enriches their natal freshwater and riparian habitats with the marine-derived nutrients. Overfishing and/or habitat degradation that reduce salmon populations can result in large reductions in marine-derived nutrients to freshwater systems. ▪ Loss of access by migrating adult salmonids to upstream areas by various types of passage barriers causes a loss of marine-derived nutrients to those areas, which can have cascading effects on the ecology of those areas.	▪ Reforestation and restoration of wetlands (these solutions are addressed through related issues above). ▪ Stream fertilization to increase the aquatic productivity of stream rearing habitats. ▪ Recovery of salmon populations to higher levels as a result of varied restoration efforts. ▪ Restore connectivity of stream systems where salmon access has been lost due to barriers.	▪ Nutrient supplement: Assess nutrient loading with marine-derived nutrients and nutrient processing in the watershed(s) of interest; as warranted, increase loading with fertilizer supplements or salmon carcasses. ▪ Natural barrier: Assess passage effectiveness at potential partial natural barriers if a salmon recovery effort might be hindered by limited passage, or if climate change can be expect to worsen passage effectiveness (such as at the South Fork Skokomish R. gorge cascades), and as deemed warranted, implement remedial measures to improve passage. ▪ Road crossings: Periodically evaluate stream crossing structures for passage effectiveness, maintain crossing structures consistent with BMPs, remove crossing structures on closed or abandoned roads, replace or upgrade outdated structures on a priority basis. ▪ Cushman Settlement: Restore salmon populations to the NF Skokomish River upstream of the Cushman Dams.

Freshwater Habitat: ***Dams and reservoirs***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Two major dams were built on the North Fork Skokomish River in the late 1920s. Those dams inundated much of the upper North Fork, forming one major and one smaller reservoir. The dams served to divert most of the North Fork flow out of the Skokomish watershed to Hood Canal for electric power generation, significantly altering the Skokomish River flow regime. No provisions for fish passage were provided at the dams, and combined with the flow diversion, resulted in the demise of the spring Chinook run into the North Fork and a loss in abundance of other salmonid populations. Although the Cushman Settlement, agreed on in 2009, provides for fish passage and reintroduction of fish runs to the upper North Fork, the reservoirs will remain in place for at least the next 40 years. Smaller dams have also been built on the Little Quilcene River and Union River, which serve to divert water for municipal purposes. Affected watersheds: This issue only applies directly to the Skokomish River. The dams in the Quilcene and Union drainage do not inundate historic habitat.	▪ Loss of access resulted in extinction of early-timed Chinook in the NF. ▪ Loss of accessibility for Chinook to re-colonize naturally. ▪ Loss of a major portion of productive Chinook habitat in the Skokomish basin due to inundation by Cushman reservoirs. ▪ Characteristics of flow regime in NF over past 80 years not supportive of native Chinook life histories (loss or changes in queues and habitat conditions for adult migration, spawning, and fry migration). ▪ Losses in habitat quantity in NF due to extreme reductions in flow. ▪ Severe aggradation in lower mainstem reduced habitat quantity and quality (creating more unstable conditions for egg incubation) --effects have extended into the river mouth estuary.	▪ Dam construction without passage facilities ▪ Inundation of productive habitat by reservoirs ▪ Dam construction and associated hydro-electric operations with water diversion out of basin	▪ Fish passage for migrating early-timed Chinook ▪ Reintroduction and on-going supplementation of early-timed Chinook using artificial propagation methods ▪ Re-creation of normative flow regime in the NF through change in how flows are regulated at Cushman Dam ▪ Regulation of high flows at Cushman Dam to promote channel scour and facilitate return to more normative conditions	▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration. Note: whether spring Chinook will be reintroduced upstream of the upper North Fork dam is in question as of 2022 due to concerns by Olympic National Park about potential impacts on the small resident Chinook population in Cushman Reservoir.

Freshwater Habitat: *Climate change*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Accelerated rates of climate change are unambiguously well documented and salmon recovery planners are urged by NOAA Fisheries, as well as Washington State resource agencies, to account for climate change in their planning. Efforts to restore stream habitat will be inadequate without accounting for climate change. Stream systems in Western Washington will be directly affected by climate change through alterations in the amount and timing of streamflow and sediment yield, as well as by an increase in average air temperature. These changes in turn will affect water temperature regimes and habitat quantity, distribution, stability, and quality. Actions aimed at ameliorating the effects of climate change should protect existing core habitats that support populations of concern and aim to restore normative in-channel, floodplain, sediment supply and transport, and flow regime characteristics as quickly as possible. Affected watersheds: All streams and rivers to some extent. Certain species, i.e., summer chum, summer steelhead, and spring Chinook are expected to be affected the most. The Dungeness watershed is particularly vulnerable to climate change effects that are increasing the frequency of drought.	▪ Increased stream temperatures during summer can stress both juvenile and adult salmonids, causing increased mortality, changes in habitat use patterns, behaviors, and ultimately lead to reductions in fish population performance. ▪ Increased environmental variability of different factors (such as intensity of storms and droughts) can increase variation in survival and performance of fish populations in one or life stages, making a population more vulnerable to extirpation. This can be manifested in lower stream flows in some years or greater peak winter flows due either to more intense storm events or the frequency of rain-on-snow events producing more frequent flooding.	▪ Natural, long-term patterns of climate cycles, independent of man's actions. ▪ Increased accumulation of atmospheric carbon dioxide resulting from man's activities, altering weather patterns and patterns of heating and cooling. ▪ Aggravating causes, combined with those directly linked to climate change, include those listed above under Flow Regime Characteristics.	▪ Maintain and promote aggressive approaches to salmon habitat restoration and protection priorities that account for climate change. ▪ Creation of artificial off-channel reservoirs to augment late-summer instream flows. ▪ Also see solutions under Flow Regime Characteristics. (Actions shown here address what can be done locally to ameliorate effects of climate change on salmonid habitat.)	▪ Dungeness Rule: Implement provisions of the Dungeness water rule adopted by WDOE in 2012. To the extent possible, purchase water credits from the water bank for protecting late summer low flows in the Dungeness River. Expand the rule to other areas of the Dungeness watershed as needed to ensure that minimum flows are maintained in the Dungeness River. ▪ Water rights: Purchase water rights and dedicate those rights to conservation. ▪ Water storage with creation of off-channel reservoirs: Create off-channel water storage reservoirs that would be filled during winter and spring high flow runoff and then used to augment late summer instream flows. The proposed Dungeness Off-Channel Reservoir Project offers a storage concept that has broad support by state, local, and tribal officials in the Dungeness valley (see Anchor 2022). ▪ All actions related to protection and restoration of normative floodplain conditions will provide resilience to ecological processes that can be affected by climate change. ▪ All actions related to protection and restoration of riparian zones will provide resilience to ecological processes that can be affected by climate change. ▪ All actions related to restoration of normative sediment supply and transport characteristics will provide resilience to ecological processes that can be affected by climate change. ▪ All actions related to restoration of normative flow regime characteristics will provide resilience to ecological processes that can be affected by climate change. ▪ Anticipate that passage effectiveness at the South Fork Skokomish R. gorge cascades will worsen for re-introduced spring Chinook, assess potential remedial measures, and implement those measures as warranted.

Natal Estuarine: *Tidal flow regime and connectivity*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Tidal flow regimes, including both freshwater input and saltwater tidal exchange, have been altered in many of the estuarine features of the region as a result of changes in the stream's flow regime, barriers to tidal exchange (such as by diking and placement of roads or highways within or across the estuary), aggradation and progradation, and loss of wetlands, changes in delta area or structure, or loss in channel area due to diking and/or filling. These changes often have resulted in loss of tidal prism, affecting estuarine sediment transport, tidal flow dynamics and patterns, and salinity structure, which can alter wetland vegetation types and estuarine nutrient dynamics and food webs. Tidal flow regimes have also been affected by construction of tidal gates. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees. Two priority natal stream-mouth estuaries have been identified to be Duckabush River (https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp) and Snow-Salmon Creek (Snow-Salmon Creek forum synthesis, HCCC [2021}).	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Tidal flow regime and connectivity are key elements of good estuarine habitat.	▪ Loss of tidal flow regime and connectivity due to diking and levees, tidal gates, filling associated with land conversions, and shoreline armoring. ▪ Changes in the freshwater flow regime. ▪ Increased sediment loading due to increased supply from upstream and from loss of tidal prism.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportation infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.

Natal Estuarine: *Sediment supply and transport*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Erosion and sediment transport by rivers is one of the natural watershed processes that shape stream channels and floodplains and the associated habitats and aquatic biota. Prior to the rapid alteration of watersheds by Euro-Americans, sediment transport from rivers is believed to have generally been in equilibrium with sediment supply in the rivers and streams of the region. Watershed alterations and management have disrupted these processes, resulting in changes—often very significant ones, to the sediment supply, storage, and movement to the estuaries--and in their transport from the rivers. Consequently, aggradation and, in many cases, unusually high rates of progradation have occurred to the estuaries of most rivers in the region, affecting channel connectivity, wetland and marsh composition, and eelgrass beds on the outer deltas. Aggradation has been particularly severe in some parts of the Skokomish estuary. Progradation has occurred to the rivers on the west side of Hood Canal, as well as in the Dungeness River and Jimmycomelately Creek. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Changes in sediment supply and transport in natal estuaries have led to less diverse habitats and associated loss in performance and residency by juvenile salmonids.	▪ Increased sediment loading due to increased supply from upstream and from loss of tidal prism. ▪ Loss of area in tidal deltas to process sediment supply in a manner that maintains delta structure conducive to producing diverse habitats for young salmonids. ▪ Diking within natal estuaries has changed how sediment accumulates and is processed through the delta, affecting the nature of the associated habitats.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy for sediment processing. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportations infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.

Natal Estuarine: *Estuarine wetlands*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Historically, estuarine wetlands were well distributed and very abundant throughout the Puget Sound coastline, including in Hood Canal and along the eastern SJDF. These wetland areas were, and continue to be, highly important to estuarine and nearshore food webs and to the growth, survival, and production of juvenile salmonids. Extensive loss of estuarine wetlands has occurred over many areas of Puget Sound and in the many stream-mouth estuaries due to diking, draining, and filling. There have also been changes in the accessibility of many wetlands to juvenile salmonids as a result of diking and tidal gates. Some estuaries have undergone extensive changes in composition of types of wetlands as a result of changes in tidal flow and freshwater inputs, affecting the biological function of existing wetlands. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Loss of the quantity and quality (including composition) of estuarine wetlands has reduced the productivity of estuarine habitat and its characteristics to function as high quality physical habitat. ▪ Loss in connectivity to wetlands has diminished the access of juvenile salmonids to estuarine wetlands.	▪ Filling of wetlands and land conversion. ▪ Diking within natal estuaries has disconnected wetlands from full tidal connection. ▪ Infrastructure (roads and highways) crossings and placement within estuarine areas has altered the connectivity of wetlands and resulted in loss of area. ▪ Increased sediment loading from upstream as changed the structure and composition of wetlands.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy for sediment processing. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportation infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.

Natal Estuarine: ***Shoreline and channel conditions***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Estuarine shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, and transportation corridors. Such changes were particularly significant in all of the major river-mouths of Hood Canal (i.e., west-side rivers) and in the Dungeness River. Estuarine shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, and transportation corridors. Such changes were particularly significant in all of the major river-mouths of Hood Canal (i.e., west-side rivers) and in the Dungeness River. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees. Two priority natal stream-mouth estuaries have been identified to be Duckabush River (https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp) and Snow-Salmon Creek (Snow-Salmon Creek forum synthesis, HCCC [2021}).	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Altered shoreline conditions have reduced the quality and diversity of physical habitats within natal estuaries for juvenile salmonids, resulting in reduced carrying capacity of these areas and habitats less likely to facilitate prolonged residency, good growth, and protection from predators.	▪ Filling of wetlands and land conversion, associated with bank armoring and diking. ▪ Infrastructure (roads and highways) crossings and placement within estuarine areas has altered the connectivity of wetlands and resulted in loss of area. ▪ Progradation of natal estuaries from increased sediment loading and other changes has altered channel elevations and changed substrate composition.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy for sediment processing. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream. ▪ Removal of shoreline armoring and other structures affecting habitat quality and diversity.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportation infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.

<u>Natal Estuarine:</u> *Water quality*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The water quality of stream-mouth estuaries and the nearshore environment can be affected by various pollutants, originating either within the adjacent watersheds or from accidental spills due to recreational, industrial, or military activities associated with boating or shipping activity. Runoff from lands where all types of land management practices can be sources of different types of pollutants to stream-mouth estuaries and the nearshore environment, including fine sediment and various types of chemicals and heavy metals. Runoff from highways and well-traveled roads are particular sources of substances of concern. Urbanized areas, where parking lots and densely populated areas, are also known sources of pollutants, and particularly the pollutant 6PPD-quinone, which results from the wear of vehicular tires on highways, roads, and parking lots (e.g., McIntyre et al. 2021; Brinkmann et al. 2022). <u>Affected watersheds:</u> The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ Elevated water temperatures can negatively affect salmonid population performance by limiting growth, prompting juvenile redistribution in search of cool water refuges, or in severe cases, direct mortality. ▪ Low DO levels can adversely affect population performance by limiting growth or causing direct mortality. ▪ Increased sedimentation reduces habitat quality and can cause increased mortality or stress in certain life stages. ▪ Small amounts of chemical pollutants can adversely affect the physiology or behavior of both juvenile and adult salmonids, leading to stress, mortality, reduced homing to spawning areas, or reproductive success. This has been found to be particularly an issue for coho salmon as a result of runoff from areas with high street density and parking lots; residue from rubber tires that contains the chemical 6PPD-quinone is highly toxic to adult coho; recent research also shows toxicity to rainbow/steelhead trout while chum salmon are asymptomatic to the pollutant.	▪ Reduced water quality of flow entering the natal estuary can diminish water quality and sediment quality within the natal estuary (see causes under Freshwater Habitat – Water quality). ▪ Loss in tidal prism and tidal flow within the natal estuary to maintain good flushing of the area. ▪ Pollutant spills or discharges of toxic substances within the natal estuary. ▪ Legacy pollutants and residue from previous activities within the area.	▪ See solutions for Freshwater Habitat. ▪ Remove legacy pollutants and residue within the estuarine area. ▪ Improved measures to capture runoff from sites likely to contain pollutants and routing into infiltration areas. ▪ Restore wetlands and riparian vegetation. ▪ Improved education of the public on sources of pollutants and how the public can help to reduce these sources.	▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Pollution control:</u> Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. Also, actions directed at restoring and protecting freshwater water quality are applicable.

Natal Estuarine: *Riparian conditions*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Riparian zones bordering stream-mouth estuaries and the shorelines of the marine nearshore environment of the region have been impacted to varying degrees by a wide variety of land-use activities, which include logging and all types of land clearing and land conversion to support societal needs. These activities have removed or altered riparian plant communities, which affect how riparian zones function in support of salmonid populations. The current condition of estuarine and nearshore riparian zones in the Hood Canal and eastern SJDF region varies greatly, ranging from areas with virtually no function to support salmonids to other areas that are virtually pristine (or close to it). Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ The ecological health of streams and natal estuaries is closely linked to the watershed landscape by the biotic and physical-chemical properties of the riparian zone. Riparian vegetation continues to serve this role in the natal estuaries, particularly in the upper, forested zone of the stream-mouth estuary. ▪ Riparian zones affect stream and shoreline shading, influencing stream temperature, dissolved oxygen, and plant species composition (e.g., invasives) along the shorelines—all of which affect salmonid performance and habitat use. ▪ Riparian zones affect water quality by trapping suspended and fine sediments and pollutants. ▪ Riparian zones store water during high flows—to be released slowly to the stream over time. ▪ Riparian zones stabilize streambanks and help maintain channel stability and bank cover for fish. ▪ Riparian zones add leaf matter and wood for the stream and stream-mouth estuary, providing both nutrients and structure to stream ecosystems. All of these functions directly and indirectly affect salmonids. ▪ Riparian vegetation supports a terrestrial-based insect food source for juvenile salmonids, which is a quality food source.	▪ Wide scale logging of old-growth forests, including riparian forests, in every watershed in the region over the past 150 years; logging continues to various degrees within existing riparian forests. ▪ Land conversion within the riparian corridors of rivers and streams in the valleys of nearly every watershed in the region, has turned riparian forested corridors into agriculture areas, rural residential areas, road systems, and urban areas (such as in the Dungeness valley and in the lower Union R.). This condition has also occurred extensively in the stream-mouth estuarine corridors. ▪ Use of off-road vehicles within riparian corridors. ▪ Construction of dikes and levees and bank hardening with rip-rap. ▪ Growth and spread of invasive plant species such as Japanese knotweed and reed canary grass, which affect the growth and survival of native vegetation within the riparian corridor and can choke seasonal channels within the corridor.	▪ Promote diverse old-growth characteristics of riparian forests by expanding buffer widths where possible, or use of active management practices (e.g., thinning, planting, and shrub and herb control) to accelerate achievement of desired conditions within the riparian corridor. ▪ Eradication of Japanese knotweed and management of reed canary grass. ▪ Restore native plant communities to the riparian corridors along stream-mouth estuaries.	▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian vegetation characteristics (considering riparian distribution, continuity, size of stands, and stand composition) using passive or active management methods.

<u>Non-Natal Estuarine and Nearshore:</u> *Tidal flow regime and connectivity*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The tidal flow regimes, including both freshwater input and saltwater tidal exchange, have been altered in many of the estuarine features of the region as a result of changes in the stream's flow regime, barriers to tidal exchange, and loss of wetlands, delta area, or channel area due to diking and/or filling. These changes often have resulted in loss of tidal prism, affecting estuarine sediment transport, tidal flow patterns, salinity structure, which can alter wetland vegetation types and estuarine nutrient dynamics and food webs. Tidal flow regimes have also been affected by construction of tidal gates. <u>Affected areas:</u> Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Tidal flow regime and connectivity are key elements of good estuarine habitat.	▪ Loss of tidal flow regime and connectivity due to diking and levees, tidal gates, filling associated with land conversions, and shoreline armoring. ▪ Changes in the freshwater flow regime. Increased sediment loading due to increased supply from upstream and from loss of tidal prism.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Channel rehab:</u> Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ <u>Hydraulic mod:</u> Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Trans infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.

<u>Non-Natal Estuarine and Nearshore:</u> *Sediment supply and transport*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Beaches and other shoreforms important to juvenile salmonids and forage fish are maintained by sediment sources along Puget Sound and the eastern SJDF transported by tidal and wave action within the region. In Puget Sound, beaches consist of two primary types: 1) those associated with coastal bluffs (called bluffbacked beaches), where the coastline has retreated landward; and 2) those associated with barrier beaches, where sediment has been deposited seaward of the original coastline. These beaches and other associated shoreforms (spits, barrier bars, and tombolos), which are affected by changes in sediment supply and transport processes, are vulnerable to degradation if the sediment sources are altered or if the transport processes are altered. Shoreline armoring, including the use of bulkheads, road locations, and nearshore fill can disrupt these processes and alter the stability of the beaches and other associated features for salmonid and forage fish use, as well as the productivity of these areas to produce forage for juvenile salmonids. <u>Affected areas:</u> Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Beach systems within the Puget Sound complex are productive zones for submerged aquatic vegetation, which function has refuge habitat for juvenile salmon as well as places of abundant, diverse food. ▪ Beach systems provide spawning habitat for forage fish, which serve has an important food base for salmonids.	▪ Shoreline armoring, bulkheads, and stabilization of bluffs (which are sediment sources) act to alter the sediment supply and transport along the shoreline, changing substrate composition, habitat structure, and food production. It can also diminish or eliminate productive eelgrass beds. ▪ Alterations in the tidal flow and tidal prism, sediment loading, and sizes of shoreline inlets and barrier embayments effects sediment processing within these shoreforms (see related issues).	▪ Remove bulkheads, shoreline armoring, and other obstructions to sediment transport (jetties and breakwaters), and restore natural shoreline features. ▪ Protect drift cells and bluffs from shoreline alterations and stabilization. ▪ Restore natural sediment processing rates within barrier embayments and shoreline inlets. ▪ In severe cases where degradation of natural sediment supply and transport rates have occurred, use periodic beach nourishment actions to replenish sediment supplies.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Beach nourishment:</u> The intentional placement of sand and/or gravel on the upper portion of a beach where historic supplies have been eliminated or reduced. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Groin removal:</u> Removal or modification of groins and similar nearshore structures built on bluff-backed beaches or barrier beaches in Puget Sound. ▪ <u>Large wood:</u> Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Re-vegetation:</u> Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Trans infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.

Non-Natal Estuarine and Nearshore: ***Small embayments and open inlet shoreforms***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Puget Sound, including Hood Canal and the eastern SJDF, historically contained hundreds of small, protected embayments and open inlets along the coastlines. Many of these were in the form of stream-mouth estuaries and barrier lagoons. Many of these features included a barrier beach that wholly or partially enclosed a lagoon or estuary. (Small embayments are often referred to as pocket estuaries.) The amount of freshwater influences within these features varies widely. Most of these embayments and inlets historically contained estuarine wetlands. A large percentage of these landforms have been degraded, or lost entirely, through nearshore filling, transportation corridors, or shoreline armoring. Affected areas: Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Coastal (or shoreline) inlets provide non-natal rearing habitat (as well as natal rearing habitat for fish produced in the upstream watershed) for juvenile salmonids migrating along the shoreline; these are productive areas for food and provide predator refugia. ▪ Barrier embayments lack the wetland area of river deltas but provide a network of distributed tidal wetlands thought to be important for rearing juvenile salmonids. These areas provide diverse functions due to their sheltered microclimate, high terrestrial inputs, frequent streamflow, and organic sediments.	▪ Increased sediment loading due to increased supply from upstream watershed and from loss of tidal prism. ▪ Loss of area in tidally influenced zone due to filling, bulkheads, diking, and roads and bridges. ▪ Changes in tidal flow due to filling, bulkheads, diking, and roads and bridges. ▪ Changes in shoreline features and structure associated with filling, bulkheads, diking, and roads and bridges.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy for sediment processing. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Large wood: Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Trans infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.

<u>Non-Natal Estuarine and Nearshore:</u> *Estuarine wetlands*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Historically, estuarine or tidal wetlands were well distributed and very abundant throughout the Puget Sound coastline, including in Hood Canal and along the eastern SJDF. These wetland areas were, and continue to be, highly important to estuarine and nearshore food webs and to the growth, survival, and production of juvenile salmonids. Extensive loss of estuarine wetlands has occurred over many areas of Puget Sound and in the many stream-mouth estuaries due to diking, draining, and filling. There have also been changes in the accessibility of many wetlands to juvenile salmonids as a result of diking and tidal gates. Some estuaries have undergone extensive changes in composition of types of wetlands as a result of changes in tidal flow and freshwater inputs. <u>Affected areas:</u> Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Diverse and productive estuarine habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Loss of the quantity and quality (including composition) of estuarine wetlands has reduced the productivity of estuarine habitat and its characteristics to function as high quality physical habitat. Loss in connectivity to wetlands has diminished the access of juvenile salmonids to estuarine wetlands.	▪ Filling of wetlands and land conversion. ▪ Diking within natal estuaries has disconnected wetlands from full tidal connection. ▪ Infrastructure (roads and highways) crossings and placement within estuarine areas has altered the connectivity of wetlands and resulted in loss of area. Increased sediment loading from upstream as changed the structure and composition of wetlands.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy for sediment processing. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Channel rehab:</u> Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Hydraulic mod:</u> Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ <u>Invasives:</u> Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Re-vegetation:</u> Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Trans infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.

Non-Natal Estuarine and Nearshore: *Shoreline modifications and infrastructure in nearshore waters*

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
Estuarine and nearshore shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, transportation corridors, and construction of overwater structures such as docks, piers, and marinas. Shoreline armoring has been particularly severe in the southern end of Discovery Bay, parts of Admiralty Inlet, along some areas of northern Hood Canal, and especially along the southern parts of Hood Canal where it is almost continuous. Many overwater structures also occur in some of these areas and in some locations within Sequim Bay. Affected areas: Extensive amounts of the shoreline within the region have been altered to varying extents. The infrastructure at the Hood Canal Bridge has been found to particularly affect the survival of steelhead smolts passing under the bridge (Moore and Berejikian 2013 and 2022). Also, it appears likely that migrant juvenile chum salmon may pause their outmigration near the bridge, making them more susceptible to predation mortality (Daubenberger et al. 2020).	▪ Diverse and productive estuarine/nearshore habitats are critical to juvenile salmonids in providing foraging conditions that are optimal for young fish (abundant, diverse and high quality food items), habitat characteristics that provide for predator avoidance, and a transitional zone for physiological change for young fish going from fresh to saltwater. ▪ The diverse types of estuarine habitat in the Puget Sound complex typically produces much higher survival than is experienced by fish populations that do not have such a diverse estuarine experience. ▪ Altered shoreline conditions have reduced the quality and diversity of physical habitats within natal and non-natal estuaries for juvenile salmonids, resulting in reduced carrying capacity of these areas and habitats less likely to facilitate high survival residency, good growth, and protection from predators. ▪ Changes in the intertidal shoreline features has negatively affected eelgrass beds and other areas used by feeding young salmonids—increasing predator exposure and decreasing the quantity of productive nearshore habitats for supporting young salmon.	▪ Filling of wetlands and land conversion, associated with bank armoring and diking. ▪ Infrastructure (roads and highways) crossings and placement within estuarine and nearshore areas has altered the connectivity of wetlands and resulted in loss of area. ▪ Shoreline armoring and construction of bulkheads to protect private property. ▪ Placement of jetties and breakwaters. ▪ Construction of overwater structures, such as docks and piers. ▪ The Hood Canal Bridge has been found to impede the outmigration of juvenile salmonids, most significantly for steelhead smolts, resulting in substantially elevated predation mortality. ▪ Progradation of natal and non-natal estuaries from increased sediment loading and other changes has altered channel elevations and changed substrate composition, adversely affecting the diversity of estuarine habitats.	▪ Reclamation of estuarine area lost to land conversions and diking. ▪ Dike breaching and dike removal. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) to restore tidal flow and tidal energy for sediment processing. ▪ Removal of overwater structures. ▪ Restoration of connectivity to historic channels and flow pathways. ▪ Restoration of more normative freshwater flow regimes. ▪ Restoration of more normative sediment loading regimes from the watershed upstream. ▪ Removal of shoreline armoring and other structures affecting habitat quality and diversity. ▪	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Beach nourishment: The intentional placement of sand and/or gravel on the upper portion of a beach where historic supplies have been eliminated or reduced. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ Groin removal: Removal or modification of groins and similar nearshore structures built on bluff-backed beaches or barrier beaches in Puget Sound. ▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Large wood: Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Trans infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. A need for a modification to the Hood Canal Bridge is especially highlighted.

Non-Natal Estuarine and Nearshore: ***Water quality***

Issue and Affected Areas	Relevance to Salmonids	Causes	Solutions	Actions
The water quality of stream-mouth estuaries and the nearshore environment can be affected by various pollutants, originating either within the adjacent watersheds or from accidental spills due to recreational, industrial, or military activities associated with boating or shipping activity. Runoff from lands where all types of land management practices can be sources of different types of pollutants to stream-mouth estuaries and the nearshore environment, including fine sediment and various types of chemicals and heavy metals. Runoff from highways and well-traveled roads are particular sources of substances of concern. Urbanized areas, where parking lots and densely populated areas, are also known sources of pollutants, and particularly the pollutant 6PPD-quinone, which results from the wear of vehicular tires on highways, roads, and parking lots (e.g., McIntyre et al. 2021; Brinkmann et al. 2022). Affected areas: Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Elevated water temperatures can negatively affect salmonid population performance by limiting growth, prompting juvenile redistribution in search of cool water refuges, or in severe cases, direct mortality. ▪ Low DO levels can adversely affect population performance by limiting growth or causing direct mortality. ▪ Increased sedimentation reduces habitat quality and can cause increased mortality or stress in certain life stages. ▪ Small amounts of chemical pollutants can adversely affect the physiology or behavior of both juvenile and adult salmonids, leading to stress, mortality, reduced homing to spawning areas, or reproductive success. This has been found to be particularly an issue for coho salmon as a result of runoff from areas with high street density and parking lots; residue from rubber tires that contains the chemical 6PPD-quinone is highly toxic to adult coho; recent research also shows toxicity to rainbow/steelhead trout while chum salmon are asymptomatic to the pollutant.	▪ Reduced water quality of flow entering the natal estuary can diminish water quality and sediment quality within the natal estuary (see causes under Freshwater Habitat – Water quality). ▪ Loss in tidal prism and tidal flow within the natal estuary to maintain good flushing of the area. ▪ Pollutant spills or discharges of toxic substances within the natal estuary. ▪ Legacy pollutants and residue from previous activities within the area.	▪ See solutions for Freshwater Habitat – Water quality. ▪ Remove legacy pollutants and residue within the estuarine area. ▪ Improved measures to capture runoff from sites likely to contain pollutants and routing into infiltration areas. ▪ Restore wetlands and riparian vegetation. ▪ Improved education of the public on sources of pollutants and how the public can help to reduce these sources.	▪ Pollution control: Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem.

Assessments for Improved Recovery Planning: ***Adult salmon staging to freshwater and vulnerability to harvest***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
There is a need to better understand the distribution and staging patterns of adult coho as they near their natal streams and rivers to assist harvest managers in designating harvest area boundaries and associated fishing regulations. Although the coho spawning escapement goal is defined for the entirety of Hood Canal, fishing regulations are generally established to avoid overfishing subpopulations or stream-specific stocks. Maintaining stock diversity and population structure within the region is an important aspect of management. The same need exists to know about summer chum staging patterns. This issue recognizes that this data gap exists and some form of assessment work may be needed. Relevant areas: Potentially many of the streams in Hood Canal.	▪ Some species of adult salmonids stage near the mouths of their natal streams in ways that can make them more vulnerable to harvest, as they await environmental queues and proper conditions for ascending the streams. ▪ The staging patterns of these species are not well understood in Hood Canal.	▪ No assessment has been made to improve understanding about staging behavior and patterns in Hood Canal. ▪ Some entities involved in habitat restoration activities are concerned that some stocks may be overly vulnerable to fishing pressure, making these stocks subject to significantly reduced abundance.	▪ Perform a well-designed assessment to investigate staging behavior and patterns for species of concern.	▪ Assess adult salmon staging: Assess staging behavioral patterns of coho and summer chum as they approach their natal streams, assessing spatial patterns and distributions in relation to the stream mouths and environmental queues or factors that affect those patterns and distributions. No assessment work has been done on this issue since the 2015 prioritization report was issued.

Assessments for Improved Recovery Planning: ***Genetic characterization of summer chum harvests by area or subarea in HC and SJDF***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
Recent analyses on the performance of the various summer chum subpopulations have relied on fishery run reconstruction methods that have been employed for decades. Those methods make assumptions about the distribution of the catch contributions (such as incidental harvest) of various subpopulations in the different harvest areas. Genetic sampling of the catches in the different fisheries would enable harvest managers to better understand the distributions of the summer chum subpopulations in the various areas that are subject to harvest. Such data would be important to improve run reconstruction methods and future analyses to evaluate subpopulation performance as recovery efforts (including habitat restoration) progress. Relevant areas: All summer chum stocks, but mainly those in Hood Canal.	▪ Estimation of the adult run sizes of the various stocks of summer chum depends on reliable estimates of the numbers of each stock that are harvested each year. The reliability of these estimates is extremely important for evaluating progress toward recovery of the two summer chum populations that comprise the ESU.	▪ Lestelle et al. (2014) identified a need for this assessment.	▪ Sample the catches of summer chum in the various fisheries to determine genetic composition, using what is known about genetic characterization of the stocks based on data collected in the natal spawning streams.	▪ Assess summer chum genetics: Assess stock composition of the catches of summer chum in different fisheries within Hood Canal and the eastern SJDF using genetic stock identification methods. No assessment work has been done on this issue since the 2015 prioritization report was issued.

Assessments for Improved Recovery Planning: ***Species and stock-specific juvenile habitat use and residency in estuarine and nearshore habitats***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
There is still a need to better understand how juvenile salmonids in the Hood Canal and eastern SJDF use natal and non-natal estuarine and nearshore habitats during their residency and emigration periods. Many of the modeling analyses that have been performed on summer chum and Chinook in the region have relied on data collected in the 1970s and early 1980s, which in the case of chum, focused on fall chum and on areas in the northern parts of Hood Canal. The Chinook analyses have generally relied on data collected in northern Puget Sound and in British Columbia. It is important to fill this data gap to better ensure that recovery planning in this region is based on region-specific information and on data applicable to summer chum. It is noted that the recent surge in productivity with many summer chum stocks is due to a PDO effect, providing good opportunity to collect field data pertaining to habitat use by summer chum stocks. Relatively recent work was conducted by the Wild Fish Conservancy on nearshore utilization patterns in mid-Hood Canal and Dabob Bay (Tuohy et al. 2019) but significant uncertainties remain, particularly with regard to use of natal estuarine and associated delta habitats. Relevant areas: The entire region of interest in this report.	▪ Improved knowledge about the use of natal and non-natal estuarine and nearshore habitats by juvenile salmonids, particularly for summer chum, will inform decision-making and prioritization about matters related to protection and restoration of these habitats.	▪ Concerns exist that inadequate attention is given to the protection and restoration of natal and non-natal estuarine and nearshore habitats for juvenile salmonids, particularly for summer chum, and forage species.	▪ Perform a well-designed assessment to improve knowledge about how juvenile salmonids, particularly summer chum, use natal and non-natal estuarine and nearshore habitats of Hood Canal, Admiralty Inlet, and the eastern SJDF.	▪ Natal/non-natal estuarine and nearshore juvenile assess: Assess the use of different estuarine and nearshore habitats by juvenile chum and Chinook within all major subregions and embayments in Hood Canal and the eastern SJDF (including Admiralty inlet) based on field sampling. Sampling should be performed over the range of all statistical weeks when age-0 fish of each species and run-type can be present, using more than one gear-type. The assessment should include: arrival time, residency time, period of use, relative abundance, stock and reproductive (natural or hatchery) origin, and size and growth. Some of this work for summer chum was done relatively recently by the Wild Fish Conservancy as reported on by Tuohy et al. (2019). That work was focused in the vicinity of Dabob Bay and significant information gaps remain. It bears noting that alternative hypotheses have been proposed for the role of natal subestuarine areas to wild juvenile salmon production, particularly for summer chum, in Hood Canal. Lestelle et al. (2018) and more recent analysis (in progress) suggest that natal subestuaries and nearshore areas in the vicinity of those habitats are particularly important to summer chum performance. Alternatively, Daubenberger et al. (2017) and Tuohy et al. (2019), proposed that habitats not associated with natal subestuaries were most important to summer chum performance. A well-designed assessment to resolve these differing hypotheses is needed. There remains a need for focused work on juvenile summer chum use of natal subestuaries, particularly on those subestuaries on the Union, Skokomish, Duckabush, Quilcene, and Snow-Salmon watersheds. ▪ Estuarine and nearshore summer chum early growth rates: Assess the early-estuarine/marine growth patterns from otoliths or scales during periods of warm and cool PDO. Such an assessment was originally proposed by Brian Beckman (NOAA) during the climate forum held by HCCC in March, 2017. The study would help understand the role of nearshore habitats near natal streams in affecting subpopulation performance related to the PDO. It would help in identifying causal mechanisms to differential survival among subpopulations and how these factors should be considered in recovery and maintenance of recovery.

Assessments for Improved Recovery Planning: ***Forage fish spawning distribution assessment***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
Limited information exists on the spawning distribution of forage fish within Hood Canal and the eastern SJDF (including Admiralty Inlet). There is strong evidence that forage fish populations throughout Puget Sound are in sharp decline, affecting food webs that help support salmon populations. There is a need to assess spawning distributions of key species in this region, and if possible, to assess spawning stock sizes. This information would inform planning for protection and restoration actions aimed at maintaining and improving stock size of forage fish species. Relevant areas: The entire region of interest in this report.	▪ Maintaining healthy populations of forage fish species is vital to the long-term health of the Puget Sound ecosystem and to the many populations of salmonids produced here.	▪ Concerns exist that forage fish populations are declining in Puget Sound and that inadequate attention is being given to maintaining their health.	▪ Perform a well-designed assessment to improve knowledge about the spawning distributions and habitats of forage fish in Hood Canal, Admiralty Inlet, and the eastern SJDF.	▪ Forage fish assess: Assess spawning distributions of forage fish species in the region. This assessment could expand on the work reported by Daubenberger et al. (2017).

<u>Assessments for Improved Recovery Planning:</u> ***Resolution of questions about stock characteristics for fall Chinook recovery in Skokomish R***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
Questions and controversy have existed about whether the existing George Adams stock is an appropriate stock source for recovering a late-timed Chinook stock in the Skokomish River (see the 2010 and 2017 versions of the recovery plan; SIT and WDFW [2010 and 2017]). The 2017 version of the recovery plan set forth an approach for addressing the matter. <u>Relevant areas:</u> Recovery planning in the Skokomish River watershed.	▪ Efforts to recover fall Chinook in the Skokomish River will be affected by decisions about stock characteristics that need to be taken into account in those efforts.	▪ It is not known to what extent life history characteristics associated with true fall Chinook can be recovered using George Adams stock in recovery efforts.	▪ Formulation of an experimental plan to address the suitability of George Adams fish for recovering a true late-timed Chinook stock in the Skokomish River.	▪ <u>Skokomish stock issue:</u> Formulate one or more alternatives for experimentally developing and evaluating life history characteristics for a Chinook stock that could be used in recovering a late-timed Chinook population in the Skokomish River. This might include a stock source other than the one currently produced in the Skokomish River. The experimental plan would identify evaluation criteria and procedures to use in the evaluation. This issue is currently being addressed through on-going work in the Skokomish River (see SIT and WDFW [2017]).

<u>Assessments for Improved Recovery Planning:</u> ***Resolution of questions about stock characteristics for Chinook recovery in Mid Hood Canal rivers***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
Questions and controversy have existed about whether the Chinook returning to Mid-Hood Canal rivers, believed to be sourced to George Adams Hatchery stock, can perform in a manner to achieve recovery. Alternative hypotheses about this matter have been put forth. This issue was originally described in the 2015 prioritization report. <u>Relevant areas:</u> Recovery planning for the Hamma Hamma, Duckabush, and Dosewallips rivers.	▪ Efforts to recover Chinook in the Mid Hood Canal rivers will be affected by whether the existing Chinook that use these rivers have genetic characteristics that make them suitable for recovery in these rivers given the mortality pressures that the existing stocks encounter.	▪ The working hypothesis of the existing Mid Hood Canal Chinook recovery is that the Chinook that currently return to the Mid Hood Canal rivers are sufficiently adapted to the rivers to enable them to recover the population. This hypothesis suggests that the current low abundance is either due to degraded habitat, or that the population is affected by demographic effects (depensation). It is notable that the NOAA habitat biologist involved in recovery consultation does not think that habitat condition is the issue keeping the stocks at low abundance. ▪ An alternative hypothesis is that the existing stocks are ill-adapted to the rivers because they have been strongly altered by hatchery practices (based on information in SIT and WDFW 2010). Information contained in Labbe et al. (2005) suggests that the historical stocks were spring Chinook and that late timed Chinook were not produced in these rivers.	▪ It was proposed several years ago that a multi-agency forum be convened to review all available information applicable to identifying the stock lineage and life history patterns of Chinook produced in or using the Mid Hood Canal rivers, as well as other factors that might be affecting the stocks. Develop a plan for resolving this uncertainty.	▪ <u>Mid HC stock issue:</u> The comanagers jointly addressed this issue through a field study to assess habitat characteristics in the mid-Hood Canal rivers and a related synthesis of available information on what is known about the historical Chinook in the rivers and the current use of the rivers by Chinook. The recently issued report (Meridian and Mid-Hood Canal Work Group [2022]) has been submitted to NMFS. The report findings were inconclusive about the historical run-type. The most relevant conclusion from that analysis was that the historical stocks, if they were naturally sustained, were small; if a reintroduction effort was to be undertaken, it would likely be unsuccessful at recreating a sustainable population. Consequently, no reintroduction effort is currently being contemplated by the comanagers.

<u>Assessments for Improved Recovery Planning:</u> ***Perform diagnosis/prioritization analyses for summer chum watersheds where native stocks extirpated***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
Recovery planning and analyses of action effectiveness for summer chum subpopulations have been based to a large extent on EDT analyses, which were first performed over 15 years ago. These analyses were only performed for the stocks (and associated watersheds) that were extant. Similar analyses had not been performed on the other watersheds where the stocks had been determined to be extirpated: Dungeness River, Chimacum Creek, Big Beef Creek, Tahuya River, Dewatto River, and Skokomish River. Questions have been raised about why reintroduction efforts in Big Beef Creek and Tahuya River have been generally unsuccessfully and what is needed to advance recovery in those streams. This issue was originally described in the 2015 prioritization report. <u>Relevant areas:</u> Recovery planning for summer chum stocks that have been extirpated.	▪ Efforts in restoration planning aimed at recovering the extirpated summer chum stocks are hampered by lack of diagnostic analysis on the stocks.	▪ Watershed-specific limiting factors analyses have not been conducted on the watersheds of concern.	▪ Perform needed diagnostic limiting factors analyses and prioritize restoration and protection activities on these streams.	▪ <u>Summer chum diagnosis:</u> The 2015 prioritization report proposed that a quantitative limiting factors analysis be performed to diagnose habitat conditions in summer chum streams, and their stream-mouth estuaries, that had not yet been analyzed. These streams included Dungeness River, Chimacum Creek, Big Beef Creek, Dewatto River, Tahuya River, and Skokomish River. The analysis should provide a means of summarizing restoration and protection priorities to help guide recovery planning. This assessment was recently completed and is contained in a report prepared by ICF and Biostream Environmental (2022). The assessment includes an updated analysis of the eight subpopulations that had previously been analyzed (see Lestelle et al. 2005), and incorporated new and updated information, as well as the new analysis for the six subpopulations that had not yet been analyzed. The results of this work have been incorporated into this updated prioritization report.

Assessments for Improved Recovery Planning: *Hood Canal floating bridge*

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
Evidence had been collected indicating that the Hood Canal floating bridge may be a cause of mortality to emigrating steelhead smolts (Moore et al. [2013]). This information, together with data from the 520 floating bridge on Lake Washington, gives reason to ask whether similar kinds of impacts might be occurring to other species, particularly to juvenile coho and Chinook. Possible impacts to other species, notably summer chum, also need to be considered. Relevant areas: Primarily relevant to the entirety of Hood Canal south of the Hood Canal floating bridge.	▪ If the Hood Canal bridge is adversely affecting the performance of salmonid populations produced in Hood Canal, recovery efforts might be hindered. Improved knowledge about this matter would inform decision makers and recovery planners.	▪ Evidence exists that the bridge is adversely affecting steelhead originating in Hood Canal rivers and streams. The extent of possible effects is uncertain. No attempt has been made to determine whether the bridge might be affecting other species.	▪ Perform a well-designed assessment to improve knowledge about potential effects of the bridge on migrating juvenile salmonids.	▪ HC Bridge: Assess effects of the Hood Canal floating bridge on the migration and feeding behaviors of juvenile salmonids belonging to stocks of concern and on how the bridge might be causing increased mortality in the vicinity of the bridge. Substantial assessment work and research has occurred since the 2015 prioritization report. The on-going work has been done primarily by the Port Gamble S'Klallam Tribe, NMFS, Long Live the Kings, and WDFW, in partnership with the Hood Canal Coordinating Council and other state and federal agencies. Findings have been reported in various documents, including Daubenberger et al. (2020) and Moore and Berejikian (2022). The work has confirmed that very substantial impacts on steelhead smolt survival are occurring as a result of the bridge infrastructure. Impacts to other species, including chum, are also believed to be occurring. Continued research and assessment of impacts is occurring. Phase 2 is underway with engineers designing guidance structures for migrating juvenile salmonids intended to reduce steelhead mortality.

Assessments for Improved Recovery Planning: ***Summer chum assessment and formulation of reintroduction criteria***

Issue and Affected Areas	Relevance to Salmonids	Causes/Concerns	Solutions	Actions
This issue consists of two sub-issues. The first was that there remained questions about the presence of summer chum in the Dungeness River and how they should be addressed for the sake of recovery. The second sub-issue involves criteria that should be considered in deciding to initiate, or re-initiate, a reintroduction effort in any of the streams where the stock had previously been determined to be extirpated; this would include the Dungeness stock, as well as those in Hood Canal that would be the highest priority candidates (i.e., Big Beef Cr and Dewatto R). This issue was originally described in the 2015 prioritization report. Relevant areas: Dungeness River and to the streams and rivers where summer chum have been extirpated.	▪ Uncertainty has existed about the quality of estimates of summer chum abundance returning to the Dungeness River. This hinders decision making about steps that should be taken in recovery planning in that river. ▪ It has been uncertain how recovery efforts for summer chum should proceed with regard to increasing population diversity by continuing or initiating new reintroduction efforts.	▪ Recovery progress as it will be measured during the warm phase of the PDO (see Lestelle et al. 2014 and 2018) may be adversely affected without continued efforts to restore extirpated stocks. ▪ Efforts to re-introduce summer chum to areas where extirpations occurred in the past may have their greatest potential if they occur during the existing, on-going cool phase of the PDO.	▪ Improve assessment of summer chum in the Dungeness River. ▪ Formulate updated criteria for continuing or initiating reintroduction efforts in watersheds where extirpations are believed to have occurred.	▪ Assess Dungeness R sum chum: Increase efforts to assess summer chum abundance in the Dungeness River during the period of favorable PDO and to collect genetic data on the stock. Historical evidence has been brought forward that confirms that a subpopulation of summer chum existed in the Dungeness River and that it was substantial in size. The Jamestown S'Klallam Tribe, in partnership with the other comanagers, is proceeding with planning for a possible reintroduction of summer chum into the Dungeness River in 2024 (personal communications with Randy Johnson and Aaron Brooks with the Jamestown S'Klallam Tribe). See ICF and Biostream Environmental (2022) for an analysis of historical performance of the subpopulation based on EDT modeling. ▪ Sum chum reintroduction criteria: Formulate criteria to be used in deciding on when, and where, reintroduction efforts should be initiated, or re-initiated, for summer chum recovery. The comanagers are proceeding (at the time of preparing this report) with discussions for a potential reintroduction to Dewatto River and potentially to Big Beef Creek in Hood Canal. As noted above, the comanagers are also proceeding with steps to initiate a reintroduction to the Dungeness River in the eastern SJDF.

5.2 Issues Scored for Stocks

Figure 5 presents the results of scoring the relative importance of the issues to each stock over 12 pages. Results are color-coded to the integer scores of 0-4, with a value of 0 meaning that the issue is not applicable to the stock (or has negligible influence), and a score of 4 indicates very high importance or applicability. A value of 1 means low importance, a 2 means medium importance, and a 3 means high importance. Greater uncertainty in how an issue or action should be regarded tended to produce a lower score. Where compelling reasons exist that an issue is substantially affecting a watershed (and therefore a stock), I generally assigned a high score (3). The highest value possible (4) was assigned if compelling reasons exist that the importance of the issue is especially high, warranting special attention.

Figure 5 is constructed so that stocks are ordered in the same way they are arranged in Table 1, sorted by species and race and arranged from north to south with regard to their natal watershed. Refer to Table 1 to identify the natal watershed, species, and race. The order of the species is as follows:

- Chum – fall
- Chum – summer
- Coho
- Steelhead – winter
- Steelhead – summer
- Chinook – fall
- Chinook – spring
- Chinook – run-type?
- Pink
- Sockeye
- Char

Type	Issue	Dunge_FChum	JohnN_FChum	Contr_FChum	Salmo_FChum	Snow _FChum	Chima_FChum	Ludlo_FChum	Un0190_FChum	Littl_FChum	Middl_FChum	Marth_FChum	Gambl_FChum	Shine_FChum	Nords_FChum	Thorn_FChum	Camp _FChum	Tarbo_FChum	Donov_FChum	LQuil_FChum	BQuil_FChum	India_FChum	Spenc_FChum	Marpl_FChum
		Stock																						
FW	Large stream channels	3																			3			
FW	Small stream channels	3	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2		2	3	3
FW	Large stream floodplains	4																			3			
FW	Small stream floodplains		1	1	2	3	3	1	1	1	1	1	3	1	1	1	1	2	2	3		1	3	3
FW	Access to in-stream				2								2	1		2		2	1				2	2
FW	Access to off-channels	2																						
FW	Riparian	3	2	2	2	3	3	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	3
FW	Sediment processes	4	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	3
FW	Flow regime	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
FW	Water quality	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW	MDNs																							
FW	Dams & reservoirs																							
FW	Climate change	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE	Tidal flow regime	3	1	1	3	3	2	1	1	1	1	2	2	2	1	1	1	1	1	3	3	2	1	1
NE	Sediment processes	3	2	2	2	2	2	2	1	1	1	3	3	1	1	1	1	1	2	3	3	2	1	1
NE	Estuarine wetlands	2	2	2	3	3	2	2	1	1	1	3	3	2	1	1	1	1	1	3	3	2	1	1
NE	Shorelines and channels	2	2	2	2	2	2	2	1	1	1	3	3	1	1	1	1	1	1	2	2	2	1	1
NE	Water quality	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1
NE	Riparian	2	2	2	3	3	1	1	1	1	1	2	2	2	1	1	1	1	1	2	2	1	1	1
A	Adult staging									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A	Sum chum genetics																							
A	Juv habitat use/residency	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution																							
A	HC floating bridge													1	1	1	1	1	1	1	1	1	1	1

Figure 5. Results of scoring issues for each stock. A blank cell is equivalent to a 0 score. Issues are arranged by the three types presented here: FW – freshwater, NE – natal estuary, and A - assessment.

Type	Issue	Stock																						
		Turne_FChum	Dosew_FChum	2nd U_FChum	UnWalk_FChum	Walke_FChum	Pierc_FChum	Ducka_FChum	McDon_FChum	Fulto_FChum	Schae_FChum	Waket_FChum	Hamma_FChum	Jorst_FChum	EaglS_FChum	Lilli_FChum	LLill_FChum	Sund_FChum	Mille_FChum	Clark_FChum	Finch_FChum	Hill_FChum	Potla_FChum	Un0218_FChum
FW	Large stream channels		2					2					2											
FW	Small stream channels	2		2	2	2	3		2	3	2	2	2	3	3	2	2	4	4	2	3	3	3	1
FW	Large stream floodplains		2										2											
FW	Small stream floodplains	2		2	2	2	3	2	3	3	2	3	2	3	3	2	2	4	4	2	3	3	3	1
FW	Access to in-stream	4		1	1	1	2														4		4	
FW	Access to off-channels		2					2					2	3	3			4	4	2	3	3		
FW	Riparian	2	2	2	2	2	3	1	3	3	3	2	2	2	3	2	1	3	3	2	3	2	2	2
FW	Sediment processes	1	2	2	2	2	2	2	2	2	1	2	2	2	2	3	1	4	4	2	3	2	2	1
FW	Flow regime	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1	1
FW	Water quality	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1	1
FW	MDNs	2																3	2			2	2	
FW	Dams & reservoirs																							
FW	Climate change	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE	Tidal flow regime	3	3	1	1	1	3	3	2	3	3	3	4	3	3	3	3	3	3	3	3	3	3	1
NE	Sediment processes	3	3	1	1	1	3	3	2	2	2	3	3	3	3	3	3	3	2	3	3	3	3	1
NE	Estuarine wetlands	2	2	1	1	1	3	2	3	2	2	3	3	3	3	2	2	3	3	3	3	3	3	1
NE	Shorelines and channels	2	2	1	1	1	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1
NE	Water quality	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1	1
NE	Riparian	2	1	1	1	1	2	1	1	2	2	2	2	3	3	1	1	3	3	2	3	3	2	1
A	Adult staging	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A	Sum chum genetics																							
A	Juv habitat use/residency	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution																							
A	HC floating bridge	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure 5 - continued.

Type	Issue	Stock																						
		Un0217_FChum	Un0216_FChum	Un0215_FChum	Skoko_FChum	BBend_FChum	Twan_FChum	TwanF_FChum	Happy_FChum	Holyo_FChum	SpLak_FChum	Sprin_FChum	Kinma_FChum	Jump_FChum	Un0376_FChum	LAnde_FChum	BBeef_FChum	LBeef_FChum	Seabe_FChum	Un0403_FChum	Stavi_FChum	Boyce_FChum	Hardi_FChum	Ander_FChum
FW	Large stream channels				3																			
FW	Small stream channels	1	1	1	2	2	3	4	2	2	2	2	3	3	2	2	2	1	2	1	2	2	2	2
FW	Large stream floodplains				3																			
FW	Small stream floodplains	1	1	1	2	2	3	4	2	2	2	2	3	3	2	1	2	1	2		1		2	2
FW	Access to in-stream					2	1	4			3	4	3	4		2	1		2	3	2		3	2
FW	Access to off-channels				2		3								1	1								
FW	Riparian	2	2	2	3	2	1	3	1	2	2	3	3	3	2	2	2	2	2	1	1	2	2	3
FW	Sediment processes	1	1	1	4	2	1	3	1	2	2	2	2	2	2	1	3	2	2	1	2	1	1	3
FW	Flow regime	1	1	1	4	1	1	2	1	1	1	2	2	2	1	1	2	1	1	1	1	1	1	1
FW	Water quality	1	1	1	1	1	1	2	1	1	1	2	2	2	1	1	2	1	1	1	1	1	1	1
FW	MDNs							2	2	2	2	2			1									
FW	Dams & reservoirs																							
FW	Climate change	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE	Tidal flow regime	1	1	1	2	3	3	3	3	3	3	3	3	2	1	2	3	2	2	2	1			2
NE	Sediment processes	1	1	1	2	3	3	3	3	3	3	3	3	2	1	2	3	2	2	1	1	1	1	2
NE	Estuarine wetlands	1	1	1	2	3	3	3	3	3	3	3	3	2	2	2	3	2	2	1	1	1	1	2
NE	Shorelines and channels	1	1	1	2	3	3	3	3	3	3	2	3	1	1	2	3	2	2	1	1			2
NE	Water quality	1	1	1	2	2	1	2	2	2	2	1	2	1	1	1	2	1	1	1	1			1
NE	Riparian	1	1	1	2	3	3	3	3	3	2	3	3	2	2	1	2	2	3	2	1	1	2	2
A	Adult staging	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A	Sum chum genetics																							
A	Juv habitat use/residency	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution																							
A	HC floating bridge	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure 5 - continued.

Type	Issue	Thoma_FChum	Dewat_FChum	LDewa_FChum	Rends_FChum	Calde_FChum	Tahuy_FChum	Shoof_FChum	LShoo_FChum	Cady_FChum	North_FChum	Stims_FChum	Sunds_FChum	LMiss_FChum	BMiss_FChum	Union_FChum	Dunge_SChum	Jimmy_SChum	Salmo_SChum	Snow_SChum	Chima_SChum	LQuil_SChum	BQuil_SChum	Dosew_SChum
		Stock																						
FW	Large stream channels																3						4	2
FW	Small stream channels	2	2	2	1	2	3	2	2	2	2	2	3	2	2	3		2	2	4	2	2		
FW	Large stream floodplains																4						4	
FW	Small stream floodplains	2	2	2	1	2	3	3	3	1	1	1	3	2	2	3		2	2	4	3	3		2
FW	Access to in-stream	3									4	2		2					4					
FW	Access to off-channels															2	2							2
FW	Riparian	3	2	2	2	3	3	2	2	2	2	2	2	2	2	3	3	2	2	3	3	2	2	1
FW	Sediment processes	2	2	2	2	3	4	2	2	2	2	2	3	3	3	3	4	2	2	4	2	2	3	2
FW	Flow regime	1	1	1	1	2	2	1	1	1	1	2	2	2	2	2	3	1	1	2	1	2	2	1
FW	Water quality	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	1	1	1
FW	MDNs																							
FW	Dams & reservoirs																							
FW	Climate change	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
NE	Tidal flow regime	3	1	1	3	3	2	3	3	3	3	3	3	2	2	2	4	2	3	4	2	3	4	3
NE	Sediment processes	3	1	1	3	3	2	3	3	3	3	3	3	2	2	2	4	2	2	4	2	3	4	3
NE	Estuarine wetlands	3	1	1	3	3	1	3	3	3	3	3	3	2	2	2	3	2	3	3	2	3	2	2
NE	Shorelines and channels	3	2	1	3	3	1	3	3	3	3	3	3	2	2	2	3	2	2	2	2	2	2	2
NE	Water quality	2	1	1	2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1
NE	Riparian	3	1	1	2	3	1	3	3	3	3	3	3	2	2	2	2	1	3	3	1	2	2	1
A	Adult staging	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
A	Sum chum genetics																2	2	2	2	2	3	3	3
A	Juv habitat use/residency	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																4							
A	Sum chum diagnoses																2				2			
A	Forage fish distribution																							
A	HC floating bridge	1	1	1	1	1	1	1	1	1	1	1	1	1	1							1	1	1

Figure 5 - continued.

Type	Issue	Ducka_SChum	Hamma_SChum	Lilli_SChum	Finch_SChum	Skoko_SChum	BBeef_SChum	Ander_SChum	Dewat_SChum	Tahuy_SChum	Union_SChum	Dunge_Coho	Meado_Coho	Coope_Coho	Cassa_Coho	Gieri_Coho	Bell_Coho	JohnN_Coho	Dean_Coho	Jimmy_Coho	Chick_Coho	EagIN_Coho	Contr_Coho	Salmo_Coho
		Stock																						
FW	Large stream channels	2	2			4						3												
FW	Small stream channels		2	2	3		2	2	1	4	3	3	3	3	3	2	3	2	2	2	2	2	2	2
FW	Large stream floodplains	2	2			4						4												
FW	Small stream floodplains		2	2	3		2	2	1	4	3	3	3	3	3	2	3	1	2	2	2	2	1	2
FW	Access to in-stream				4		1	1						2	2	2	2		1					2
FW	Access to off-channels	2				2						2	2	3	3	1	3		1					1
FW	Riparian	1	2	2	3	3	2	3	2	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2
FW	Sediment processes	2	2	3	3	4	3	3	1	4	3	3	2	2	2	2	3	2	2	2	2	2	2	2
FW	Flow regime	1	1	1	2	4	2	1	1	2	2	3	1	1	1	2	3	1	1	1	1	1	1	1
FW	Water quality	1	1	1	2	1	2	1	1	1	2	2	2	2	2	1	2	1	1	1	1	1	1	1
FW	MDNs											2	2		2	2	2	2	2		2	2	2	
FW	Dams & reservoirs																							
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	4	4	3	4	3	4	2	1	3	2	3	3	3	3	3	2	1	2	2	2	2	1	2
NE	Sediment processes	3	4	3	4	3	4	2	1	3	2	2	3	3	3	3	2	2	2	2	2	2	2	2
NE	Estuarine wetlands	2	3	2	4	2	2	2	1	2	2	3	3	3	3	3	2	2	2	2	2	2	2	2
NE	Shorelines and channels	2	3	2	4	2	3	2	1	2	2	2	3	3	3	2	2	2	2	1	2	2	2	2
NE	Water quality	1	1	1	2	2	2	1	1	1	2	2	2	2	2	2	2	1	2	1	1	1	1	1
NE	Riparian	1	2	1	4	2	2	2	1	3	2	2	3	3	3	2	2	2	2	2	2	2	2	2
A	Adult staging	2	2	2	2	2	2	2	2	2	2													
A	Sum chum genetics	3	3	3	3	3	3	3	3	3	3													
A	Juv habitat use/residency	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro						4		4	2														
A	Sum chum diagnoses					2	2	2	2	3														
A	Forage fish distribution											3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge	1	1	1	1	1	1	1	1	1	1													

Figure 5 - continued.

Type	Issue	Stock																						
		Snow _Coho	Chima_Coho	LGoos_Coho	Piddl_Coho	Ludlo_Coho	Un0190_Coho	Hawks_Coho	Littl_Coho	Middl_Coho	Marth_Coho	Gambl_Coho	Toddh_Coho	Bones_Coho	Shine_Coho	Nords_Coho	Thorn_Coho	Un0167_Coho	Fishe_Coho	Camp_Coho	Tarbo_Coho	Un0126_Coho	Un0123_Coho	Donov_Coho
FW	Large stream channels																							
FW	Small stream channels	3	2	4	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	3	3	2
FW	Large stream floodplains																							
FW	Small stream floodplains	3	3	4	3	1	2	2	1	1	1	3	2	1	1	1	1	2	2	2	2	2	3	2
FW	Access to in-stream	2		2	3		1	2				2	1		1	2	2	2	2		3		3	1
FW	Access to off-channels	2	2	3	2	1	1																	
FW	Riparian	3	3	3	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2
FW	Sediment processes	3	2	2	2	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	3	2
FW	Flow regime	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2
FW	Water quality	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
FW	MDNs	2		2	2	2	2	2	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1
FW	Dams & reservoirs																							
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	2	2	3	2	2	2	2	1	1	2	2	2	1	2	1	1	2	1	2	1	3	3	1
NE	Sediment processes	2	2	3	2	2	2	2	1	1	3	3	3	1	1	1	1	2	1	2	1	2	3	2
NE	Estuarine wetlands	2	2	3	2	2	2	2	1	1	3	3	3	1	2	1	1	2	1	2	1	2	3	1
NE	Shorelines and channels	2	2	3	2	2	2	2	1	1	3	3	3	1	1	1	1	2	1	2	1	3	3	1
NE	Water quality	1	1	2	2	2	2	1	1	1	2	2	2	1	1	1	1	1	2	1	1	1	1	1
NE	Riparian	2	1	3	3	2	2	2	1	1	2	2	2	1	2	1	1	2	1	2	1	3	3	1
A	Adult staging								2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Sum chum genetics																							
A	Juv habitat use/residency	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge														3	3	3	3	3	3	3	3	3	3

Figure 5 - continued.

Type	Issue	Stock																						
		LQuil_Coho	BQuil_Coho	India_Coho	DevLak_Coho	Spenc_Coho	Marpl_Coho	Turne_Coho	Dosew_Coho	2nd U_Coho	UnWalk_Coho	Walke_Coho	Un0439_Coho	Pierc_Coho	Ducka_Coho	McDon_Coho	Fulto_Coho	Schae_Coho	Waket_Coho	Hamma_Coho	Jorst_Coho	EaglS_Coho	Lilli_Coho	LLill_Coho
FW	Large stream channels		3						2						2					2				
FW	Small stream channels	2		3	2	3	3	2		2	2	2	3	3		2	3	2	2	2	3	3	2	2
FW	Large stream floodplains		3						2											2				
FW	Small stream floodplains	3		3	2	3	3	2		2	2	2	3	3	2	2	3	2	3	2	3	3	2	2
FW	Access to in-stream					2	2	4		1	1	1	2	2										
FW	Access to off-channels	1	2	3	1				2						2					2	3	3		
FW	Riparian	3	2	3	2	3	3	2	2	2	2	2	3	3	1	3	3	3	2	2	2	3	2	1
FW	Sediment processes	2	3	2	1	2	3	1	2	2	2	2	2	2	2	2	2	1	2	2	2	2	3	1
FW	Flow regime	3	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW	Water quality	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW	MDNs							2																
FW	Dams & reservoirs																							
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	2	3	2	1	3	3	3	3	1	1	1	3	3	3	2	3	3	3	3	3	3	3	3
NE	Sediment processes	2	3	2	1	3	3	3	3	1	1	1	3	3	3	2	2	2	3	3	3	3	3	3
NE	Estuarine wetlands	2	2	2	1	3	3	2	2	1	1	1	3	3	2	3	2	2	3	3	3	3	2	2
NE	Shorelines and channels	2	2	2	1	1	1	2	2	1	1	1	3	3	2	3	3	3	3	3	3	3	3	3
NE	Water quality	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE	Riparian	2	2	2	1	3	3	2	1	1	1	1	2	2	1	1	2	2	2	2	3	3	1	1
A	Adult staging	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Sum chum genetics																							
A	Juv habitat use/residency	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Figure 5 - continued.

Type	Issue	Stock																						
		Sund _Coho	Mille_Coho	Clark_Coho	Finch_Coho	Hill _Coho	Potla_Coho	Un0218_Coho	Un0217_Coho	Un0216_Coho	Un0215_Coho	Skoko_Coho	BBend_Coho	Twan_Coho	TwanF_Coho	Un0130_Coho	Happy_Coho	Holyo_Coho	SpLak_Coho	Dever_Coho	Sprin_Coho	Kinma_Coho	Jump _Coho	Catta_Coho
FW	Large stream channels											3												
FW	Small stream channels	4	4	2	3	3	3	1	1	1	1	2	2	3	4	2	2	2	2	2	2	3	3	
FW	Large stream floodplains											3												
FW	Small stream floodplains	4	4	2	3	3	3	1	1	1	1	2	2	3	4	3	2	2	2	1	2	3	3	
FW	Access to in-stream				4		4						2	1	4				3	4	4	3	4	2
FW	Access to off-channels	4	4	2	3	3						2		3										
FW	Riparian	3	3	2	3	2	2	2	2	2	2	3	2	1	3	2	1	2	2	2	3	3	3	
FW	Sediment processes	4	4	2	3	2	2	1	1	1	1	4	2	1	3	2	1	2	2	2	2	2	2	
FW	Flow regime	2	2	1	2	1	1	1	1	1	1	4	1	1	2	1	1	1	1	1	2	2	2	
FW	Water quality	2	2	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2	2	
FW	MDNs	3	2			2	2								2	2	2	2	2	2	2			
FW	Dams & reservoirs											3												
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	3	3	3	3	3	3	1	1	1	1	3	3	3	3	3	3	3	3	1	3	3	2	3
NE	Sediment processes	3	2	3	3	3	3	1	1	1	1	3	3	3	3	3	3	3	3	1	3	3	2	3
NE	Estuarine wetlands	3	3	3	3	3	3	1	1	1	1	2	3	3	3	3	3	3	3	1	3	3	2	3
NE	Shorelines and channels	3	3	3	3	3	3	1	1	1	1	2	3	3	3	3	3	3	3	1	2	3	1	
NE	Water quality	2	2	1	2	1	1	1	1	1	1	2	2	1	2	2	2	2	2	1	1	2	1	
NE	Riparian	3	3	2	3	3	2	1	1	1	1	2	3	3	3	3	3	3	2	1	3	3	2	2
A	Adult staging	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Sum chum genetics																							
A	Juv habitat use/residency	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Figure 5 - continued.

Type	Issue	Stock																						
		DevHol_Coho	Un0376_Coho	LAnde_Coho	JohnS_Coho	BBeef_Coho	LBeef_Coho	Seabe_Coho	Un0403_Coho	Stavi_Coho	Boyce_Coho	Hardi_Coho	Ander_Coho	Thoma_Coho	Dewat_Coho	LDewa_Coho	Rends_Coho	Brown_Coho	Calde_Coho	Tahuy_Coho	Shoof_Coho	LShoo_Coho	Cady _Coho	North_Coho
FW	Large stream channels																							
FW	Small stream channels	2	2	2	3	2	1	2	1	2	2	2	2	2	2	2	1	2	2	3	2	2	2	2
FW	Large stream floodplains																							
FW	Small stream floodplains	2	2	1	2	2	1	2		1		2	2	2	2	2	1	2	2	3	3	3	1	1
FW	Access to in-stream	2		2	1	1		2	3	2		3	2	3				4						4
FW	Access to off-channels	2	1	1																				
FW	Riparian		2	2	2	2	2	2	1	1	2	2	3	3	2	2	2	2	3	3	2	2	2	2
FW	Sediment processes	2	2	1	1	3	2	2	1	2	1	1	3	2	2	2	2	1	3	3	2	2	2	2
FW	Flow regime	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1
FW	Water quality	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW	MDNs	1	1																					
FW	Dams & reservoirs																							
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	3	1	2	3	3	2	2	2	1			2	3	1	1	3	3	3	2	3	3	3	3
NE	Sediment processes	3	1	2	3	3	2	2	1	1	1	1	2	3	1	1	3	3	3	2	3	3	3	3
NE	Estuarine wetlands	3	2	2	3	3	2	2	1	1	1	1	2	3	1	1	3	3	3	1	3	3	3	3
NE	Shorelines and channels	3	1	2	1	3	2	2	1	1			2	3	2	1	3	2	3	1	3	3	3	3
NE	Water quality	2	1	1	1	2	1	1	1	1			1	2	1	1	2	2	1	1	1	1	1	1
NE	Riparian	2	2	1	3	2	2	3	2	1	1	2	2	3	1	1	2	2	3	1	3	3	3	3
A	Adult staging	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Sum chum genetics																							
A	Juv habitat use/residency	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Figure 5 - continued.

Type	Issue	Stims_Coho	Sunds_Coho	LMiss_Coho	BMiss_Coho	Union_Coho	Dunge_WSth	Meado_WSth	Coope_WSth	Cassa_WSth	Gieri_WSth	Bell_WSth	JohnN_WSth	Jimmy_WSth	Salmo_WSth	Snow_WSth	Chima_WSth	Marth_WSth	Gambl_WSth	Shine_WSth	Thorn_WSth	Tarbo_WSth	Donov_WSth	LQuil_WSth
		Stock																						
FW	Large stream channels						3																	
FW	Small stream channels	2	3	2	2	3	3	3	3	3	2	3	2	2	2	3	2	2	3	2	2	2	2	2
FW	Large stream floodplains						2																	
FW	Small stream floodplains	1	3	2	2	3	3	3	3	3	2	3	1	2	2	3	3	1	3	1	1	2	2	3
FW	Access to in-stream	2		2					2	2	2	2			2	2			2	1	2	3	1	
FW	Access to off-channels					2	1	1	1	1	1	1			1	1	1							1
FW	Riparian	2	2	2	2	3	3	3	3	3	3	3	2	2	2	3	3	2	2	2	2	3	2	3
FW	Sediment processes	2	3	3	3	3	3	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2
FW	Flow regime	2	2	2	2	2	3	1	1	1	2	3	1	1	1	1	2	1	1	1	1	1	2	3
FW	Water quality	1	1	1	1	2	2	2	2	2	1	2	1	1	1	1	2	1	1	1	1	1	2	1
FW	MDNs						2	2		2	2	2	2			2		1	1	2	1	1	1	
FW	Dams & reservoirs																							
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	3	3	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	1	1	1	2
NE	Sediment processes	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2
NE	Estuarine wetlands	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2
NE	Shorelines and channels	3	3	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	1	1	1	1	2
NE	Water quality	1	1	1	1	2	2	2	2	2	2	2	1	1	1	1	1	2	2	1	1	1	1	1
NE	Riparian	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	1	1	1	2
A	Adult staging	2	2	2	2	2																		
A	Sum chum genetics																							
A	Juv habitat use/residency	2	2	2	2	2																		
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge	3	3	3	3	3														4	4	4	4	4

Figure 5 - continued.

Type	Issue	Stock																						
		BQuil_WSth	Spenc_WSth	Dosew_WSth	Pierc_WSth	Ducka_WSth	Hamma_WSth	EaglS_WSth	Lilli_WSth	Skoko_WSth	LAnde_WSth	BBeef_WSth	Seabe_WSth	Stavi_WSth	Ander_WSth	Dewat_WSth	LDewa_WSth	Rends_WSth	Tahuy_WSth	LMiss_WSth	BMiss_WSth	Union_WSth	Dunge_SSth	Dosew_SSth
FW	Large stream channels	3		2		2	2			3													3	2
FW	Small stream channels		3		3		2	3	2	2	2	2	2	2	2	2	2	1	3	2	2	3	3	
FW	Large stream floodplains	3		2			2			3													2	2
FW	Small stream floodplains		3		3	2	2	3	2	2	1	2	3	1	2	2	2	1	3	2	2	3	3	
FW	Access to in-stream		2		2							1	2	2	2					2				
FW	Access to off-channels	1		1		1	1	1		1												2	1	1
FW	Riparian	2	3	2	3	1	2	3	2	3	2	2	2	1	3	2	2	2	3	2	2	3	3	2
FW	Sediment processes	3	2	2	2	2	2	2	3	4	1	3	2	2	3	2	2	2	3	3	3	3	3	2
FW	Flow regime	2	1	1	1	1	1	1	1	4	1	2	1	1	1	1	1	1	2	2	2	2	3	1
FW	Water quality	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	1
FW	MDNs																						2	
FW	Dams & reservoirs									3														
FW	Climate change	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NE	Tidal flow regime	2	2	2	2	2	2	2	2	2	2	2	2		2	1	1	2	2	2	2	2	2	2
NE	Sediment processes	2	2	2	2	2	2	2	2	2	2	2	2		2	1	1	2	2	2	2	2	2	2
NE	Estuarine wetlands	2	2	2	2	2	2	2	2	2	2	2	2		2	1	1	2	1	2	2	2	2	2
NE	Shorelines and channels	2	1	2	2	2	2	2	2	2	2	2	1		2	2	1	2	1	2	2	2	2	2
NE	Water quality	1	2	1	1	1	1	1	1	2	1	2	1		1	1	1	2	1	1	1	2	2	1
NE	Riparian	2	2	1	2	1	2	2	1	2	1	2	2		2	1	1	2	1	2	2	2	2	1
A	Adult staging																							
A	Sum chum genetics																							
A	Juv habitat use/residency																							
A	Skok Chin stock issue																							
A	Mid HC Chin stock issue																							
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A	HC floating bridge	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		4

Figure 5 - continued.

Type	Issue	Stock																						
		Ducka_SSth	Skoko_SSth	Skoko_FChin	Dunge_SChin	Skoko_SChin	Dosew_Chin	Ducka_Chin	Hamma_Chin	Dunge_Pink	LQuil_Pink	BQuil_Pink	Dosew_Pink	Ducka_Pink	Hamma_Pink	Lilli_Pink	Skoko_Pink	Dewat_Pink	Tahuy_Pink	Union_Pink	Skoko_Sock	Dunge_Char	Dosew_Char	Skoko_Char
FW	Large stream channels	2	3	4	4	4	1	1	1	4		3	2	2	2		4				1	3	2	3
FW	Small stream channels		2	3	2				1		2				2	2		1	3	3	2	3		2
FW	Large stream floodplains		3	4	4	4		1	1	4		3		2	2		4					2	2	3
FW	Small stream floodplains	2	2	3	2		1		1		3		2		2			1	3	3		3		2
FW	Access to in-stream					3																		
FW	Access to off-channels	1	1	2	4	2				2			2	2			2					1	1	1
FW	Riparian	1	3	3	3	3	1	1	1	3	2	2	1	1	2	1	3	2	3	3		3	2	3
FW	Sediment processes	2	4	4	4	4	1	1	1	4	2	3	2	2	2	3	4	1	4	3		3	2	4
FW	Flow regime	1	4	4	4	4	1	1	1	2	1	1	1	1	1	1	4	1	2	2		3	1	4
FW	Water quality	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2		2	1	1
FW	MDNs																					2		
FW	Dams & reservoirs					4															4			4
FW	Climate change	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
NE	Tidal flow regime	2	2	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
NE	Sediment processes	2	2	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
NE	Estuarine wetlands	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
NE	Shorelines and channels	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
NE	Water quality	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2
NE	Riparian	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2
A	Adult staging																							
A	Sum chum genetics																							
A	Juv habitat use/residency			3	3	3	1	1	1	2	2	2	2	2	2	2	2	2	2	2				
A	Skok Chin stock issue			4																				
A	Mid HC Chin stock issue						1	1	1															
A	Sum chum assess/reintro																							
A	Sum chum diagnoses																							
A	Forage fish distribution	3	3	3	3	3	1	1	1															
A	HC floating bridge	4	4	2		2	1	1	1															

Figure 5 - continued.

5.3 Actions Scored for Stocks

Figure 6 presents the results of scoring the relative importance, or applicability, of the actions to each stock over 12 pages. Results are color-coded to the integer scores of 0-4, with a value of 0 meaning that the action is not applicable to the stock (or would have negligible effect), and a score of 4 indicates very high importance or applicability. A value of 1 means low importance, a 2 means medium importance, and a 3 means high importance. Greater uncertainty in how an action should be regarded tended to produce a lower score. Where compelling reasons exist that an action would be especially important, I generally assigned a high score (3). The highest value possible (4) was assigned if compelling reasons exist that the importance of the action is especially high, warranting special attention.

In considering how a single action might be relevant to more than one issue, I tried to account for which issue was of greatest importance and how the action could be expected to affect that issue.

The reader needs to keep in mind that if an action is scored with a very high value (e.g. the action called "Road crossings", which is aimed at correcting fish passage problems), it does not necessarily mean that action is a relevant one for that stock. In this case, the action "Road crossings" is scored with a value of 4 for all stocks. But not all stocks have a fish passage issue associated with road crossings—in fact, most do not. This is seen by viewing the results of the issue scoring. In this example, a stock that does not have a fish passage issue would be scored with a 0 for that issue. That score indicates that an action aimed at remediation is irrelevant. The score for the action indicates the degree that the action is the right one for an issue, but the magnitude of the importance of the issue would be the ultimate determinant of the relevance of the action (see further discussion of this in Section 7.0).

Figure 6 is constructed so that stocks are ordered in the same way they are arranged in Table 1, sorted by species and race and arranged from north to south with regard to their natal watershed. Refer to Table 1 to identify the natal watershed, species, and race. The order of the species is as follows:

- Chum – fall
- Chum – summer
- Coho
- Steelhead – winter
- Steelhead – summer
- Chinook – fall
- Chinook – spring
- Chinook – run-type?
- Pink
- Sockeye
- Char

Code	Action	Dunge_FChum	JohnN_FChum	Contr_FChum	Salmo_FChum	Snow _FChum	Chima_FChum	Ludlo_FChum	Un0190_FChum	Littl_FChum	Middl_FChum	Marth_FChum	Gambl_FChum	Shine_FChum	Nords_FChum	Thorn_FChum	Camp _FChum	Tarbo_FChum	Donov_FChum	LQuil_FChum	BQuil_FChum	India_FChum	Spenc_FChum	Marpl_FChum
FW-2	Beaver dams																							
FW-3	Beaver mgmt	2	2	2	2	2	3	2	2	2	2	2	2	2	1	1	1	2	2	2		1	1	1
FW-4	Channel pattern	4	2	2	2	4	4	2	1	1	1	1	1	1	1	1	1	2	1	4	4	1	1	1
FW-5	CMZ	4	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	2	4	4	1	1	1
FW-6	Cushman Settlement																							
FW-7	Decommissioning	3			3	3	2						1	1	1	3	1	3	3	3	3	1	1	1
FW-8	Dungeness water storage	4																						
FW-9	Dungeness Rule	4																						
FW-10	Forest maturity	3	1	1	3	3	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	3	3	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3	3	3	3	2	2	2
FW-12	Large wood	3	2	2	2	4	3	2	2	2	2	2	2	2	2	2	2	2	2	4	4	2	2	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	3	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2
FW-15	Non-road sediment	3	3	3	2	3	3	2	2	2	2	2	3	2	2	2	2	2	2	3	3	2	2	2
FW-16	Nutrient supplement																							
FW-17	Off-channel access																							
FW-18	Off-channel habitat																							
FW-19	Protect floodplains	3	1	1	1	2	4	1	1	1	1	1	2	2	1	2	1	2	1	2	2	1	1	1
FW-20	Protect riparian	3	2	2	1	2	4	2	2	2	2	2	3	2	2	4	2	4	3	3	3	1	1	1
FW-21	Restore floodplains	4	2	2	2	4	4	2	2	2	2	2	3	2	2	2	2	3	2	3	4	2	2	2
FW-22	Restore riparian	4	3	3	2	4	4	2	2	2	2	2	3	2	2	2	2	3	2	3	4	2	2	2
FW-23	RMAP	3			3	3	2						1	2		3	2	2	2	3	3	2	2	2
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	4	2	2	2	2	4	2	2	2	2	2	3	1	1	2	1	2	2	2	2	1	1	1
FW-26	Sediment deposits	3				4	2													2	2			
FW-1	Streambank structure	3	2	2	1	2	2	2	2	2	2	2	1	1	1		1	1	1	3	3	1	1	1
FW-27	Trans infrastructure	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	1	1	1
FW-28	Water rights	3			1	1	1						2							3	3			
FW-29	Watershed analysis	3	1	1	1	3	3	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1
NE-1	Armor removal	3	1	1	1	2		1	1	1	1	1		1	1		1			2	2	2	1	1
NE-2	Berm/dike removal	4	1	1	3	3		1	1	1	1	1								3	3	2	3	3
NE-3	Channel rehab	3	1	1	2	3		1	1	1	1	1								2	4	1	3	3
NE-4	Debris removal	1	1	1	1	1		1	1	1	1	1	1							1	1			
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	2	1	1	1	1	2	1	1	1	1	1	2	1		1		1	1	1	1	1	1	1
NE-8	Protection	2					2						1	2	1	4	1	4	1			1		
NE-9	Restore riparian	3	2	1	3	3		1	1	1	1	1	1	2	1	1	1		2	2	2	1	1	1
NE-10	Revegetation																							
NE-11	Topo restoration	2	1	1	2	2		1	1	1	1	1			1		1			2	2	1	1	1
NE-12	Trans infrastructure	2	1	1	4	4		1	1	1	1	1	1		1		1				4	1	1	1
A-1	Adult staging												2	4	4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-3	HC Bridge													2	2	2	2	2	2	2	2	2	2	2
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-6	Nearshore synthesis	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6. Results of scoring actions by stock. A blank cell is equivalent to a 0 score.

Code	Action	Turne_FChum	Dosew_FChum	2nd U_FChum	UnWalk_FChum	Walke_FChum	Pierc_FChum	Ducka_FChum	McDon_FChum	Fulto_FChum	Schae_FChum	Waket_FChum	Hamma_FChum	Jorst_FChum	EaglS_FChum	Lilli_FChum	LLill_FChum	Sund _FChum	Mille_FChum	Clark_FChum	Finch_FChum	Hill _FChum	Potla_FChum	Un0218_FChum
FW-2	Beaver dams																							
FW-3	Beaver mgmt	1		1	1	1	1		1	1	1	1		1	1	1	1	1	1	1	1	1	1	
FW-4	Channel pattern	1	3	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	
FW-5	CMZ	1	3	1	1	1	1	3	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	
FW-6	Cushman Settlement																							
FW-7	Decommissioning	1	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2
FW-8	Dungeness water storage																							
FW-9	Dungeness Rule																							
FW-10	Forest maturity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
FW-12	Large wood	2	4	2	2	2	2	3	2	2	2	2	3	3	3	3	2	2	2	2	3	3	3	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	2	1	1	1	2	2	2	2	2	2	1	2	2	2	1	2	2	1	2	2	2	1
FW-15	Non-road sediment	2	1	1	1	1	2	1	1	1	2	1	1	1	1	3	1	2	2	1	1	2	2	1
FW-16	Nutrient supplement																							
FW-17	Off-channel access																							
FW-18	Off-channel habitat																							
FW-19	Protect floodplains	1	2	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
FW-20	Protect riparian	1	3	1	1	1	1	3	1	1	1	1	3	1	1	2	1	1	1	1	1	1	1	1
FW-21	Restore floodplains	2	3	2	2	2	2	3	2	2	2	1	3	1	1	2	2	2	2	2	1	2	2	1
FW-22	Restore riparian	2	3	2	2	2	2	3	2	2	2	1	3	2	2	2	2	2	2	2	2	2	2	1
FW-23	RMAP	2	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2	3	3	3	3	3	3	3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	1	2	1	1	1	1	2	1	1	1	1	1	2	2	2	1	2	2	1	2	2	2	1
FW-26	Sediment deposits																							
FW-1	Streambank structure	1	3	1	1	1	1	3	1	1	1	1	2	1	1	2	1	1	1	1	1	2	2	
FW-27	Trans infrastructure	1	1	1	1	1	1	1	1	1	1	1	1	2	1	3	1	2	2	1	1	2	2	1
FW-28	Water rights																							
FW-29	Watershed analysis	1	2	1	1	1	1	2	1	1	1	1	2	1	1	3	1	3	3	1	1	3	3	1
NE-1	Armor removal	1	2	1	1	1	1	2	1	1	2	1	3	2	2	2	1	3	3	1	2	3	3	
NE-2	Berm/dike removal	3	4				3	4	3	3	3	2	4	3	3	1		3	3		3	3	3	
NE-3	Channel rehab	3	1				3	1	2	2	2	2	2	2	2	2		3	3		2	3	3	
NE-4	Debris removal		1															1	1			1	1	
NE-5	Hydraulic mod																	1	1			1	1	
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	1				1	1	1	1	1	1	1	1	1	2		2	2		2	2	2	
NE-8	Protection		2	1	1	1		2					2			1	1			1				1
NE-9	Restore riparian	1	2	1	1	1	3	3	1	1	1	1	2	2	3	3	1	3	3	1	3	3	3	1
NE-10	Revegetation																	2	2			2	2	
NE-11	Topo restoration	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	1	3	3	1
NE-12	Trans infrastructure	1	4	1	1	1	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-3	HC Bridge	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-6	Nearshore synthesis	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	Un0217_FChum	Un0216_FChum	Un0215_FChum	Skoko_FChum	BBend_FChum	Twan_FChum	TwanF_FChum	Happy_FChum	Holyo_FChum	SpLak_FChum	Sprin_FChum	Kinma_FChum	Jump_FChum	Un0376_FChum	LAnde_FChum	BBeef_FChum	LBeef_FChum	Seabe_FChum	Un0403_FChum	Stavi_FChum	Boyce_FChum	Hardi_FChum	Ander_FChum
FW-2	Beaver dams																							
FW-3	Beaver mgmt				2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW-4	Channel pattern				4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
FW-5	CMZ				4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
FW-6	Cushman Settlement				4																			
FW-7	Decommissioning	2	2	2	4	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	1	1	2
FW-8	Dungeness water storage																							
FW-9	Dungeness Rule																							
FW-10	Forest maturity	3	3	3	4	3	3	3	3	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2
FW-12	Large wood	2	2	2	4	2	3	3	3	3	3	2	2	2	2	2	2	3	2	2	2	2	2	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	1	1	1	3	1	2	2	2	2	2	2	2	2	2	2	3	3	2	2	2	1	1	1
FW-15	Non-road sediment	1	1	1	3	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1	1	1
FW-16	Nutrient supplement																							
FW-17	Off-channel access																							
FW-18	Off-channel habitat																							
FW-19	Protect floodplains	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW-20	Protect riparian	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
FW-21	Restore floodplains	1	1	1	4	2	2	2	2	2	2	3	3	1	2	2	2	2	2	2	2	1	1	1
FW-22	Restore riparian	1	1	1	4	2	2	2	2	2	2	3	3	1	2	2	3	2	2	2	2	1	2	3
FW-23	RMAP	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	3	3	3	3	3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1	1	1
FW-26	Sediment deposits				3												3							
FW-1	Streambank structure				4	1	2	2	2	2	2	1	1	1	2	2	2	2	2	1	2			1
FW-27	Trans infrastructure	1	1	1	3	1	2	2	2	2	2	1	1	1	2	2	1	2	2	1	2	1		1
FW-28	Water rights																1							
FW-29	Watershed analysis	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	3	1	1	2
NE-1	Armor removal				2	3	3	3	3	3	3	2	4	1	2	2	3	3	2	2				2
NE-2	Berm/dike removal				2	3	3	3	3	3	3	3	3	1	1	1	4	2	2	1				1
NE-3	Channel rehab				3	3	3	3	3	3	3	2	3	1	1	1	3	2	2	1				1
NE-4	Debris removal				1	1	1	1	1	1	1						1							
NE-5	Hydraulic mod					1	1	1	1	1	1													
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
NE-7	Pollution control				2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1		
NE-8	Protection	1	1	1	2															1	3	2		1
NE-9	Restore riparian	1	1	1	3	3	3	3	3	3	3	3	3	2	3	3	1	1	1					2
NE-10	Revegetation					2	2	2	2	2	2				1	1								
NE-11	Topo restoration	1	1	1	2	3	3	3	3	3	3	2	2	1	2	2		1	1					
NE-12	Trans infrastructure	1	1	1	4	4	4	4	4	4	4	1	2		2	2	4	3	3	2	2	1		3
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-3	HC Bridge	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-6	Nearshore synthesis	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	Thoma_FChum	Dewat_FChum	LDewa_FChum	Rends_FChum	Calde_FChum	Tahuy_FChum	Shoof_FChum	LShoo_FChum	Cady _FChum	North_FChum	Stims_FChum	Sunds_FChum	LMiss_FChum	BMiss_FChum	Union_FChum	Dunge_SChum	Jimmy_SChum	Salmo_SChum	Snow _SChum	Chima_SChum	LQuil_SChum	BQuil_SChum	Dosew_SChum
FW-2	Beaver dams																							
FW-3	Beaver mgmt	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2		
FW-4	Channel pattern	1		1	1	1	3	1	1	1	1	1	1	3	1	1	4	1	3	4	4	4	4	3
FW-5	CMZ	1					2	1	1	1	1	1			2	2	4	1	3	4	2	4	4	3
FW-6	Cushman Settlement																							
FW-7	Decommissioning	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	3	3	3	3	2	3	3	3
FW-8	Dungeness water storage																4							
FW-9	Dungeness Rule																4							
FW-10	Forest maturity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3
FW-11	Invasives	2	3	2	2	2	3	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
FW-12	Large wood	2	2	2	2	2	4	2	2	2	2	2	2	2	3	3	3	1	2	4	3	4	4	4
FW-13	Natural barrier																							
FW-14	Non-forest roads	1	1	1	1	1	3						1	1	1	2	3	2	2	2	3	2	2	2
FW-15	Non-road sediment	1	1	1	1	1	3						1	1	1	3	3	1	2	3	3	3	3	1
FW-16	Nutrient supplement																							
FW-17	Off-channel access																							
FW-18	Off-channel habitat																							
FW-19	Protect floodplains	1	4	1	1	1	2	1	1	1	1	1	1	1	1	2	3	2	1	2	4	2	2	2
FW-20	Protect riparian	1	4	1	1	1	2	1	1	1	1	1	1	1	2	2	3	2	1	2	4	3	3	3
FW-21	Restore floodplains	2	2	1	1	1	4	1	1	1	1	2	1	1	1	3	4	2	2	4	4	3	4	3
FW-22	Restore riparian	2	3	3	3	3	4	3	3	3	3	3	3	3	3	4	4	2	2	4	4	3	4	3
FW-23	RMAP	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	1	1	1	1	1	2	1	1	1	1	1	1	1	1	3	4	2	2	2	4	2	2	2
FW-26	Sediment deposits						2								1	1	3			4	2	2	2	
FW-1	Streambank structure	1	1	1	1	2	2					1	2	2	2	2	3	1	1	2	2	3	3	3
FW-27	Trans infrastructure	1		1	1	1	2	1	1	1	1	2	1	1	1	2	2	1	1	1	2	3	4	2
FW-28	Water rights															2	3		1	1	1	3	3	
FW-29	Watershed analysis	1	3	2	2	2	4	1	1	1	1	2	1	1	3	3	3	1	1	3	3	2	2	2
NE-1	Armor removal	2	1		4	3	2	3	3	3	3	3	3	2	2	1	3		1	2		2	2	2
NE-2	Berm/dike removal	2	2		4	4	1	4	4	4	4	4	4	4	4	2	4		3	3		3	4	3
NE-3	Channel rehab	2			3	4	1	4	4	4	4	4	4	4	2	2	3		2	3		2	4	1
NE-4	Debris removal															1	1		1	1		1	1	1
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	1	1	1	2	1	1	1	1	1	1	1	2	2	2	2	1	1	1	2	1	1	1
NE-8	Protection		4	1			3									2	2				2			2
NE-9	Restore riparian	2	2	1	1	2	2	2	2	2	2	2	2	3	3	2	3	2	3	3		2	2	2
NE-10	Revegetation																							
NE-11	Topo restoration	2	1		2	2		2	2	2	2	2	2	3	2	1	2	1	2	2		2	2	1
NE-12	Trans infrastructure	2	1		4	4	4	4	4	4	4	3	3	3	3	1	2	1	4	4			4	4
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						4	4	4
A-4	Forage fish assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-3	HC Bridge	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						2	2	2
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-6	Nearshore synthesis	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																2				2			
A-9	Sum chum genetics																2	2	2	2	2	3	3	3
A-10	Spawner assess																3							
A-11	Reintroduce criteria																4							

Figure 6 - continued.

Code	Action	Ducka_SChum	Hamma_SChum	Lilli_SChum	Finch_SChum	Skoko_SChum	BBeef_SChum	Ander_SChum	Dewat_SChum	Tahuy_SChum	Union_SChum	Dunge_Coho	Meado_Coho	Coope_Coho	Cassa_Coho	Gieri_Coho	Bell_Coho	JohnN_Coho	Dean_Coho	Jimmy_Coho	Chick_Coho	EaglN_Coho	Contr_Coho	Salmo_Coho
FW-2	Beaver dams											1	1	1	1	1	1	1	1	1	1	1	1	1
FW-3	Beaver mgmt			1	1	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
FW-4	Channel pattern	2	2	2	1	4	1	1		3	1	4	2	2	2	2	2	2	2	1	2	2	2	2
FW-5	CMZ	3	3	2	1	4	1			2	2	4	1	1	1	1	1	1	1	1	1	1	1	1
FW-6	Cushman Settlement					4																		
FW-7	Decommissioning	3	3	2	2	4	2	2	2	3	2	3								3				3
FW-8	Dungeness water storage											4					4							
FW-9	Dungeness Rule											4					4							
FW-10	Forest maturity	3	3	3	3	4	3	3	3	3	3	3	1	1	1	1	1	1	1	3	1	1	1	3
FW-11	Invasives	2	2	2	2	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-12	Large wood	3	3	3	3	4	2	2	2	4	3	4	2	2	2	2	2	2	2	1	2	2	2	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	1	2	2	3	3	1	1	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2
FW-15	Non-road sediment	1	1	3	1	3	3	1	1	3	3	3	3	3	3	3	3	3	3	1	3	3	3	2
FW-16	Nutrient supplement											1	1	1	1	1	1	1	1		1	1	1	
FW-17	Off-channel access											3	2	2	2	2	2	2	2	1	2	2	2	1
FW-18	Off-channel habitat											4	2	2	2	2	2	2	2	1	2	2	2	1
FW-19	Protect floodplains	2	2	1	1	3	1	1	4	2	2	3	1	1	1	1	1	1	1	2	1	1	1	1
FW-20	Protect riparian	3	3	2	1	2	1	1	4	2	2	3	2	2	2	2	2	2	2	2	2	2	2	1
FW-21	Restore floodplains	3	3	2	1	4	2	1	2	4	3	4	2	2	2	2	2	2	2	2	2	2	2	2
FW-22	Restore riparian	3	3	2	2	4	3	3	3	4	4	4	3	3	3	3	3	3	3	2	3	3	3	2
FW-23	RMAP	3	3	2	3	4	2	3	3	3	3	3								3				3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	1	2	2	2	3	1	1	2	3	4	2	2	2	2	3	2	2	2	2	2	2	2
FW-26	Sediment deposits					3	3			2	1	3				2								
FW-1	Streambank structure	3	2	3	1	4	2	1	1	2	2	3	2	2	2	2	2	2	2	1	2	2	2	1
FW-27	Trans infrastructure	1	1	3	1	3	1	1		2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
FW-28	Water rights						1				2	4	2	2	2	2	3							1
FW-29	Watershed analysis	2	2	3	1	3	2	2	3	4	3	3	1	1	1	1	1	1	1	1	1	1	1	1
NE-1	Armor removal	2	3	3	2	2	3	2	1	2	1	3	1	1	1	1	1	1	1		1	1	1	1
NE-2	Berm/dike removal	4	4	3	3	2	4	1	2	1	2	4	1	1	1	4	1	1	1		1	1	1	3
NE-3	Channel rehab	1	2	2	2	3	3	1		1	2	3	1	1	1	4	1	1	1		1	1	1	2
NE-4	Debris removal					1	1				1	1	1	1	1	1	1	1	1		1	1	1	1
NE-5	Hydraulic mod															4								
NE-6	Invasives	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	1	2	2	2	1		1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
NE-8	Protection	2	2	1		2		1	4	3	2	2												
NE-9	Restore riparian	3	2	3	3	3	1	2	2	2	2	3	2	2	2	2	2	2	2	2	1	1	1	3
NE-10	Revegetation																							
NE-11	Topo restoration	1	1	1	1	2			1		1	2	1	1	1	1	1	1	1	1	1	1	1	2
NE-12	Trans infrastructure	4	4	4	4	4	4	3	1	4	1	2	1	1	1	1	1	1	1	1	1	1	1	3
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4													
A-4	Forage fish assess	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
A-3	HC Bridge	2	2	2	2	2	2	2	2	2	2													
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
A-6	Nearshore synthesis	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
A-7	Skok stock issue																							
A-8	Sum chum diagnosis					2	2	2	2	2														
A-9	Sum chum genetics	3	3	3		3		3	3	3	3													
A-10	Spawner assess																							
A-11	Reintroduce criteria						4		4	4														

Figure 6 - continued.

Code	Action	Snow _Coho	Chima_Coho	LGoos_Coho	Piddl_Coho	Ludlo_Coho	Un0190_Coho	Hawks_Coho	Littl_Coho	Middl_Coho	Marth_Coho	Gambl_Coho	Toddh_Coho	Bones_Coho	Shine_Coho	Nords_Coho	Thorn_Coho	Un0167_Coho	Fishe_Coho	Camp_Coho	Tarbo_Coho	Un0126_Coho	Un0123_Coho	Donov_Coho
FW-2	Beaver dams	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW-3	Beaver mgmt	2	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	2	1	1	2
FW-4	Channel pattern	4	4	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
FW-5	CMZ	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2
FW-6	Cushman Settlement																							
FW-7	Decommissioning	3	2									1			1	1	3	1	1	1	3	1	1	3
FW-8	Dungeness water storage																							
FW-9	Dungeness Rule																							
FW-10	Forest maturity	3	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	3	3	2	2	2	2	2	2	2	3	3	2	2	2	2	3	2	2	2	3	2	2	3
FW-12	Large wood	4	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2
FW-15	Non-road sediment	3	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2
FW-16	Nutrient supplement	1		1	1	1	1	1	1	1	1		1	1		1		1	1	1		1	1	
FW-17	Off-channel access	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2
FW-18	Off-channel habitat	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2
FW-19	Protect floodplains	2	4	1	1	1	1	1	1	1	1	2	1	1	2	1	2	1	1	1	2	1	1	1
FW-20	Protect riparian	2	4	2	2	2	2	2	2	2	2	3	2	2	2	2	4	2	2	2	4	2	2	3
FW-21	Restore floodplains	4	4	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2
FW-22	Restore riparian	4	4	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2
FW-23	RMAP	3	2									1			2		3	2	2	2	2	2	2	2
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	4	2	2	2	2	2	2	2	2	3	2	1	1	1	2	1	1	1	2	1	1	2
FW-26	Sediment deposits	4	2																					
FW-1	Streambank structure	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1		1	1	1	1	1	1	1
FW-27	Trans infrastructure	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW-28	Water rights	1	1									2												
FW-29	Watershed analysis	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-1	Armor removal	2		1	1	1	1	1	1	1	1		1	1	1	1		1	1	1		1	1	
NE-2	Berm/dike removal	3		1	1	1	1	1	1	1	1		1	1										
NE-3	Channel rehab	3		1	1	1	1	1	1	1	1		1	1										
NE-4	Debris removal	1		1	1	1	1	1	1	1	1	1	1	1										
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	2	1	1	1	1	1	1	1	1	2	1	1	1		1				1			1
NE-8	Protection		2									1			2	1	4	1	1	1	4	1	1	1
NE-9	Restore riparian	3		1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1		1	1	2
NE-10	Revegetation																							
NE-11	Topo restoration	2		1	1	1	1	1	1	1	1		1	1		1		1	1	1		1	1	
NE-12	Trans infrastructure	4		1	1	1	1	1	1	1	1	1	1	1		1		1	1	1		1	1	
A-1	Adult staging											2			4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-3	HC Bridge														3	3	3	3	3	3	3	3	3	3
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-6	Nearshore synthesis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	LQuil_Coho	BQuil_Coho	India_Coho	DevLak_Coho	Spenc_Coho	Marpl_Coho	Turne_Coho	Dosew_Coho	2nd U_Coho	UnWalk_Coho	Walke_Coho	Un0439_Coho	Pierc_Coho	Ducka_Coho	McDon_Coho	Fulto_Coho	Schae_Coho	Waket_Coho	Hamma_Coho	Jorst_Coho	EaglS_Coho	Lilli_Coho	LLill_Coho
FW-2	Beaver dams	1		1	1	1	1	1		1	1	1	1	1		1	1	1	1		1	1	1	1
FW-3	Beaver mgmt	2		1	1	1	1	1		1	1	1	1	1		1	1	1	1		1	1	1	1
FW-4	Channel pattern	4	4	1	1	1	1	1	3	1	1	1	1	1	2	1	1	1	1	2	1	1	1	1
FW-5	CMZ	4	4	1	1	1	1	1	3	1	1	1	1	1	3	1	1	1	1	3	1	1	1	1
FW-6	Cushman Settlement																							
FW-7	Decommissioning	3	3	1	1	1	1	1	3	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2
FW-8	Dungeness water storage																							
FW-9	Dungeness Rule																							
FW-10	Forest maturity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	3	3	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
FW-12	Large wood	4	4	2	2	2	2	2	4	2	2	2	2	2	3	2	2	2	2	3	3	3	3	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	1	2	2	2	1
FW-15	Non-road sediment	3	3	2	2	2	2	2	1	1	1	1	2	2	1	1	1	2	1	1	1	1	3	1
FW-16	Nutrient supplement			1	1	1	1	1		1	1	1	1	1		1	1	1	1		1	1	1	1
FW-17	Off-channel access	3	3	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2
FW-18	Off-channel habitat	3	4	2	2	2	2	2	4	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2
FW-19	Protect floodplains	2	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	2	1	1	1	1
FW-20	Protect riparian	3	3	1	1	1	1	1	3	1	1	1	1	1	3	1	1	1	1	3	1	1	2	1
FW-21	Restore floodplains	3	4	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	1	3	1	1	2	2
FW-22	Restore riparian	3	4	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	1	3	2	2	2	2
FW-23	RMAP	3	3	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	2	2	1
FW-26	Sediment deposits	2	2																					
FW-1	Streambank structure	3	3	1	1	1	1	1	3	1	1	1	1	1	3	1	1	1	1	2	1	1	2	1
FW-27	Trans infrastructure	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	3	1
FW-28	Water rights	3	3																					
FW-29	Watershed analysis	2	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	2	1	1	3	1
NE-1	Armor removal	2	2	2	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	3	2	2	2	1
NE-2	Berm/dike removal	3	3	2		3	3	3	4				3	3	4	3	3	3	2	4	3	3	1	
NE-3	Channel rehab	2	4	1		3	3	3	1				3	3	1	2	2	2	2	2	2	2	2	
NE-4	Debris removal	1	1						1															
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	1	1		1	1	1	1				1	1	1	1	1	1	1	1	1	1	2	
NE-8	Protection			1	1				2	1	1	1			2					2			1	1
NE-9	Restore riparian	2	2	1	1	1	1	1	2	1	1	1	3	3	3	1	1	1	1	2	2	3	3	1
NE-10	Revegetation																							
NE-11	Topo restoration	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-12	Trans infrastructure		4	1	1	1	1	1	4	1	1	1	3	3	4	4	4	4	4	4	4	4	4	4
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-3	HC Bridge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-6	Nearshore synthesis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	Sund_Coho	Mille_Coho	Clark_Coho	Finch_Coho	Hill_Coho	Potla_Coho	Un0218_Coho	Un0217_Coho	Un0216_Coho	Un0215_Coho	Skoko_Coho	BBend_Coho	Twan_Coho	TwanF_Coho	Un0130_Coho	Happy_Coho	Holyo_Coho	SpLak_Coho	Dever_Coho	Sprin_Coho	Kinma_Coho	Jump_Coho	Catta_Coho
FW-2	Beaver dams	1	1	1	1	1	1					2	1	1	1	1	1	1	1	1	1	1	1	
FW-3	Beaver mgmt	1	1	1	1	1	1					2	1	1	1	1	1	1	1	1	1	1	1	
FW-4	Channel pattern	1	1	1	1	1	1					4	1	1	1	1	1	1	1	1	1	1	1	
FW-5	CMZ	1	1	1	1	1	1					4	1	1	1	1	1	1	1	1	1	1	1	
FW-6	Cushman Settlement											4												
FW-7	Decommissioning	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	1	1	1	1
FW-8	Dungeness water storage																							
FW-9	Dungeness Rule																							
FW-10	Forest maturity	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	2	2	2	1
FW-11	Invasives	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2
FW-12	Large wood	2	2	2	3	3	3	2	2	2	2	4	2	3	3	3	3	3	3	2	2	2	2	1
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	2	1	2	2	2	1	1	1	1	3	1	2	2	2	2	2	2	1	2	2	2	2
FW-15	Non-road sediment	2	2	1	1	2	2	1	1	1	1	3	1	2	2	2	2	2	2	1	2	2	2	1
FW-16	Nutrient supplement	2	2	1	1	2	2														2	2	2	2
FW-17	Off-channel access	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2	2	3
FW-18	Off-channel habitat	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2	2	2
FW-19	Protect floodplains	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1
FW-20	Protect riparian	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
FW-21	Restore floodplains	2	2	2	1	2	2	1	1	1	1	4	2	2	2	2	2	2	2	2	3	3	1	1
FW-22	Restore riparian	2	2	2	2	2	2	1	1	1	1	4	2	2	2	2	2	2	2	2	3	3	1	1
FW-23	RMAP	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	2	2	2	2
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	2	1	2	2	2	1	1	1	1	2	1	2	2	2	2	2	2	1	2	2	2	2
FW-26	Sediment deposits											3												
FW-1	Streambank structure	1	1	1	1	2	2					4	1	2	2	2	2	2	2	1	1	1	1	
FW-27	Trans infrastructure	2	2	1	1	2	2	1	1	1	1	3	1	2	2	2	2	2	2	1	1	1	1	
FW-28	Water rights																							
FW-29	Watershed analysis	3	3	1	1	3	3	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1
NE-1	Armor removal	3	3	1	2	3	3					2	3	3	3	3	3	3	3		2	4	1	1
NE-2	Berm/dike removal	3	3		3	3	3					2	3	3	3	3	3	3	3		3	3	1	3
NE-3	Channel rehab	3	3		2	3	3					3	3	3	3	3	3	3	3		2	3	1	2
NE-4	Debris removal	1	1			1	1					1	1	1	1	1	1	1	1					
NE-5	Hydraulic mod	1	1			1	1						1	1	1	1	1	1	1					
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	2	2		2	2	2					2	2	2	2	2	2	2	2		2	2	1	1
NE-8	Protection			1				1	1	1	1	2								1				
NE-9	Restore riparian	3	3	1	3	3	3	1	1	1	1	3	3	3	3	3	3	3	3	1	3	3	2	
NE-10	Revegetation	2	2			2	2						2	2	2	2	2	2	2					
NE-11	Topo restoration	3	3	1	1	3	3	1	1	1	1	2	3	3	3	3	3	3	3	1	2	2	1	2
NE-12	Trans infrastructure	4	4	4	4	4	4	1	1	1	1	4	4	4	4	4	4	4	4	1	1	2		4
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-3	HC Bridge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-6	Nearshore synthesis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	DevHol_Coho	Un0376_Coho	LAnde_Coho	JohnS_Coho	BBeef_Coho	LBeef_Coho	Seabe_Coho	Un0403_Coho	Stavi_Coho	Boyce_Coho	Hardi_Coho	Ander_Coho	Thoma_Coho	Dewat_Coho	LDewa_Coho	Rends_Coho	Brown_Coho	Calde_Coho	Tahuy_Coho	Shoof_Coho	LShoo_Coho	Cady_Coho	North_Coho
FW-2	Beaver dams	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW-3	Beaver mgmt	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FW-4	Channel pattern	1	1	1	1	1	1	1	1	1			1	1		1	1	1	1	3	1	1	1	1
FW-5	CMZ	1	1	1	1	1	1	1	1	1				1						2	1	1	1	1
FW-6	Cushman Settlement																							
FW-7	Decommissioning	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	3	2	2	2	2
FW-8	Dungeness water storage																							
FW-9	Dungeness Rule																							
FW-10	Forest maturity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2
FW-12	Large wood	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	2	2	2	3	3	2	2	2	1	1	1	1	1	1	1	1	1	3				
FW-15	Non-road sediment	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	3				
FW-16	Nutrient supplement																							
FW-17	Off-channel access		2	2	2	3	2	2	2	2	2	2	3	2	3	2	3	2	3	3	2	2	2	2
FW-18	Off-channel habitat		2	2	2	3	2	2	2	2	2	2	3	2	3	2	3	2	3	3	2	2	2	2
FW-19	Protect floodplains	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1	1	1	2	1	1	1	1
FW-20	Protect riparian	1	1	1	1	1	1	1	1	1	2	1	1	1	4	1	1	1	1	2	1	1	1	1
FW-21	Restore floodplains	2	2	2	2	2	2	2	2	2	1	1	1	2	2	1	1	1	1	4	1	1	1	1
FW-22	Restore riparian	2	2	2	2	3	2	2	2	2	1	2	3	2	3	3	3	3	3	4	3	3	3	3
FW-23	RMAP	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1
FW-26	Sediment deposits					3														2				
FW-1	Streambank structure	2	2	2	2	2	2	2	1	2			1	1	1	1	1	1	2	2				
FW-27	Trans infrastructure	4	2	2	1	1	2	2	1	2	1		1	1		1	1	1	1	2	1	1	1	1
FW-28	Water rights					1																		
FW-29	Watershed analysis	1	1	1	1	2	1	1	1	3	1	1	2	1	3	2	2	1	2	4	1	1	1	1
NE-1	Armor removal	1	2	2	3	3	3	2	2				2	2	1		4	3	3	2	3	3	3	3
NE-2	Berm/dike removal	4	1	1	4	4	2	2	1				1	2	2		4	3	4	1	4	4	4	4
NE-3	Channel rehab	4	1	1	4	3	2	2	1				1	2			3	4	4	1	4	4	4	4
NE-4	Debris removal					1																		
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	2	1	1	2	1	1	1	1	1	1			1	1	1	1	1	2	1	1	1	1	1
NE-8	Protection								1	3	2		1		4	1				3				
NE-9	Restore riparian	2	3	3	2	1	1	1					2	2	2	1	1	1	2	2	2	2	2	2
NE-10	Revegetation		1	1																				
NE-11	Topo restoration	2	2	2	2		1	1						2	1		2	2	2		2	2	2	2
NE-12	Trans infrastructure	4	2	2	1	4	3	3	2	2	1		3	2	1		4	4	4	4	4	4	4	4
A-1	Adult staging	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
A-4	Forage fish assess	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-3	HC Bridge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-6	Nearshore synthesis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	Stims_Coho	Sunds_Coho	LMiss_Coho	BMiss_Coho	Union_Coho	Dunge_WSth	Meado_WSth	Coope_WSth	Cassa_WSth	Gieri_WSth	Bell_WSth	JohnN_WSth	Jimmy_WSth	Salmo_WSth	Snow_WSth	Chima_WSth	Marth_WSth	Gambl_WSth	Shine_WSth	Thorn_WSth	Tarbo_WSth	Donov_WSth	LQuil_WSth
FW-2	Beaver dams	1	1	1	1	1																		
FW-3	Beaver mgmt	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	1	2	2	2
FW-4	Channel pattern	1	1	3	1	1	4	2	2	2	2	2	2	1	2	4	4	1	1	1	1	2	1	4
FW-5	CMZ	1			2	2	4	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	4
FW-6	Cushman Settlement																							
FW-7	Decommissioning	2	2	2	2	2	3							3	3	3	2		1	1	3	3	3	3
FW-8	Dungeness water storage						4					4												
FW-9	Dungeness Rule						4					4												
FW-10	Forest maturity	3	3	3	3	3	3	1	1	1	1	1	1	3	3	3	1	2	2	3	3	3	3	3
FW-11	Invasives	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3
FW-12	Large wood	2	2	2	3	3	4	2	2	2	2	2	2	1	2	4	3	2	2	2	2	2	2	4
FW-13	Natural barrier																							
FW-14	Non-forest roads		1	1	1	2	3	2	2	2	2	2	2	2	2	2	3	2	3	2	2	2	2	2
FW-15	Non-road sediment		1	1	1	3	3	3	3	3	3	3	3	1	2	3	3	2	3	2	2	2	2	3
FW-16	Nutrient supplement						1	1	1	1	1	1	1			1		1						
FW-17	Off-channel access	3	2	2	3	3																		
FW-18	Off-channel habitat	3	2	2	3	4																		
FW-19	Protect floodplains	1	1	1	1	2	3	1	1	1	1	1	1	2	1	2	4	1	2	2	2	2	1	2
FW-20	Protect riparian	1	1	1	2	2	3	2	2	2	2	2	2	2	1	2	4	2	3	2	4	4	3	3
FW-21	Restore floodplains	2	1	1	1	3	4	2	2	2	2	2	2	2	2	4	4	2	3	2	2	3	2	3
FW-22	Restore riparian	3	3	3	3	4	4	3	3	3	3	3	3	2	2	4	4	2	3	2	2	3	2	3
FW-23	RMAP	3	3	3	3	3	3							3	3	3	2		1	2	3	2	2	3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	1	1	1	1	3	4	2	2	2	2	3	2	2	2	2	4	2	3	1	2	2	2	2
FW-26	Sediment deposits				1	1	3				2					4	2							2
FW-1	Streambank structure	1	2	2	2	2	3	2	2	2	2	2	2	1	1	2	2	2	1	1		1	1	3
FW-27	Trans infrastructure	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2
FW-28	Water rights					2	3	2	2	2	2	3			1	1	1		2					3
FW-29	Watershed analysis	2	1	1	3	3	3	1	1	1	1	1	1	1	1	3	3	1	1	1	1	1	1	2
NE-1	Armor removal	3	3	2	2	1	3	1	1	1	1	1	1		1	2		1		1				2
NE-2	Berm/dike removal	4	4	4	4	2	4	1	1	1	4	1	1		3	3		1						3
NE-3	Channel rehab	4	4	4	2	2	3	1	1	1	4	1	1		2	3		1						2
NE-4	Debris removal					1	1	1	1	1	1	1	1		1	1		1	1					1
NE-5	Hydraulic mod										4													
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	1	1
NE-8	Protection					2	2										2		1	2	4	4	1	
NE-9	Restore riparian	2	2	3	3	2	3	2	2	2	2	2	2	2	3	3		1	1	2	1		2	2
NE-10	Revegetation																							
NE-11	Topo restoration	2	2	3	2	1	2	1	1	1	1	1	1	1	2	2		1						2
NE-12	Trans infrastructure	3	3	3	3	1	2	1	1	1	1	1	1	1	4	4		1	1					
A-1	Adult staging	4	4	4	4	4																		
A-4	Forage fish assess	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-3	HC Bridge	3	3	3	3	3														4	4	4	4	4
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A-6	Nearshore synthesis	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	BQuil_WSth	Spenc_WSth	Dosew_WSth	Pierc_WSth	Ducka_WSth	Hamma_WSth	EaglS_WSth	Lilli_WSth	Skoko_WSth	LAnde_WSth	BBeef_WSth	Seabe_WSth	Stavi_WSth	Ander_WSth	Dewat_WSth	LDewa_WSth	Rends_WSth	Tahuy_WSth	LMiss_WSth	BMiss_WSth	Union_WSth	Dunge_SSth	Dosew_SSth
FW-2	Beaver dams																							
FW-3	Beaver mgmt		1		1			1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	
FW-4	Channel pattern	4	1	3	1	2	2	1	1	4	1	1	1	1	1		1	1	3	3	1	1	4	3
FW-5	CMZ	4	1	3	1	3	3	1	1	4	1	1	1	1					2		2	2	4	3
FW-6	Cushman Settlement									4														
FW-7	Decommissioning	3	1	3	2	3	3	2	2	4	2	2	2	2	2	2	2	2	3	2	2	2	3	3
FW-8	Dungeness water storage																						4	
FW-9	Dungeness Rule																						4	
FW-10	Forest maturity	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	3	2	3	2	2	2	2	2	3	2	3	2	2	2	3	2	2	3	2	3	3	3	3
FW-12	Large wood	4	2	4	2	3	3	3	3	4	2	2	2	2	2	2	2	2	4	2	3	3	4	4
FW-13	Natural barrier																							
FW-14	Non-forest roads	2	2	2	2	2	1	2	2	3	2	3	2	2	1	1	1	1	3	1	1	2	3	2
FW-15	Non-road sediment	3	2	1	2	1	1	1	3	3	2	3	2	2	1	1	1	1	3	1	1	3	3	1
FW-16	Nutrient supplement		1		1			1	1														1	
FW-17	Off-channel access																							
FW-18	Off-channel habitat																							
FW-19	Protect floodplains	2	1	2	1	2	2	1	1	3	1	1	1	1	1	4	1	1	2	1	1	2	3	2
FW-20	Protect riparian	3	1	3	1	3	3	1	2	2	1	1	1	1	1	4	1	1	2	1	2	2	3	3
FW-21	Restore floodplains	4	2	3	2	3	3	1	2	4	2	2	2	2	1	2	1	1	4	1	1	3	4	3
FW-22	Restore riparian	4	2	3	2	3	3	2	2	4	2	3	2	2	3	3	3	3	4	3	3	4	4	3
FW-23	RMAP	3	2	3	2	3	3	2	2	4	2	2	2	3	3	3	3	3	3	3	3	3	3	3
FW-24	Road crossings	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	1	2	1	2	1	2	2	2	2	3	2	2	1	1	1	1	2	1	1	3	4	2
FW-26	Sediment deposits	2								3		3							2		1	1	3	
FW-1	Streambank structure	3	1	3	1	3	2	1	2	4	2	2	2	2	1	1	1	1	2	2	2	2	3	3
FW-27	Trans infrastructure	4	1	1	1	1	1	1	3	3	2	1	2	2	1		1	1	2	1	1	2	2	1
FW-28	Water rights	3										1										2	3	
FW-29	Watershed analysis	2	1	2	1	2	2	1	3	3	1	2	1	3	2	3	2	2	4	1	3	3	3	2
NE-1	Armor removal	2	1	2	1	2	3	2	2	2	2	3	2		2	1		4	2	2	2	1	3	2
NE-2	Berm/dike removal	3	3	4	3	4	4	3	1	2	1	4	2		1	2		4	1	4	4	2	4	4
NE-3	Channel rehab	4	3	1	3	1	2	2	2	3	1	3	2		1			3	1	4	2	2	3	1
NE-4	Debris removal	1		1						1		1										1	1	1
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	1	1	1	1	1	1	2	2	1	1	1	1		1	1	1	1	2	2	2	2	1
NE-8	Protection			2		2	2		1	2				3	1	4	1		3			2	2	2
NE-9	Restore riparian	2	1	2	3	3	2	3	3	3	3	1	1		2	2	1	1	2	3	3	2	3	2
NE-10	Revegetation										1													
NE-11	Topo restoration	2	1	1	1	1	1	1	1	2	2		1			1		2		3	2	1	2	1
NE-12	Trans infrastructure	4	1	4	3	4	4	4	4	4	2	4	3	2	3	1		4	4	3	3	1	2	4
A-1	Adult staging																							
A-4	Forage fish assess	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
A-3	HC Bridge	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		4
A-4	Mid HC stock issue																							
A-5	Nearshore juv assess	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
A-6	Nearshore synthesis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
A-7	Skok stock issue																							
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

Code	Action	Ducka_SSth	Skoko_SSth	Skoko_FChin	Dunge_SChin	Skoko_SChin	Dosew_Chin	Ducka_Chin	Hamma_Chin	Dunge_Pink	LQuil_Pink	BQuil_Pink	Dosew_Pink	Ducka_Pink	Hamma_Pink	Lilli_Pink	Skoko_Pink	Dewat_Pink	Tahuy_Pink	Union_Pink	Skoko_Sock	Dunge_Char	Dosew_Char	Skoko_Char
FW-2	Beaver dams																							
FW-3	Beaver mgmt		2	2	2	2				2	2					1	2	1	1	1	2	2		2
FW-4	Channel pattern	2	4	4	4	4	1	1	1	3	2	3	3	2	2	1	2		3	1	1	1	1	3
FW-5	CMZ	3	4	4	4	4	1	1	1	4	2	4	3	3	3	1	2		2	2	1	1	1	3
FW-6	Cushman Settlement		4	4		4											3				4			4
FW-7	Decommissioning	3	4	4	3	4	1	1	1	3	3	3	3	3	3	2	4	2	3	2	4	3	3	4
FW-8	Dungeness water storage				4					4												4		
FW-9	Dungeness Rule				4					4												4		
FW-10	Forest maturity	3	4	4	3	4	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FW-11	Invasives	2	3	3	3	3	1	1	1	3	3	3	3	2	2	2	3	3	3	3	3	3	3	3
FW-12	Large wood	3	4	4	4	4	1	1	1	4	4	4	4	3	3	3	4	2	4	3	4	4	4	4
FW-13	Natural barrier		2			4																		1
FW-14	Non-forest roads	2	3	3	3	3	1	1	1	3	2	2	2	2	1	2	3	1	3	2	3	3	2	3
FW-15	Non-road sediment	1	3	3	3	3	1	1	1	3	3	3	1	1	1	3	3	1	3	3	3	3	1	3
FW-16	Nutrient supplement				1																			
FW-17	Off-channel access																							
FW-18	Off-channel habitat																							
FW-19	Protect floodplains	2	3	3	3	3	1	1	1	3	2	2	2	2	2	1	3	4	2	2	3	3	2	3
FW-20	Protect riparian	3	2	2	3	2	1	1	1	3	3	3	3	3	3	2	2	4	2	2	2	3	3	2
FW-21	Restore floodplains	3	4	4	4	4	1	1	1	4	3	4	3	3	3	2	4	2	4	3	4	4	3	4
FW-22	Restore riparian	3	4	4	4	4	1	1	1	4	3	4	3	3	3	2	4	3	4	4	4	4	3	4
FW-23	RMAP	3	4	4	3	4	1	1	1	3	3	3	3	3	3	2	4	3	3	3	4	3	3	4
FW-24	Road crossings	4	4	4	4	4	1	1	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
FW-25	Runoff BMPs	2	2	2	4	2	1	1	1	4	2	2	2	2	1	2	2	1	2	3	2	4	2	2
FW-26	Sediment deposits		3	3	3	3				3	2	2					3		2	1	3	3		3
FW-1	Streambank structure	3	4	4	3	4	1	1	1	3	3	3	3	3	2	2	4	1	2	2	4	3	3	
FW-27	Trans infrastructure	1	3	3	2	3	1	1	1	2	2	4	1	1	1	3	3		2	2	3	2	1	3
FW-28	Water rights				3					3	3	3								2		3		
FW-29	Watershed analysis	2	3	3	3	3	1	1	1	3	2	2	2	2	2	3	3	3	4	3	3	3	2	3
NE-1	Armor removal	2	2	2	3	2	1	1	1	3	2	2	2	2	3	2	2	1	2	1	2	3	2	2
NE-2	Berm/dike removal	4	2	2	4	2	1	1	1	4	3	3	4	4	4	1	2	2	1	2	2	4	4	2
NE-3	Channel rehab	1	3	3	3	3	1	1	1	3	2	4	1	1	2	2	3		1	2	3	3	1	3
NE-4	Debris removal		1	1	1	1				1	1	1	1				1			1	1	1	1	1
NE-5	Hydraulic mod																							
NE-6	Invasives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NE-7	Pollution control	1	2	2	2	2	1	1	1	2	1	1	1	1	1	2	2	1	1	2	2	2	1	2
NE-8	Protection	2	2	2	2	2	1	1	1	2			2	2	2	1	2	4	3	2	2	2	2	2
NE-9	Restore riparian	3	3	3	3	3	1	1	1	3	2	2	2	3	2	3	3	2	2	2	3	3	2	3
NE-10	Revegetation																							
NE-11	Topo restoration	1	2	2	2	2	1	1	1	2	2	2	1	1	1	1	2	1		1	2	2	1	2
NE-12	Trans infrastructure	4	4	4	2	4	1	1	1	2		4	4	4	4	4	4	1	4	1	4	2	4	4
A-1	Adult staging					2																		
A-4	Forage fish assess			3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1			3	3
A-3	HC Bridge	4	4	3		3	1	1	1		1	1	1	1	1	1	1	1	1	1	1		3	3
A-4	Mid HC stock issue						1	1	1															
A-5	Nearshore juv assess			3		3				1	1	1	1	1	1	1	1	1	1	1			1	1
A-6	Nearshore synthesis			3	3	3				1	1	1	1	1	1	1	1	1	1	1			1	1
A-7	Skok stock issue			4																				
A-8	Sum chum diagnosis																							
A-9	Sum chum genetics																							
A-10	Spawner assess																							
A-11	Reintroduce criteria																							

Figure 6 - continued.

6.0 Prioritization of Nearshore Habitat Areas

The guidance given in this document for prioritizing actions aimed at non-natal estuarine habitats and the nearshore zone is based principally on recommendations given by PSNERP as presented in Cereghino et al. (2012). Until more information is collected on how juvenile salmonids are using the nearshore zone of the region of interest in this report, I conclude that emphasis for any proposed projects should be aimed at actions that either protect or restore physical processes and associated ecological functions—not at enhancing habitat functions (see Figure 2 in this document). It is my view that there is generally not a need at the current time to put resources into enhancing severely degraded habitats in the nearshore zone within the region, unless it becomes more evident that potential benefits of such actions could outweigh those aimed at either protection or restoration. The proposed procedure for scoring actions within the nearshore zone is based on this view.

It is important to recognize that guidance given in this document related to natal estuarine habitat was presented in Sections 4.0 and 5.0. The procedure described below addresses only stream-mouth estuaries from the perspective of non-natal use and all other nearshore areas.

PSNERP classified the entire Puget Sound shoreline into four distinct kinds of features: river deltas, beaches, barrier embayments, and coastal (or shoreline) inlets. Within each kind of feature, PSNERP identified individual landscape sites, identifiable by specific landscape process-based characteristics. All sites were then assessed for their site potential based on the size and complexity of the landscape site. A site's potential was assumed to remain latent within the geomorphology of the site, regardless of the current extent of degradation. The extent of degradation at each site was then assessed.

The combination of site potential and extent of degradation was then used by PSNERP (in Cereghino et al. 2012) to assign each site to one of six different categories, which identified the type of action believed to be most needed and an initial priority level (see Figure 2).

The procedure for prioritizing nearshore actions addresses the three parts of prioritization presented in this document (first stock, then issue, then action) as described in the following steps.

1. Stock priority: Any area within the nearshore zone in the region of interest to this report is potentially used by one of the stocks identified to be in the highest priority group for stocks (Figure 3). Therefore, stock priority for any action proposed for the nearshore zone is the highest possible (i.e., the priority score that is given to Group 1 stocks).

2. Issue priority: The issue priority score for an action proposed for the nearshore zone is to be based on how well it aligns with the priority and action type assigned in Cereghino et al. (2012), as seen in Appendix A of that document and inserted into this report as Figures 7 - 15. The highest score in this part would be achieved if the action being proposed matches the type and priority as seen in Figure 2 of this report. Lower scores would be obtained based on the degree of alignment and priority with the Cereghino et al. (2012) rationale. Scoring would be as shown below (refer to Figures 7 - 15):

Issue score	Alignment with Cereghino et al. (2012)
4	Action proposed at a location having high site potential and action type matches with PSNERP proposed type (i.e., protection is being proposed where PSNERP recommends protection and restoration is proposed where restoration is recommended). High site potential locations are those designated as either High Protection or High Restoration.
3	Action proposed at a location having high site potential and action type (only protection and restoration) is NOT matched to the PSNERP proposed type (i.e., protection is being proposed where PSNERP recommends restoration and restoration is proposed where protection is recommended). High site potential locations are those designated as either High Protection or High Restoration. The rationale applied here is that some forms of restoration may still be suitable where degradation is minor or protection may still be warranted if moderate degradation has occurred.
2	Action proposed at a location having lower site potential and action type matches with PSNERP proposed type (i.e., protection is being proposed where PSNERP recommends protection and restoration is proposed where restoration is recommended). Lower site potential locations are those designated as either Protection or Restoration.
1	Action proposed at a location having lower site potential and action type (only protection and restoration) is NOT matched to the PSNERP proposed type (i.e., protection is being proposed where PSNERP recommends restoration and restoration is proposed where protection is recommended). Lower site potential locations are those designated as either Protection or Restoration. In addition, this score would be applied to an enhancement action type being proposed to high site potential locations.
0	An enhancement action being proposed for a low site potential location.

3. <u>Action priority</u>: The action priority score would be based on how well the proposed action takes into account the risk factors presented in Cereghino et al. (2012). The level of risk in that document is based on 60-year projections of population growth in the Puget Sound region from Bolte and Vache (2010). Risk is meant to convey the potential for compromise to the effectiveness of efforts to either protect or restore nearshore features based on where and the extent that human population growth are expected to occur. The risk factors are designated as being in one of four levels (none, low, medium, or high); the factors are listed in Appendix B of Cereghino et al. (2012) for each shoreline site. So, for example, the factor "Watershed Development Risk" indicates the level of projected future development in the watershed. A designation of "low" would mean that future watershed development is expected to remain at a low level. In contrast, a designation of "high" would mean that watershed development is expected to occur at a high rate of change over the next 60 years.

   The score for a proposed action in this step would be determined by subtracting a risk factor decrement from the score obtained in Step 2. The conceptual basis is that protection actions would be generally viewed as being most important in areas where the risk of future population growth is high—so, it is seen as being important to commit resources to protect sites from future degradation before development can degrade those sites. On the other hand, it is seen as less important to devote resources to protect sites if there is either no or low potential for future development over the next 60 years. In contrast, the efforts to restore more normative conditions to sites could be compromised if future development is projected to be high, or even medium.

For a proposed protection action, the decrement (the number to subtract from the score in Step 2) would be as follows for each level of risk associated with a location (see Appendix B in Cereghino et al. 2012):

Risk factor	Decrement (value to subtract)
None (0)	3
Low	2
Medium	0
High	0

For a proposed restoration action, the decrement (the number to subtract from the score in Step 2) would be as follows for each level of risk associated with a location (see Appendix B in Cereghino et al. 2012):

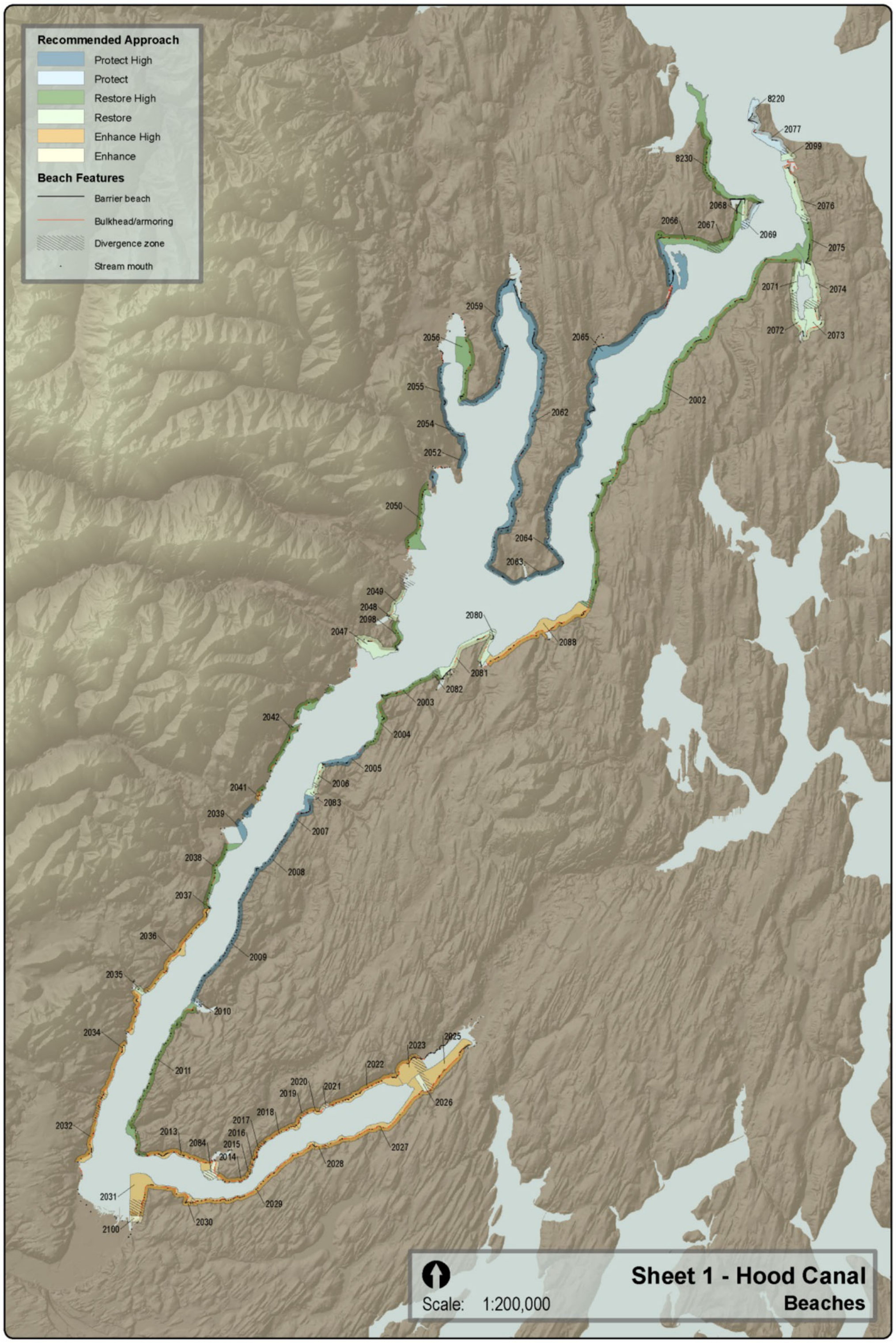
Risk factor	Decrement (value to subtract)
None (0)	0
Low	0
Medium	2
High	3

It is noted that the plan of action (specifics of a proposed project) would need careful evaluation in the project ranking process to assess whether the risk factors given in Cereghino et al. (2012) adequately capture how the risk might affect project effectiveness. Risk might be expected to either be higher or lower than how it was viewed in Cereghino et al. (2012) in some cases.

7.0 Final Comments and Application

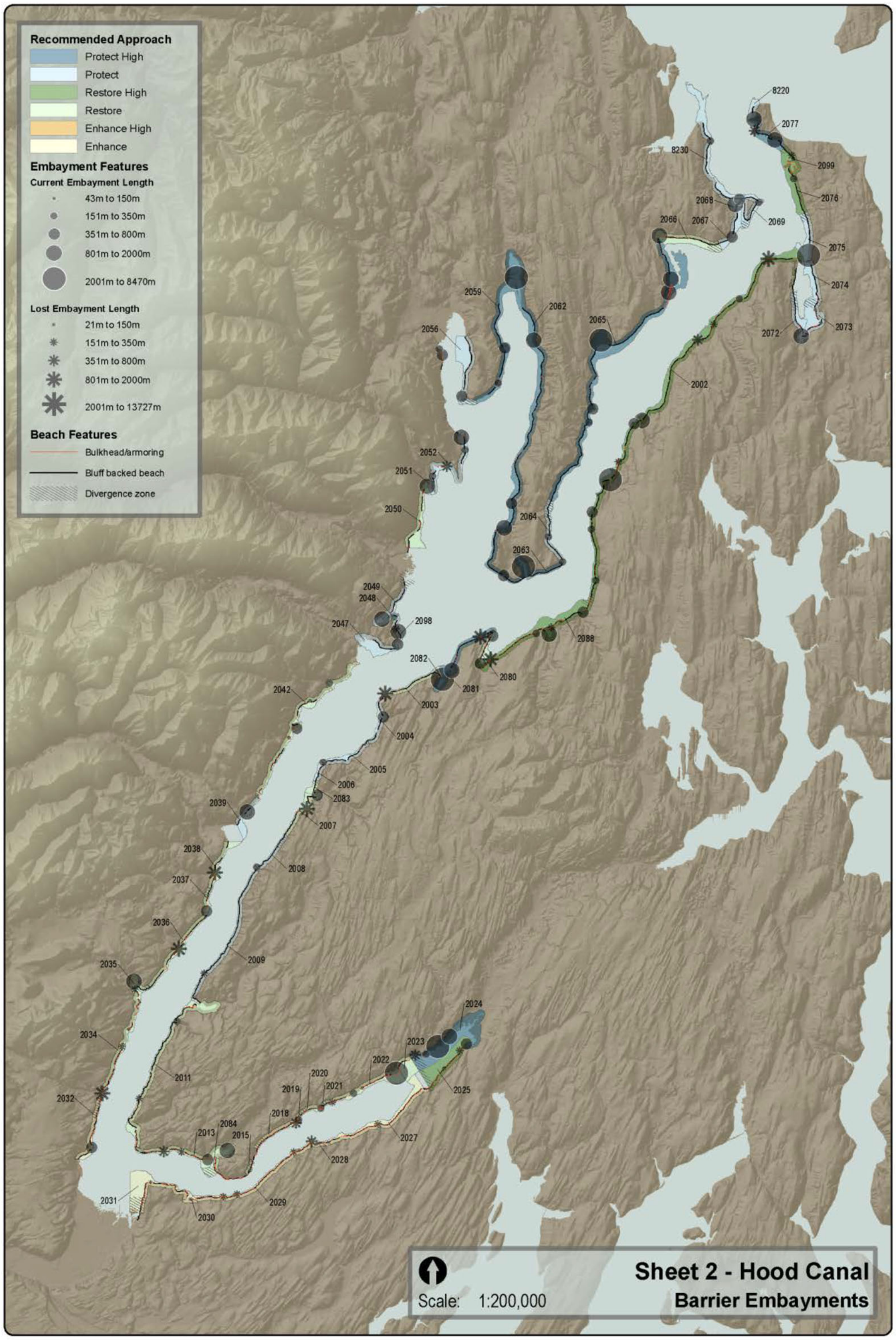
This document is intended to provide guidance about priorities for salmonid recovery actions. The guidance is given to inform project planners and the HCCC about the relative priority that should be given to stocks, issues affecting those stocks, and potential actions for redressing the effects of those issues. Although I have made every attempt to be as complete as possible within the scope of this effort, I recognize that some information may not have been adequately incorporated or considered. Moreover, various scores that have been assigned may not reflect the perspectives of individuals who have other, firsthand information about particular areas in the region. Information can be updated within the report as those individuals consider the material herein and offer comments.

The guidance provided here is meant to be used in assigning a portion of the scoring that would be given to proposed projects in HCCC's annual project selection process. In some cases, in that process, compelling reasons might be given by a project proponent as to why some part of the score taken from this document is incorrect or out-of-date. The project reviewers should take into account any new information that might be brought forward, assuming it is adequately substantiated.



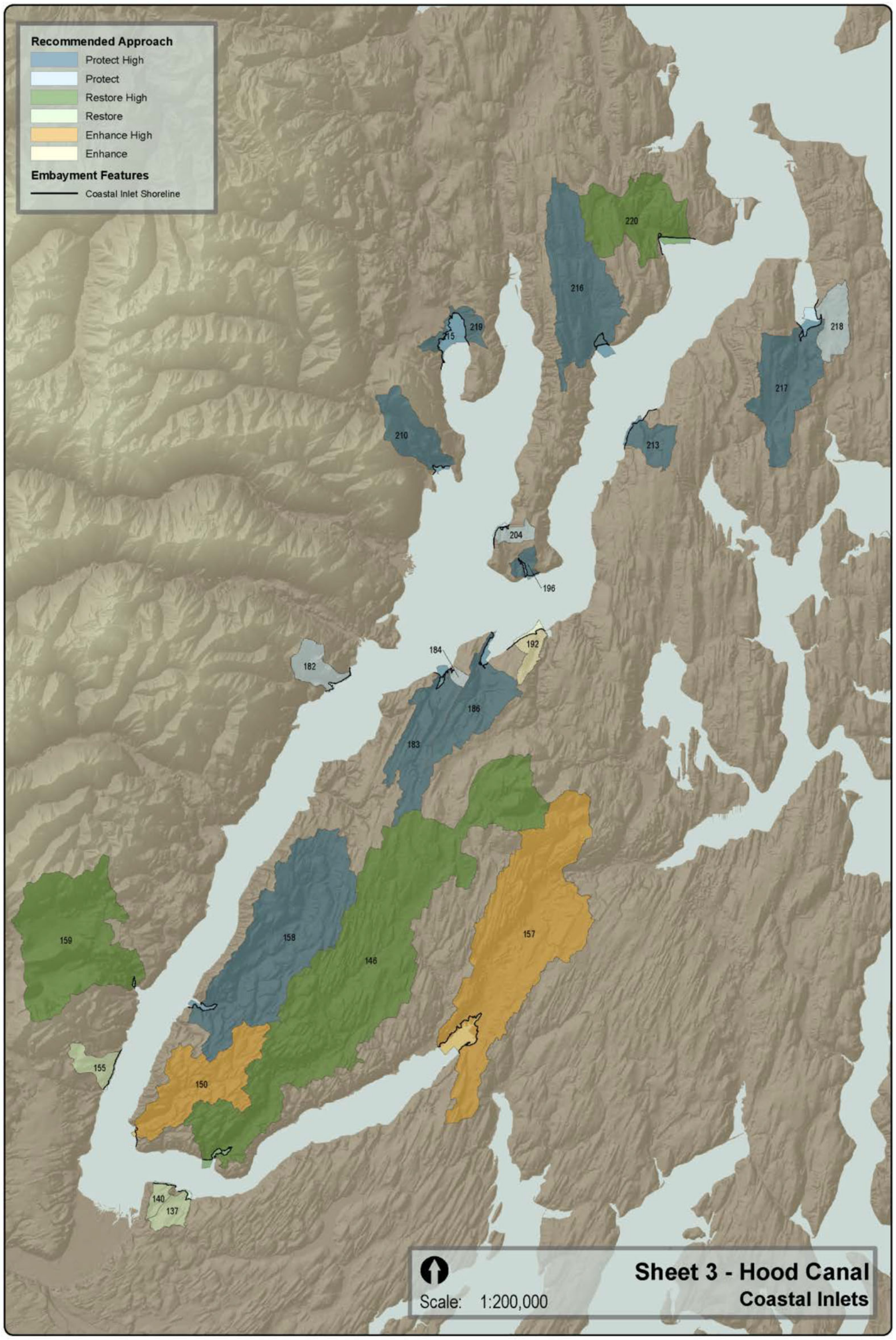
These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 7. Recommended priorities for Hood Canal beaches (Cereghino et al. 2012).



These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 8. Recommended priorities for Hood Canal embayments (Cereghino et al. 2012).



These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 9. Recommended priorities for Hood Canal coastal inlets (Cereghino et al. 2012).

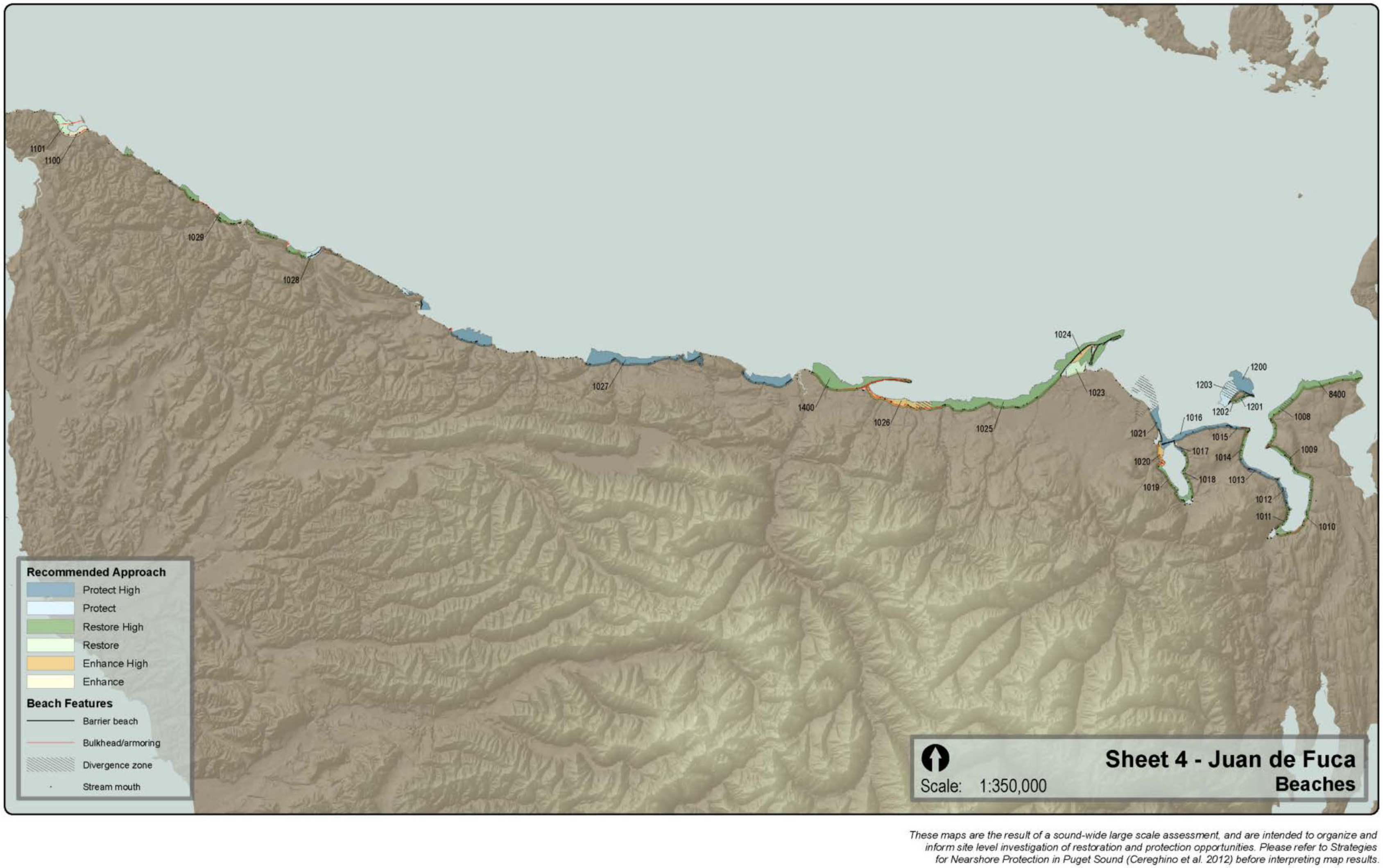
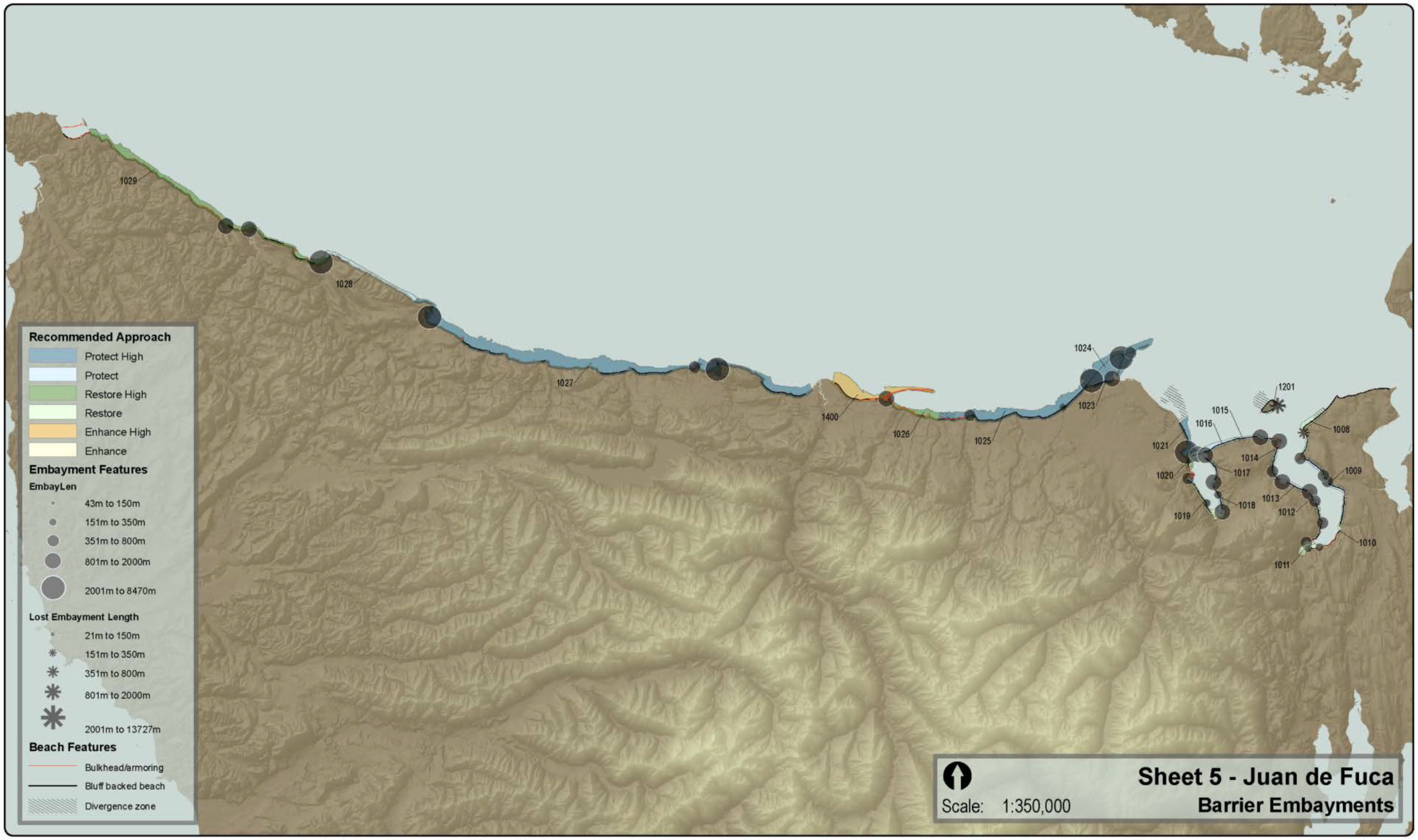
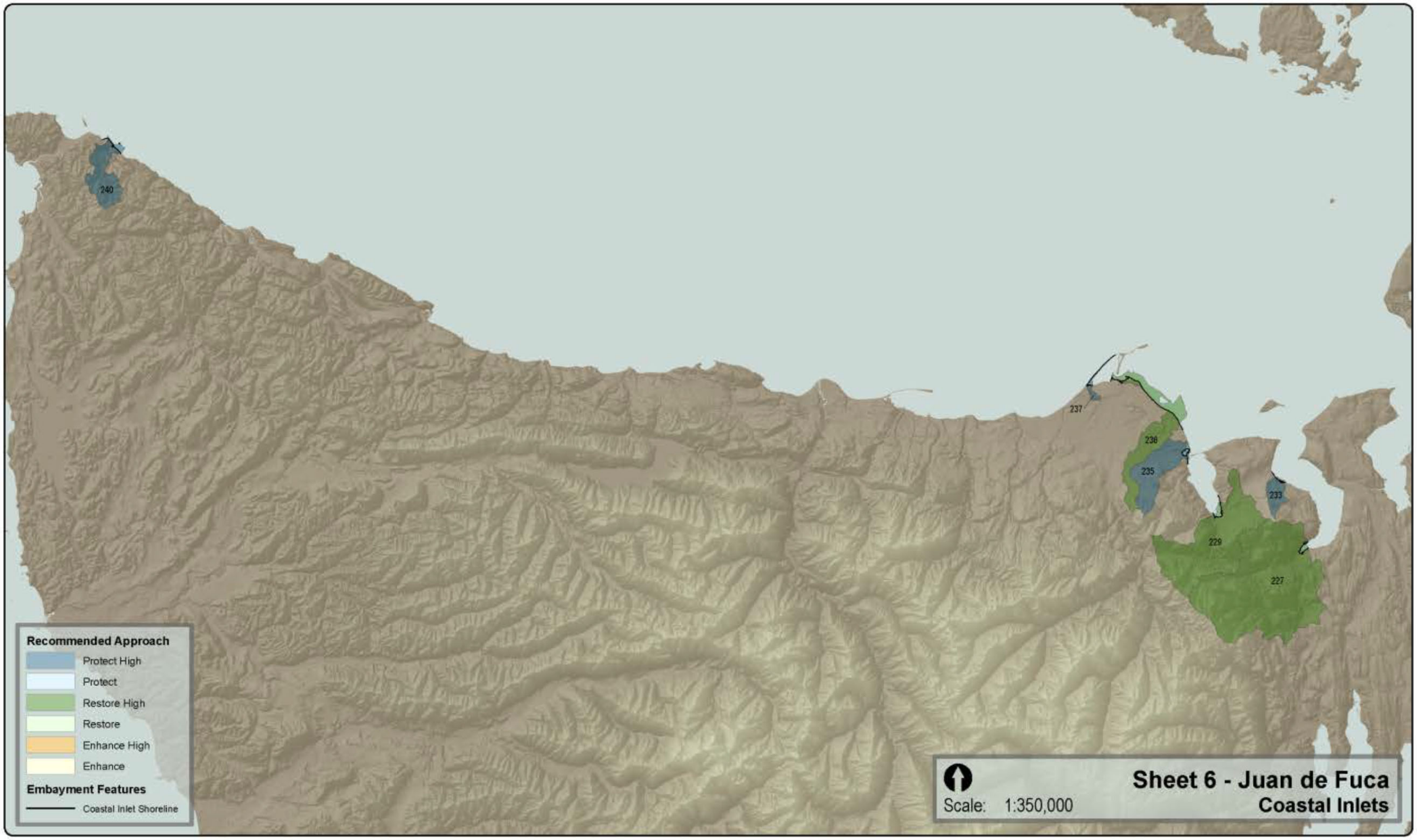


Figure 10. Recommended priorities for Juan de Fuca beaches (Cereghino et al. 2012).



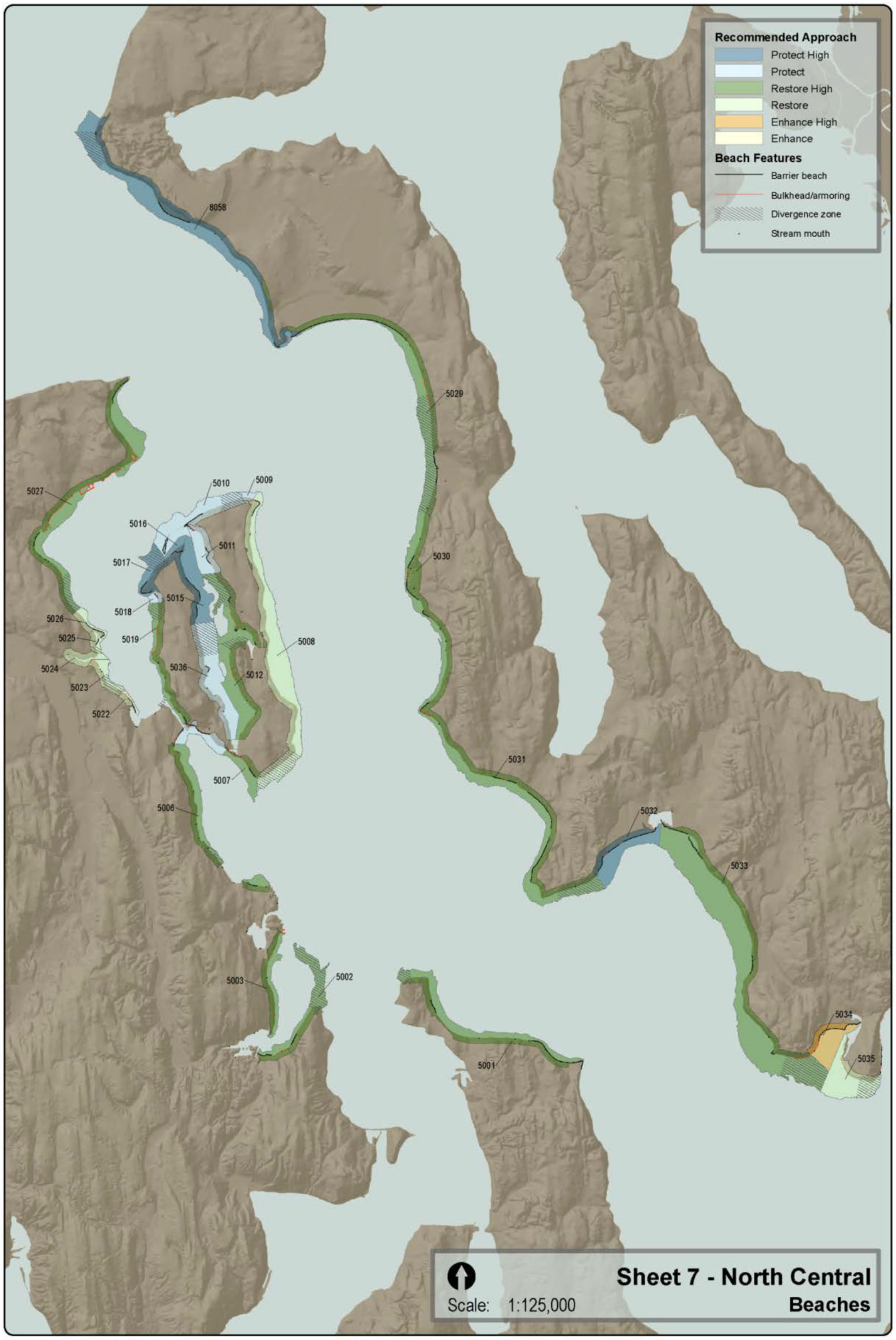
These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 11. Recommended priorities for Juan de Fuca embayments (Cereghino et al. 2012).



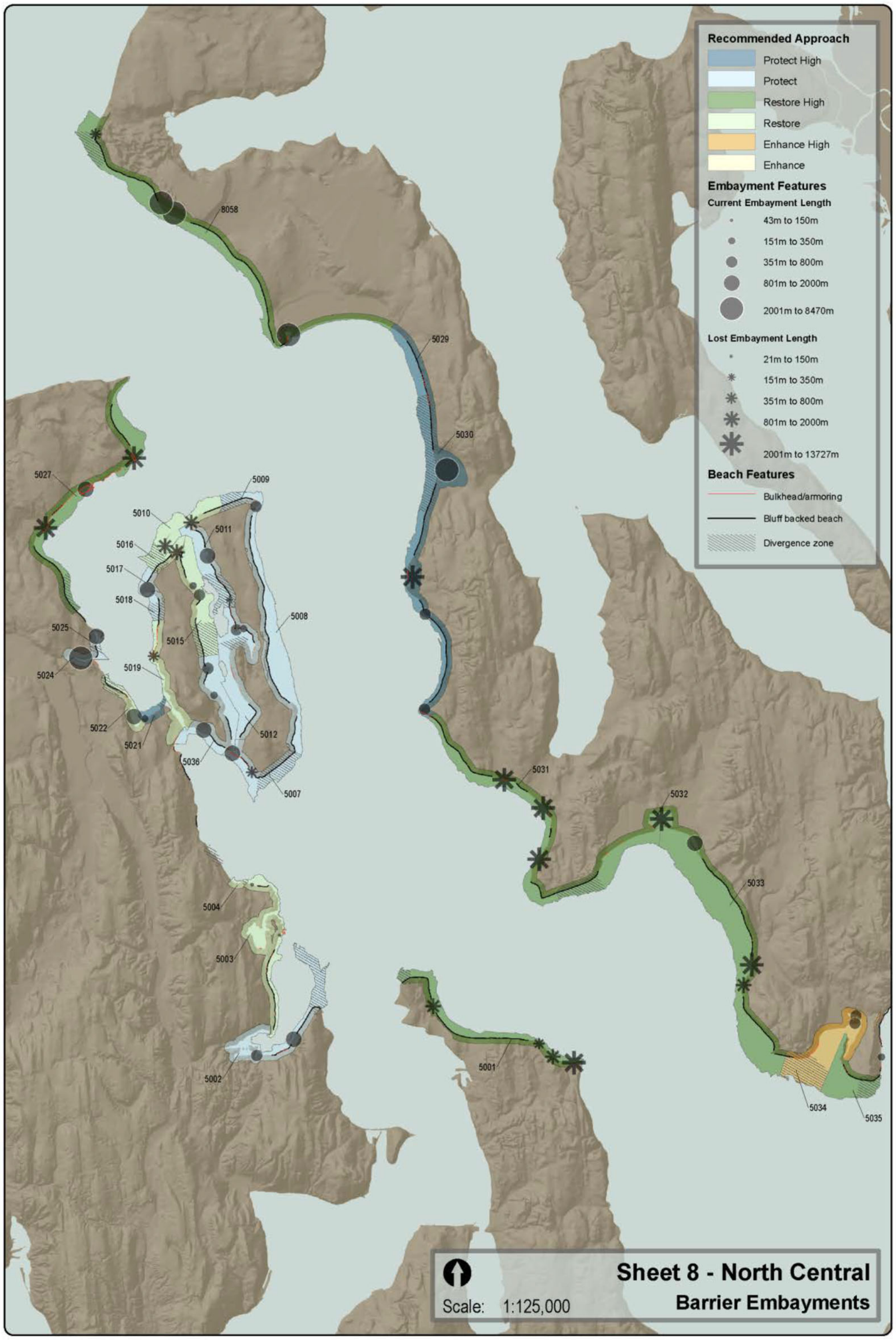
These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 12. Recommended priorities for Juan de Fuca coastal inlets (Cereghino et al. 2012).



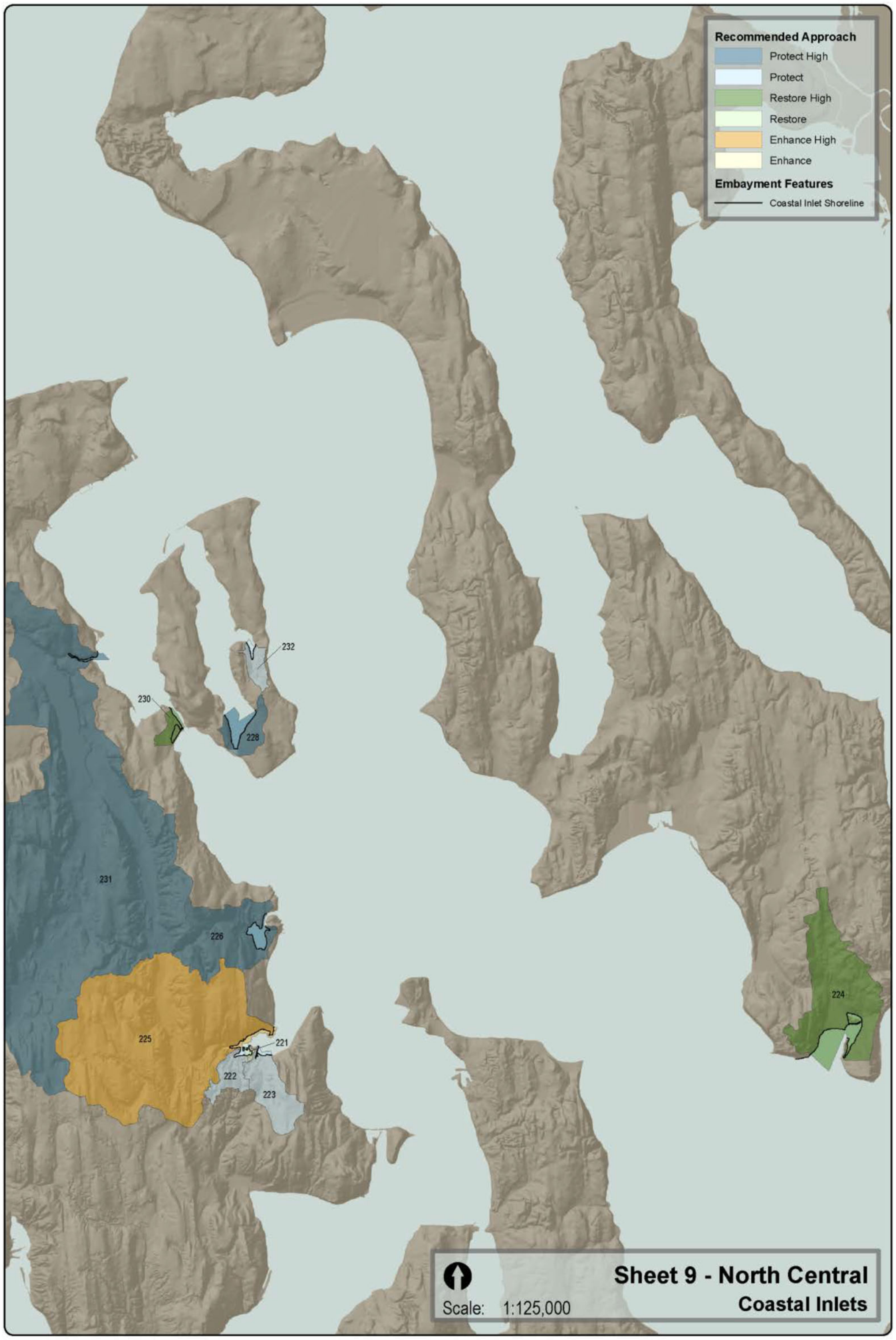
These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 13. Recommended priorities for North Central beaches (Cereghino et al. 2012).



These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 14. Recommended priorities for North Central embayments (Cereghino et al. 2012).



These maps are the result of a sound-wide large scale assessment, and are intended to organize and inform site level investigation of restoration and protection opportunities. Please refer to Strategies for Nearshore Protection in Puget Sound (Cereghino et al. 2012) before interpreting map results.

Figure 15. Recommended priorities for North Central coastal inlets (Cereghino et al. 2012).

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Appendix A – List of Prioritized Stocks

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
1	Skoko_SChum	16.25	1	HC	Skokomish R	Skoko	16.0001	SChum
1	Salmo_SChum	15.75	2	E Strait	Salmon Cr	Salmo	17.0245	SChum
1	Snow _SChum	15.75	2	E Strait	Snow Cr	Snow	17.0219	SChum
1	BQuil_SChum	15.75	2	HC	Big Quilcene R	BQuil	17.0012	SChum
1	Hamma_SChum	15.5	5	HC	Hamma Hamma R	Hamma	16.0251	SChum
1	Skoko_SChin	15.25	6	HC	Skokomish R	Skoko	16.0001	SChin
1	Dewat_SChum	15.25	6	HC	Dewatto R	Dewat	15.0420	SChum
1	Dosew_SChum	15	8	HC	Dosewallips R	Dosew	16.0442	SChum
1	Ducka_SChum	15	8	HC	Duckabush R	Ducka	16.0351	SChum
1	Union_SChum	15	8	HC	Union R	Union	15.0503	SChum
2	Dunge_SChin	14.75	11	E Strait	Dungeness R	Dunge	18.0018	SChin
2	LQuil_SChum	14.75	11	HC	Little Quilcene R	LQuil	17.0076	SChum
2	Skoko_FChin	14.75	11	HC	Skokomish R	Skoko	16.0001	FChin
2	Dunge_SChum	14.5	14	E Strait	Dungeness R	Dunge	18.0018	SChum
2	Tahuy_SChum	14.5	14	HC	Tahuya R	Tahuy	15.0446	SChum
2	Skoko_WSth	14.5	14	HC	Skokomish R	Skoko	16.0001	WSth
2	Chima_SChum	14.25	17	Ad Inlet	Chimacum Cr	Chima	17.0203	SChum
2	Jimmy_SChum	14.25	17	E Strait	Jimmycomelately Cr	Jimmy	17.0285	SChum
2	Dunge_WSth	14.25	17	E Strait	Dungeness R	Dunge	18.0018	WSth
2	Lilli_SChum	14.25	17	HC	Lilliwaup Cr	Lilli	16.0230	SChum
2	BBeef_SChum	14.25	17	HC	Big Beef Cr	BBeef	15.0389	SChum
3	Chima_Coho	13.75	22	Ad Inlet	Chimacum Cr	Chima	17.0203	Coho
3	Salmo_Coho	13.75	22	E Strait	Salmon Cr	Salmo	17.0245	Coho
3	Snow _Coho	13.75	22	E Strait	Snow Cr	Snow	17.0219	Coho
3	Snow _WSth	13.5	25	E Strait	Snow Cr	Snow	17.0219	WSth
3	BBeef_Coho	13.5	25	HC	Big Beef Cr	BBeef	15.0389	Coho
3	Dosew_WSth	13.5	25	HC	Dosewallips R	Dosew	16.0442	WSth
3	Ducka_WSth	13.5	25	HC	Duckabush R	Ducka	16.0351	WSth
3	Dewat_Coho	13.5	25	HC	Dewatto R	Dewat	15.0420	Coho
3	Tahuy_Coho	13.5	25	HC	Tahuya R	Tahuy	15.0446	Coho
3	Salmo_WSth	13.25	31	E Strait	Salmon Cr	Salmo	17.0245	WSth
3	Union_Coho	13.25	31	HC	Union R	Union	15.0503	Coho
3	Hamma_WSth	13	33	HC	Hamma Hamma R	Hamma	16.0251	WSth
3	Dewat_WSth	13	33	HC	Dewatto R	Dewat	15.0420	WSth
3	Tahuy_WSth	13	33	HC	Tahuya R	Tahuy	15.0446	WSth
3	Skoko_SSth	13	33	HC	Skokomish R	Skoko	16.0001	SSth
3	Skoko_Char	13	33	HC	Skokomish R	Skoko	16.0001	Char
3	Skoko_Coho	13	33	HC	Skokomish R	Skoko	16.0001	Coho
4	Dunge_SSth	12.75	39	E Strait	Dungeness R	Dunge	18.0018	SSth
4	Jimmy_Coho	12.75	39	E Strait	Jimmycomelately Cr	Jimmy	17.0285	Coho
4	Jimmy_WSth	12.75	39	E Strait	Jimmycomelately Cr	Jimmy	17.0285	WSth
4	Tarbo_Coho	12.75	39	HC	Tarboo Cr	Tarbo	17.0129	Coho
4	Dunge_Coho	12.75	39	E Strait	Dungeness R	Dunge	18.0018	Coho
4	Dunge_Char	12.75	39	E Strait	Dungeness R	Dunge	18.0018	Char
4	Stavi_Coho	12.75	39	HC	Stavis Cr	Stavi	15.0404	Coho
4	Dosew_Coho	12.75	39	HC	Dosewallips R	Dosew	16.0442	Coho
4	Dosew_SSth	12.75	39	HC	Dosewallips R	Dosew	16.0442	SSth
4	Ducka_Coho	12.75	39	HC	Duckabush R	Ducka	16.0351	Coho

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
4	Ducka_SSth	12.75	39	HC	Duckabush R	Ducka	16.0351	SSth
4	Ander_Coho	12.75	39	HC	Anderson Cr	Ander	15.0412	Coho
4	Hamma_Coho	12.75	39	HC	Hamma Hamma R	Hamma	16.0251	Coho
4	BMiss_Coho	12.75	39	HC	Big Mission Cr	BMiss	15.0495	Coho
4	LAnde_Coho	12.75	39	HC	Little Anderson Cr	LAnde	15.0377	Coho
4	Cassa_Coho	12.25	54	E Strait	Cassalery Cr	Cassa	18.0015	Coho
4	Gieri_Coho	12.25	54	E Strait	Gierin Cr	Gieri	18.0004	Coho
4	Bell _Coho	12.25	54	E Strait	Bell Cr	Bell	18.0001	Coho
4	Rends_Coho	12.25	54	HC	Rendsland Cr	Rends	15.0439	Coho
4	Coope_Coho	12.25	54	E Strait	Cooper Cr	Coope	18.0017	Coho
4	JohnN_Coho	12.25	54	E Strait	Johnson Cr N	JohnN	17.0301	Coho
4	Dean _Coho	12.25	54	E Strait	Dean Cr	Dean	17.0293	Coho
4	Chick_Coho	12.25	54	E Strait	Chicken Coop Cr	Chick	17.0278	Coho
4	EaglN_Coho	12.25	54	E Strait	Eagle Cr N	EaglN	17.0272	Coho
4	Contr_Coho	12.25	54	E Strait	Contractors Cr	Contr	17.0270	Coho
4	LGoos_Coho	12.25	54	Ad Inlet	Little Goose Cr	LGoos	17.0200A	Coho
4	Piddl_Coho	12.25	54	Ad Inlet	Piddling Cr	Piddl	17.0200	Coho
4	Ludlo_Coho	12.25	54	Ad Inlet	Ludlow Cr	Ludlo	17.0192	Coho
4	Un0190_Coho	12.25	54	Ad Inlet	Unnamed 17.0190	Un0190	17.0190	Coho
4	Hawks_Coho	12.25	54	Ad Inlet	Hawks Hole Cr	Hawks	15.0347	Coho
4	Toddh_Coho	12.25	54	Ad Inlet	Toddhunter Cr	Toddh	15.0360	Coho
4	Sprin_Coho	12.25	54	HC	Spring Cr	Sprin	15.0364	Coho
4	Bones_Coho	12.25	54	HC	Bones Cr	Bones	17.0181A	Coho
4	Shine_Coho	12.25	54	HC	Shine Cr	Shine	17.0181	Coho
4	Nords_Coho	12.25	54	HC	Nordstrom Cr	Nords	17.0180	Coho
4	Kinma_Coho	12.25	54	HC	Kinman Cr	Kinma	15.0367	Coho
4	Jump _Coho	12.25	54	HC	Jump Off Joe Cr	Jump	15.0369	Coho
4	Catta_Coho	12.25	54	HC	Cattail Cr	Catta	15.0370	Coho
4	DevHol_Coho	12.25	54	HC	Devils Hole Cr	DevHol	15.0374	Coho
4	Un0376_Coho	12.25	54	HC	Unnamed 15.0376	Un0376	15.0376	Coho
4	Thorn_Coho	12.25	54	HC	Thorndyke Cr	Thorn	17.0170	Coho
4	Un0167_Coho	12.25	54	HC	Unnamed 17.0167	Un0167	17.0167	Coho
4	JohnS_Coho	12.25	54	HC	Johnson Cr S	JohnS	15.0387	Coho
4	Fishe_Coho	12.25	54	HC	Fisherman Harbor Cr	Fishe	17.0153	Coho
4	LBeef_Coho	12.25	54	HC	Little Big Beef Cr	LBeef	15.0399	Coho
4	Seabe_Coho	12.25	54	HC	Seabeck Cr	Seabe	15.0400	Coho
4	Camp _Coho	12.25	54	HC	Camp Discovery Cr	Camp	17.0141	Coho
4	Un0126_Coho	12.25	54	HC	Unnamed 17.0126	Un0126	17.0126	Coho
4	Un0123_Coho	12.25	54	HC	Unnamed 17.0123	Un0123	17.0123	Coho
4	LQuil_WSth	12.25	54	HC	Little Quilcene R	LQuil	17.0076	WSth
4	BQuil_WSth	12.25	54	HC	Big Quilcene R	BQuil	17.0012	WSth
4	Spenc_Coho	12.25	54	HC	Spencer Cr	Spenc	17.0004	Coho
4	Marpl_Coho	12.25	54	HC	Marple Cr	Marpl	17.0001	Coho
4	Turne_Coho	12.25	54	HC	Turner Cr	Turne	16.0559	Coho
4	Un0403_Coho	12.25	54	HC	Unnamed 15.0403	Un0403	15.0403	Coho
4	2nd U_Coho	12.25	54	HC	2nd Unnamed N of Walker Cr	2nd U	16.0441B	Coho
4	UnWalk_Coho	12.25	54	HC	Unnamed N of Walker Cr	UnWalk	16.0441A	Coho
4	Walke_Coho	12.25	54	HC	Walker Cr	Walke	16.0441	Coho
4	Un0439_Coho	12.25	54	HC	Unnamed 16.0439	Un0439	16.0439	Coho
4	Pierc_Coho	12.25	54	HC	Pierce Cr	Pierc	16.0438	Coho
4	McDon_Coho	12.25	54	HC	McDonald Cr	McDon	16.0349	Coho

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
4	Boyce_Coho	12.25	54	HC	Boyce Cr	Boyce	15.0407	Coho
4	Fulto_Coho	12.25	54	HC	Fulton Cr	Fulto	16.0332	Coho
4	Schae_Coho	12.25	54	HC	Schaerer Cr	Schae	16.0326	Coho
4	Waket_Coho	12.25	54	HC	Waketickeh Cr	Waket	16.0318	Coho
4	Hardi_Coho	12.25	54	HC	Harding Cr	Hardi	15.0408	Coho
4	Thoma_Coho	12.25	54	HC	Thomas Cr	Thoma	15.0417	Coho
4	Jorst_Coho	12.25	54	HC	Jorsted Cr	Jorst	16.0248	Coho
4	EaglS_Coho	12.25	54	HC	Eagle Cr S	EaglS	16.0243	Coho
4	LDewa_Coho	12.25	54	HC	Little Dewatto Cr	LDewa	15.0438	Coho
4	Lilli_Coho	12.25	54	HC	Lilliwaup Cr	Lilli	16.0230	Coho
4	LLill_Coho	12.25	54	HC	Little Lilliwaup Cr	LLill	16.0228	Coho
4	Sund _Coho	12.25	54	HC	Sund Cr	Sund	16.0226	Coho
4	Mille_Coho	12.25	54	HC	Miller Cr	Mille	16.0225	Coho
4	Clark_Coho	12.25	54	HC	Clark Cr	Clark	16.0224	Coho
4	Brown_Coho	12.25	54	HC	Browns Cr	Brown	15.0444	Coho
4	Calde_Coho	12.25	54	HC	Caldervin Cr	Calde	15.0445	Coho
4	Shoof_Coho	12.25	54	HC	Shoofly Cr	Shoof	15.0478	Coho
4	LShoo_Coho	12.25	54	HC	Little Shoofly Cr	LShoo	15.0483	Coho
4	Cady _Coho	12.25	54	HC	Cady Cr	Cady	15.0486	Coho
4	North_Coho	12.25	54	HC	Northshore Nursery Cr	North	15.0487	Coho
4	Stims_Coho	12.25	54	HC	Stimson Cr	Stims	15.0488	Coho
4	Sunds_Coho	12.25	54	HC	Sundstrom Cr	Sunds	15.0492	Coho
4	LMiss_Coho	12.25	54	HC	Little Mission Cr	LMiss	15.0493	Coho
4	Dever_Coho	12.25	54	HC	Devereaux Cr	Dever	14.0124	Coho
4	SpLak_Coho	12.25	54	HC	Springbrook Lakewood Cr	SpLak	14.0126	Coho
4	Holyo_Coho	12.25	54	HC	Holyoke Cr	Holyo	14.0127	Coho
4	Happy_Coho	12.25	54	HC	Happy Hollow Cr	Happy	14.0129	Coho
4	Un0130_Coho	12.25	54	HC	Unnamed 14.0130	Un0130	14.0130	Coho
4	TwanF_Coho	12.25	54	HC	Twanoh Falls Cr	TwanF	14.0132	Coho
4	Twan_Coho	12.25	54	HC	Twanoh Cr	Twan	14.0134	Coho
4	BBend_Coho	12.25	54	HC	Big Bend Cr	BBend	14.0138	Coho
5	BBeef_WSth	12	131	HC	Big Beef Cr	BBeef	15.0389	WSth
5	Ander_WSth	12	131	HC	Anderson Cr	Ander	15.0412	WSth
5	BMiss_WSth	12	131	HC	Big Mission Cr	BMiss	15.0495	WSth
5	Union_WSth	12	131	HC	Union R	Union	15.0503	WSth
5	Skoko_Sock	12	131	HC	Skokomish R	Skoko	16.0001	Sock
5	Stavi_WSth	12	131	HC	Stavis Cr	Stavi	15.0404	WSth
5	Hamma_FChum	12	131	HC	Hamma Hamma R	Hamma	16.0251	FChum
5	Tahuy_FChum	12	131	HC	Tahuya R	Tahuy	15.0446	FChum
5	Union_FChum	12	131	HC	Union R	Union	15.0503	FChum
5	Chima_WSth	11.75	140	Ad Inlet	Chimacum Cr	Chima	17.0203	WSth
5	Gambl_WSth	11.75	140	Ad Inlet	Gamble Cr	Gambl	15.0356	WSth
5	Donov_Coho	11.75	140	HC	Donovan Cr	Donov	17.0115	Coho
5	Meado_WSth	11.75	140	E Strait	Meadowbrook Cr	Meado	18.0020	WSth
5	Coope_WSth	11.75	140	E Strait	Cooper Cr	Coope	18.0017	WSth
5	Cassa_WSth	11.75	140	E Strait	Cassalery Cr	Cassa	18.0015	WSth
5	Gieri_WSth	11.75	140	E Strait	Gierin Cr	Gieri	18.0004	WSth
5	Bell _WSth	11.75	140	E Strait	Bell Cr	Bell	18.0001	WSth
5	JohnN_WSth	11.75	140	E Strait	Johnson Cr N	JohnN	17.0301	WSth
5	Tarbo_WSth	11.75	140	HC	Tarboo Cr	Tarbo	17.0129	WSth
5	BQuil_FChum	11.75	140	HC	Big Quilcene R	BQuil	17.0012	FChum
5	Dosew_FChum	11.75	140	HC	Dosewallips R	Dosew	16.0442	FChum

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
5	Marth_WSth	11.75	140	Ad Inlet	Martha John Cr	Marth	15.0353	WSth
5	Shine_WSth	11.75	140	HC	Shine Cr	Shine	17.0181	WSth
5	Thorn_WSth	11.75	140	HC	Thorndyke Cr	Thorn	17.0170	WSth
5	LAnde_WSth	11.75	140	HC	Little Anderson Cr	LAnde	15.0377	WSth
5	Seabe_WSth	11.75	140	HC	Seabeck Cr	Seabe	15.0400	WSth
5	Donov_WSth	11.75	140	HC	Donovan Cr	Donov	17.0115	WSth
5	BQuil_Char	11.75	140	HC	Big Quilcene R	BQuil	17.0012	Char
5	Spenc_WSth	11.75	140	HC	Spencer Cr	Spenc	17.0004	WSth
5	Dosew_Char	11.75	140	HC	Dosewallips R	Dosew	16.0442	Char
5	Pierc_WSth	11.75	140	HC	Pierce Cr	Pierc	16.0438	WSth
5	Ducka_Char	11.75	140	HC	Duckabush R	Ducka	16.0351	Char
5	Hamma_Char	11.75	140	HC	Hamma Hamma R	Hamma	16.0251	Char
5	EaglS_WSth	11.75	140	HC	Eagle Cr S	EaglS	16.0243	WSth
5	LDewa_WSth	11.75	140	HC	Little Dewatto Cr	LDewa	15.0438	WSth
5	Lilli_WSth	11.75	140	HC	Lilliwaup Cr	Lilli	16.0230	WSth
5	Rends_WSth	11.75	140	HC	Rendsland Cr	Rends	15.0439	WSth
5	LMiss_WSth	11.75	140	HC	Little Mission Cr	LMiss	15.0493	WSth
5	Ducka_FChum	11.5	169	HC	Duckabush R	Ducka	16.0351	FChum
5	Gambl_Coho	11.25	170	Ad Inlet	Gamble Cr	Gambl	15.0356	Coho
5	LQuil_FChum	11.25	170	HC	Little Quilcene R	LQuil	17.0076	FChum
5	Littl_Coho	11.25	170	Ad Inlet	Little Boston Cr	Littl	15.0350	Coho
5	Middl_Coho	11.25	170	Ad Inlet	Middle Cr	Middl	15.0352	Coho
5	Marth_Coho	11.25	170	Ad Inlet	Martha John Cr	Marth	15.0353	Coho
5	India_Coho	11.25	170	HC	Indian George Cr	India	17.0011	Coho
5	DevLak_Coho	11.25	170	HC	Devil's Lake Cr	DevLak	17.0007	Coho
5	Finch_Coho	11.25	170	HC	Finch Cr	Finch	16.0222	Coho
5	Hill _Coho	11.25	170	HC	Hill Cr	Hill	16.0221	Coho
5	Potla_Coho	11.25	170	HC	Potlatch Cr	Potla	16.0220	Coho
5	Un0218_Coho	11.25	170	HC	Unnamed 16.0218	Un0218	16.0218	Coho
5	Un0217_Coho	11.25	170	HC	Unnamed 16.0217	Un0217	16.0217	Coho
5	Un0216_Coho	11.25	170	HC	Unnamed 16.0216	Un0216	16.0216	Coho
5	Un0215_Coho	11.25	170	HC	Unnamed 16.0215	Un0215	16.0215	Coho
5	BBeef_FChum	11	184	HC	Big Beef Cr	BBeef	15.0389	FChum
5	Tarbo_FChum	11	184	HC	Tarboo Cr	Tarbo	17.0129	FChum
5	Stavi_FChum	11	184	HC	Stavis Cr	Stavi	15.0404	FChum
5	Ander_FChum	11	184	HC	Anderson Cr	Ander	15.0412	FChum
5	Dewat_FChum	11	184	HC	Dewatto R	Dewat	15.0420	FChum
5	BMiss_FChum	11	184	HC	Big Mission Cr	BMiss	15.0495	FChum
5	Dunge_Pink	10.75	190	E Strait	Dungeness R	Dunge	18.0018	Pink
5	Meado_Coho	10.75	190	E Strait	Meadowbrook Cr	Meado	18.0020	Coho
5	LQuil_Coho	10.75	190	HC	Little Quilcene R	LQuil	17.0076	Coho
5	Gambl_FChum	10.75	190	Ad Inlet	Gamble Cr	Gambl	15.0356	FChum
5	Donov_FChum	10.75	190	HC	Donovan Cr	Donov	17.0115	FChum
5	India_FChum	10.75	190	HC	Indian George Cr	India	17.0011	FChum
5	BQuil_Coho	10.75	190	HC	Big Quilcene R	BQuil	17.0012	Coho
6	Seabe_FChum	10	197	HC	Seabeck Cr	Seabe	15.0400	FChum
6	Shine_FChum	10	197	HC	Shine Cr	Shine	17.0181	FChum
6	Thorn_FChum	10	197	HC	Thorndyke Cr	Thorn	17.0170	FChum
6	Dosew_Pink	10	197	HC	Dosewallips R	Dosew	16.0442	Pink
6	Ducka_Pink	10	197	HC	Duckabush R	Ducka	16.0351	Pink
6	Hamma_Pink	10	197	HC	Hamma Hamma R	Hamma	16.0251	Pink
6	Stims_FChum	10	197	HC	Stimson Cr	Stims	15.0488	FChum

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
6	Skoko_FChum	10	197	HC	Skokomish R	Skoko	16.0001	FChum
6	Skoko_Pink	10	197	HC	Skokomish R	Skoko	16.0001	Pink
6	LAnde_FChum	9.75	206	HC	Little Anderson Cr	LAnde	15.0377	FChum
6	Spenc_FChum	9.75	206	HC	Spencer Cr	Spenc	17.0004	FChum
6	Marpl_FChum	9.75	206	HC	Marple Cr	Marpl	17.0001	FChum
6	Turne_FChum	9.75	206	HC	Turner Cr	Turne	16.0559	FChum
6	2nd U_FChum	9.75	206	HC	2nd Unnamed N of Walker Cr	2nd U	16.0441B	FChum
6	UnWalk_FChum	9.75	206	HC	Unnamed N of Walker Cr	UnWalk	16.0441A	FChum
6	Walke_FChum	9.75	206	HC	Walker Cr	Walke	16.0441	FChum
6	McDon_FChum	9.75	206	HC	McDonald Cr	McDon	16.0349	FChum
6	Fulto_FChum	9.75	206	HC	Fulton Cr	Fulto	16.0332	FChum
6	Schae_FChum	9.75	206	HC	Schaerer Cr	Schae	16.0326	FChum
6	Waket_FChum	9.75	206	HC	Waketickeh Cr	Waket	16.0318	FChum
6	Lilli_FChum	9.75	206	HC	Lilliwaup Cr	Lilli	16.0230	FChum
6	Pierc_FChum	9.5	218	HC	Pierce Cr	Pierc	16.0438	FChum
6	Rends_FChum	9.5	218	HC	Rendsland Cr	Rends	15.0439	FChum
6	Shoof_FChum	9.25	220	HC	Shoofly Cr	Shoof	15.0478	FChum
6	LMiss_FChum	9.25	220	HC	Little Mission Cr	LMiss	15.0493	FChum
6	LQuil_Pink	9.25	220	HC	Little Quilcene R	LQuil	17.0076	Pink
6	BQuil_Pink	9.25	220	HC	Big Quilcene R	BQuil	17.0012	Pink
6	Dewat_Pink	9.25	220	HC	Dewatto R	Dewat	15.0420	Pink
6	Lilli_Pink	9.25	220	HC	Lilliwaup Cr	Lilli	16.0230	Pink
6	Tahuy_Pink	9.25	220	HC	Tahuya R	Tahuy	15.0446	Pink
6	Union_Pink	9.25	220	HC	Union R	Union	15.0503	Pink
6	Dunge_FChum	9	228	E Strait	Dungeness R	Dunge	18.0018	FChum
6	LBeef_FChum	9	228	HC	Little Big Beef Cr	LBeef	15.0399	FChum
6	Un0403_FChum	9	228	HC	Unnamed 15.0403	Un0403	15.0403	FChum
6	Skoko_Cutt	9	228	HC	Skokomish R	Skoko	16.0001	Cutt
6	Dosew_Chin	9	228	HC	Dosewallips R	Dosew	16.0442	Chin
6	Ducka_Chin	9	228	HC	Duckabush R	Ducka	16.0351	Chin
6	Dunge_Cutt	9	228	E Strait	Dungeness R	Dunge	18.0018	Cutt
6	JohnN_FChum	9	228	E Strait	Johnson Cr N	JohnN	17.0301	FChum
6	Salmo_FChum	9	228	E Strait	Salmon Cr	Salmo	17.0245	FChum
6	Chima_FChum	9	228	Ad Inlet	Chimacum Cr	Chima	17.0203	FChum
6	Ludlo_FChum	9	228	Ad Inlet	Ludlow Cr	Ludlo	17.0192	FChum
6	Sprin_FChum	9	228	HC	Spring Cr	Sprin	15.0364	FChum
6	Kinma_FChum	9	228	HC	Kinman Cr	Kinma	15.0367	FChum
6	Jump _FChum	9	228	HC	Jump Off Joe Cr	Jump	15.0369	FChum
6	Un0376_FChum	9	228	HC	Unnamed 15.0376	Un0376	15.0376	FChum
6	BBeef_Cutt	9	228	HC	Big Beef Cr	BBeef	15.0389	Cutt
6	LQuil_Cutt	9	228	HC	Little Quilcene R	LQuil	17.0076	Cutt
6	Boyce_FChum	9	228	HC	Boyce Cr	Boyce	15.0407	FChum
6	Hardi_FChum	9	228	HC	Harding Cr	Hardi	15.0408	FChum
6	Ander_Cutt	9	228	HC	Anderson Cr	Ander	15.0412	Cutt
6	Thoma_FChum	9	228	HC	Thomas Cr	Thoma	15.0417	FChum
6	Dewat_Cutt	9	228	HC	Dewatto R	Dewat	15.0420	Cutt
6	LDewa_FChum	9	228	HC	Little Dewatto Cr	LDewa	15.0438	FChum
6	Calde_FChum	9	228	HC	Caldervin Cr	Calde	15.0445	FChum
6	Tahuy_Cutt	9	228	HC	Tahuya R	Tahuy	15.0446	Cutt
6	LShoo_FChum	9	228	HC	Little Shoofly Cr	LShoo	15.0483	FChum
6	Cady _FChum	9	228	HC	Cady Cr	Cady	15.0486	FChum

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
6	North_FChum	9	228	HC	Northshore Nursery Cr	North	15.0487	FChum
6	Sunds_FChum	9	228	HC	Sundstrom Cr	Sunds	15.0492	FChum
6	BMiss_Cutt	9	228	HC	Big Mission Cr	BMiss	15.0495	Cutt
6	Union_Cutt	9	228	HC	Union R	Union	15.0503	Cutt
6	Un0190_FChum	9	228	Ad Inlet	Unnamed 17.0190	Un0190	17.0190	FChum
6	Nords_FChum	9	228	HC	Nordstrom Cr	Nords	17.0180	FChum
6	Camp _FChum	9	228	HC	Camp Discovery Cr	Camp	17.0141	FChum
6	Chima_Cutt	8.75	262	Ad Inlet	Chimacum Cr	Chima	17.0203	Cutt
6	Gambl_Cutt	8.75	262	Ad Inlet	Gamble Cr	Gambl	15.0356	Cutt
6	Stavi_Cutt	8.75	262	HC	Stavis Cr	Stavi	15.0404	Cutt
6	Meado_Cutt	8.75	262	E Strait	Meadowbrook Cr	Meado	18.0020	Cutt
6	Coope_Cutt	8.75	262	E Strait	Cooper Cr	Coope	18.0017	Cutt
6	Cassa_Cutt	8.75	262	E Strait	Cassalery Cr	Cassa	18.0015	Cutt
6	Gieri_Cutt	8.75	262	E Strait	Gierin Cr	Gieri	18.0004	Cutt
6	Bell _Cutt	8.75	262	E Strait	Bell Cr	Bell	18.0001	Cutt
6	Jimmy_Cutt	8.75	262	E Strait	Jimmycomelately Cr	Jimmy	17.0285	Cutt
6	Salmo_Cutt	8.75	262	E Strait	Salmon Cr	Salmo	17.0245	Cutt
6	Snow _Cutt	8.75	262	E Strait	Snow Cr	Snow	17.0219	Cutt
6	Thorn_Cutt	8.75	262	HC	Thorndyke Cr	Thorn	17.0170	Cutt
6	Tarbo_Cutt	8.75	262	HC	Tarboo Cr	Tarbo	17.0129	Cutt
6	Donov_Cutt	8.75	262	HC	Donovan Cr	Donov	17.0115	Cutt
6	BQuil_Cutt	8.75	262	HC	Big Quilcene R	BQuil	17.0012	Cutt
6	Dosew_Cutt	8.75	262	HC	Dosewallips R	Dosew	16.0442	Cutt
6	Ducka_Cutt	8.75	262	HC	Duckabush R	Ducka	16.0351	Cutt
6	Hamma_Cutt	8.75	262	HC	Hamma Hamma R	Hamma	16.0251	Cutt
6	Lilli_Cutt	8.75	262	HC	Lilliwaup Cr	Lilli	16.0230	Cutt
6	Rends_Cutt	8.75	262	HC	Rendsland Cr	Rends	15.0439	Cutt
6	Stims_Cutt	8.75	262	HC	Stimson Cr	Stims	15.0488	Cutt
6	LBeef_Cutt	8.75	262	HC	Little Big Beef Cr	LBeef	15.0399	Cutt
6	Seabe_Cutt	8.75	262	HC	Seabeck Cr	Seabe	15.0400	Cutt
6	Un0403_Cutt	8.75	262	HC	Unnamed 15.0403	Un0403	15.0403	Cutt
6	Jorst_FChum	8.75	262	HC	Jorsted Cr	Jorst	16.0248	FChum
6	EaglS_FChum	8.75	262	HC	Eagle Cr S	EaglS	16.0243	FChum
6	LLill_FChum	8.75	262	HC	Little Lilliwaup Cr	LLill	16.0228	FChum
6	JohnN_Cutt	8.75	262	E Strait	Johnson Cr N	JohnN	17.0301	Cutt
6	Dean _Cutt	8.75	262	E Strait	Dean Cr	Dean	17.0293	Cutt
6	Chick_Cutt	8.75	262	E Strait	Chicken Coop Cr	Chick	17.0278	Cutt
6	EaglN_Cutt	8.75	262	E Strait	Eagle Cr N	EaglN	17.0272	Cutt
6	Contr_Cutt	8.75	262	E Strait	Contractors Cr	Contr	17.0270	Cutt
6	LGoos_Cutt	8.75	262	Ad Inlet	Little Goose Cr	LGoos	17.0200A	Cutt
6	Piddl_Cutt	8.75	262	Ad Inlet	Piddling Cr	Piddl	17.0200	Cutt
6	Ludlo_Cutt	8.75	262	Ad Inlet	Ludlow Cr	Ludlo	17.0192	Cutt
6	Un0190_Cutt	8.75	262	Ad Inlet	Unnamed 17.0190	Un0190	17.0190	Cutt
6	Hawks_Cutt	8.75	262	Ad Inlet	Hawks Hole Cr	Hawks	15.0347	Cutt
6	Jukes_Cutt	8.75	262	Ad Inlet	Jukes Cr	Jukes	15.0348	Cutt
6	Littl_Cutt	8.75	262	Ad Inlet	Little Boston Cr	Littl	15.0350	Cutt
6	Middl_Cutt	8.75	262	Ad Inlet	Middle Cr	Middl	15.0352	Cutt
6	Marth_Cutt	8.75	262	Ad Inlet	Martha John Cr	Marth	15.0353	Cutt
6	Toddh_Cutt	8.75	262	Ad Inlet	Toddhunter Cr	Toddh	15.0360	Cutt
6	Sprin_Cutt	8.75	262	HC	Spring Cr	Sprin	15.0364	Cutt
6	Bones_Cutt	8.75	262	HC	Bones Cr	Bones	17.0181A	Cutt
6	Shine_Cutt	8.75	262	HC	Shine Cr	Shine	17.0181	Cutt

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
6	Nords_Cutt	8.75	262	HC	Nordstrom Cr	Nords	17.0180	Cutt
6	Kinma_Cutt	8.75	262	HC	Kinman Cr	Kinma	15.0367	Cutt
6	Jump _Cutt	8.75	262	HC	Jump Off Joe Cr	Jump	15.0369	Cutt
6	Catta_Cutt	8.75	262	HC	Cattail Cr	Catta	15.0370	Cutt
6	DevHol_Cutt	8.75	262	HC	Devils Hole Cr	DevHol	15.0374	Cutt
6	Un0376_Cutt	8.75	262	HC	Unnamed 15.0376	Un0376	15.0376	Cutt
6	Un0167_Cutt	8.75	262	HC	Unnamed 17.0167	Un0167	17.0167	Cutt
6	LAnde_Cutt	8.75	262	HC	Little Anderson Cr	LAnde	15.0377	Cutt
6	JohnS_Cutt	8.75	262	HC	Johnson Cr S	JohnS	15.0387	Cutt
6	Fishe_Cutt	8.75	262	HC	Fisherman Harbor Cr	Fishe	17.0153	Cutt
6	Camp _Cutt	8.75	262	HC	Camp Discovery Cr	Camp	17.0141	Cutt
6	Un0126_Cutt	8.75	262	HC	Unnamed 17.0126	Un0126	17.0126	Cutt
6	Un0123_Cutt	8.75	262	HC	Unnamed 17.0123	Un0123	17.0123	Cutt
6	India_Cutt	8.75	262	HC	Indian George Cr	India	17.0011	Cutt
6	DevLak_Cutt	8.75	262	HC	Devil's Lake Cr	DevLak	17.0007	Cutt
6	Spenc_Cutt	8.75	262	HC	Spencer Cr	Spenc	17.0004	Cutt
6	Marpl_Cutt	8.75	262	HC	Marple Cr	Marpl	17.0001	Cutt
6	Turne_Cutt	8.75	262	HC	Turner Cr	Turne	16.0559	Cutt
6	2nd U_Cutt	8.75	262	HC	2nd Unnamed N of Walker Cr	2nd U	16.0441B	Cutt
6	UnWalk_Cutt	8.75	262	HC	Unnamed N of Walker Cr	UnWalk	16.0441A	Cutt
6	Walke_Cutt	8.75	262	HC	Walker Cr	Walke	16.0441	Cutt
6	Un0439_Cutt	8.75	262	HC	Unnamed 16.0439	Un0439	16.0439	Cutt
6	Pierc_Cutt	8.75	262	HC	Pierce Cr	Pierc	16.0438	Cutt
6	McDon_Cutt	8.75	262	HC	McDonald Cr	McDon	16.0349	Cutt
6	Boyce_Cutt	8.75	262	HC	Boyce Cr	Boyce	15.0407	Cutt
6	Fulto_Cutt	8.75	262	HC	Fulton Cr	Fulto	16.0332	Cutt
6	Schae_Cutt	8.75	262	HC	Schaerer Cr	Schae	16.0326	Cutt
6	Waket_Cutt	8.75	262	HC	Waketickeh Cr	Waket	16.0318	Cutt
6	Hardi_Cutt	8.75	262	HC	Harding Cr	Hardi	15.0408	Cutt
6	Thoma_Cutt	8.75	262	HC	Thomas Cr	Thoma	15.0417	Cutt
6	Jorst_Cutt	8.75	262	HC	Jorsted Cr	Jorst	16.0248	Cutt
6	EaglS_Cutt	8.75	262	HC	Eagle Cr S	EaglS	16.0243	Cutt
6	LDewa_Cutt	8.75	262	HC	Little Dewatto Cr	LDewa	15.0438	Cutt
6	LLill_Cutt	8.75	262	HC	Little Lilliwaup Cr	LLill	16.0228	Cutt
6	Sund _Cutt	8.75	262	HC	Sund Cr	Sund	16.0226	Cutt
6	Mille_Cutt	8.75	262	HC	Miller Cr	Mille	16.0225	Cutt
6	Clark_Cutt	8.75	262	HC	Clark Cr	Clark	16.0224	Cutt
6	Finch_Cutt	8.75	262	HC	Finch Cr	Finch	16.0222	Cutt
6	Hill _Cutt	8.75	262	HC	Hill Cr	Hill	16.0221	Cutt
6	Potla_Cutt	8.75	262	HC	Potlatch Cr	Potla	16.0220	Cutt
6	Brown_Cutt	8.75	262	HC	Browns Cr	Brown	15.0444	Cutt
6	Calde_Cutt	8.75	262	HC	Caldervin Cr	Calde	15.0445	Cutt
6	Shoof_Cutt	8.75	262	HC	Shoofly Cr	Shoof	15.0478	Cutt
6	LShoo_Cutt	8.75	262	HC	Little Shoofly Cr	LShoo	15.0483	Cutt
6	Cady _Cutt	8.75	262	HC	Cady Cr	Cady	15.0486	Cutt
6	North_Cutt	8.75	262	HC	Northshore Nursery Cr	North	15.0487	Cutt
6	Sunds_Cutt	8.75	262	HC	Sundstrom Cr	Sunds	15.0492	Cutt
6	LMiss_Cutt	8.75	262	HC	Little Mission Cr	LMiss	15.0493	Cutt
6	Dever_Cutt	8.75	262	HC	Devereaux Cr	Dever	14.0124	Cutt
6	SpLak_Cutt	8.75	262	HC	Springbrook Lakewood Cr	SpLak	14.0126	Cutt
6	Holyo_Cutt	8.75	262	HC	Holyoke Cr	Holyo	14.0127	Cutt

Rank group	Stock	Region score	Rank	Subregion	Watershed	Watershed code	WRIA#	Species
6	Happy_Cutt	8.75	262	HC	Happy Hollow Cr	Happy	14.0129	Cutt
6	Un0130_Cutt	8.75	262	HC	Unnamed 14.0130	Un0130	14.0130	Cutt
6	TwanF_Cutt	8.75	262	HC	Twanoh Falls Cr	TwanF	14.0132	Cutt
6	Twan_Cutt	8.75	262	HC	Twanoh Cr	Twan	14.0134	Cutt
6	BBend_Cutt	8.75	262	HC	Big Bend Cr	BBend	14.0138	Cutt
6	Un0218_Cutt	8.75	262	HC	Unnamed 16.0218	Un0218	16.0218	Cutt
6	Un0217_Cutt	8.75	262	HC	Unnamed 16.0217	Un0217	16.0217	Cutt
6	Un0216_Cutt	8.75	262	HC	Unnamed 16.0216	Un0216	16.0216	Cutt
6	Un0215_Cutt	8.75	262	HC	Unnamed 16.0215	Un0215	16.0215	Cutt
6	Hamma_Chin	8.5	367	HC	Hamma Hamma R	Hamma	16.0251	Chin
6	Contr_FChum	8.5	367	E Strait	Contractors Cr	Contr	17.0270	FChum
6	Littl_FChum	8.5	367	Ad Inlet	Little Boston Cr	Littl	15.0350	FChum
6	Snow _FChum	8.5	367	E Strait	Snow Cr	Snow	17.0219	FChum
6	Twan_FChum	8.25	371	HC	Twanoh Cr	Twan	14.0134	FChum
6	Middl_FChum	8	372	Ad Inlet	Middle Cr	Middl	15.0352	FChum
6	Marth_FChum	8	372	Ad Inlet	Martha John Cr	Marth	15.0353	FChum
6	SpLak_FChum	8	372	HC	Springbrook Lakewood Cr	SpLak	14.0126	FChum
6	Holyo_FChum	8	372	HC	Holyoke Cr	Holyo	14.0127	FChum
6	Happy_FChum	8	372	HC	Happy Hollow Cr	Happy	14.0129	FChum
6	TwanF_FChum	8	372	HC	Twanoh Falls Cr	TwanF	14.0132	FChum
6	BBend_FChum	8	372	HC	Big Bend Cr	BBend	14.0138	FChum
6	Sund _FChum	7.75	379	HC	Sund Cr	Sund	16.0226	FChum
6	Mille_FChum	7.75	379	HC	Miller Cr	Mille	16.0225	FChum
6	Clark_FChum	7.75	379	HC	Clark Cr	Clark	16.0224	FChum
6	Hill _FChum	7.75	379	HC	Hill Cr	Hill	16.0221	FChum
6	Potla_FChum	7.75	379	HC	Potlatch Cr	Potla	16.0220	FChum
6	Un0218_FChum	7.75	379	HC	Unnamed 16.0218	Un0218	16.0218	FChum
6	Un0217_FChum	7.75	379	HC	Unnamed 16.0217	Un0217	16.0217	FChum
6	Un0216_FChum	7.75	379	HC	Unnamed 16.0216	Un0216	16.0216	FChum
6	Un0215_FChum	7.75	379	HC	Unnamed 16.0215	Un0215	16.0215	FChum
6	Ander_SChum	6.75	388	HC	Anderson Cr	Ander	15.0412	SChum
6	Finch_FChum	6.75	388	HC	Finch Cr	Finch	16.0222	FChum
6	Finch_SChum	5.75	390	HC	Finch Cr	Finch	16.0222	SChum

Appendix B – Part 2 of Issue and Action Framework

(begins on following page)

Issue and action framework – Part 2. Objectives (or hypotheses), uncertainties, and information sources are listed.

Freshwater Habitat: *Large stream channel conditions*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Large river channels in the region have lost structural and habitat diversity compared to their historic condition to varying extents depending on river, resulting in changes in channel stability, changes in substrate stability, loss of pool habitat and other habitat types, and coarsening of channel substrates (or fining of substrates in some cases), and in one river (Skokomish R.), a major increase in flood frequency now exists due in part to extreme aggradation (a buildup in the streambed due to sediment deposition) that has occurred. Aggradation has also been significant in the lower Dungeness and Big Quilcene rivers. In the most altered reaches of these rivers, historic pool-riffle morphology has devolved into plane-bed morphology with elongated riffle/glide sections; also channel sinuosity and total channel length have been reduced (with corresponding losses in habitat diversity and quantity). Affected watersheds: Dungeness, Quilcene, Dosewallips, Duckabush, Hamma Hamma, Skokomish rivers.	▪ Channel pattern: Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern. ▪ CMZ: Enlarge existing active channel migration zone (CMZ) (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration. ▪ Large wood: Construct engineered log jams (ELJs) or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Protect riparian: Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ Sediment deposits: Strategically address key sediment deposits that constrict channel, limit flood capacity, or promote channel instability as part of an overall approach to restoring normative channel function. ▪ Streambank structure: Implement streambank remediation measures if determined consistent with providing for normative channel pattern, structure, or function, as well as natural erosion rates and patterns (see Technique 12 in Cramer 2012). This may involve removal of hard bank armor and replacement with soft bank protection material more	▪ CMZ enlargement more toward its natural size will help restore meander and natural channel patterns, provide greater channel capacity, provide for side channel development, and promote greater stability and function to the riparian zone. ▪ Restoration of large wood complexes will promote greater habitat diversity, promote side channel development, facilitate channel deepening, help develop vegetated islands, and help stabilize streambanks. ▪ Control of invasive vegetation will facilitate development of native vegetation, faster development of fully functioning riparian zones, and help provide more effective movements of juvenile salmonids into side channels and off-channels. ▪ Removal of key sediment deposits in areas of significant deposition will facilitate more natural channel development provide for greater flood capacity. ▪ Restoration of more normative flow regime will facilitate channel scour and development and help retain low flow channel connectivity. ▪ Protection and restoration of riparian zone will stabilize streambanks, reduce re-entrainment of terrace sediments, and diversify and improve quality of aquatic habitats.	▪ Rate and timeframe that degraded channels can be restored to more normative function to support and maintain life stage survival of salmonid species consistent with long-term viability and production levels desired by co-managers. ▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Time required to arrest re-activated paraglacial processes in Skokomish R. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Adequate levels of woody debris and ELJ loading. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Sufficient size of CMZ by reach. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014b ▪ USBOR 2002 ▪ WDFW and PNPTT 2000 ▪ WDFW and PNPTT 2005 **Actions:** ▪ Cramer 2012 ▪ DRRWG 1997 ▪ HCCC 2005 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000

<u>Freshwater Habitat:</u> ***Large stream channel conditions***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
	conducive to normative channel function and structure. It is noted that bank protection measures done as “restoration” are often inconsistent with process-based habitat restoration and may worsen channel conditions for salmonid habitat – careful planning is needed.			

Freshwater Habitat: ***Small stream channel conditions***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Many small streams that flow directly to the marine environment, as well as small streams tributary to the major river channels in the region, have lost structural and habitat diversity compared to their historic condition, resulting in changes in channel stability, changes in substrate stability, loss of pool habitat and other habitat types, and coarsening of channel substrates (or fining of substrates in some cases). Depending on the types of factors operating on the channel and the valley and geology characteristics, the channel may also be downcut (entrenched or incised) or it may be aggraded (e.g., much of the Tahuya River and the lower portion of Big Beef Creek) in response to alterations. Affected watersheds: All streams smaller than the Hamma Hamma River in the region to varying extents.	▪ Channel pattern: Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern. ▪ CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Large wood: Construct ELJs or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Protect riparian: Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ Sediment deposits: Strategically address key sediment deposits that constrict channel, limit flood capacity, or promote channel instability as part of an overall approach to restoring normative channel function. ▪ Streambank structure: Implement streambank remediation measures if determined consistent with providing for normative channel pattern, structure, or function, as well as natural erosion rates and patterns (see Technique 12 in Cramer 2012). This may involve removal of hard bank armor and replacement with soft bank protection material more conducive to normative channel function and structure. It is noted that bank protection measures done as "restoration" are often inconsistent with process-based habitat restoration and may worsen channel conditions for salmonid habitat – careful planning is needed. .	▪ CMZ enlargement more toward its natural size will help restore meander and natural channel patterns, provide greater channel capacity, provide for side channel development, and promote greater stability and function to the riparian zone. ▪ Restoration of large wood complexes will promote greater habitat diversity, promote side channel development, facilitate channel deepening, help develop vegetated islands, and help stabilize streambanks. ▪ Control of invasive vegetation will facilitate development of native vegetation, faster development of fully functioning riparian zones, and help provide more effective movements of juvenile salmonids into side channels and off-channels. ▪ Removal of key sediment deposits in areas of significant deposition will facilitate more natural channel development provide for greater flood capacity. ▪ Restoration of more normative flow regime will facilitate channel scour and development and help retain low flow channel connectivity. ▪ Protection and restoration of riparian zone will stabilize streambanks, reduce re-entrainment of terrace sediments, and diversify and improve quality of aquatic habitats.	▪ Rate and timeframe that degraded channels can be restored to more normative function to support and maintain life stage survival of salmonid species consistent with long-term viability and production levels desired by co-managers. ▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Adequate levels of woody debris and ELJ loading. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Sufficient size of CMZ by reach. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Anonymous 2013 ▪ Correa 2002 ▪ Correa 2003 ▪ Godaire and Bountry 2011 ▪ Haring 1999 ▪ HCCC 2005 ▪ Kuttel 2003 ▪ Latham 2004 ▪ May and Peterson 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ WDFW and PNPTT 2000 ▪ WDFW and PNPTT 2005 **Actions:** ▪ Anonymous 2013 ▪ Cramer 2012 ▪ DRRWG 1997 ▪ HCCC 2005 ▪ Latham 2004 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ WDFW and PNPTT 2000

Freshwater Habitat: *Large stream floodplain conditions*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Major parts of the floodplains of large river channels in the region have been disconnected from the active channels within the alluvial valleys due to various channel and flood control measures. To a large extent, these floodplains have been converted to agriculture, rural residential lands, or urbanized areas (as in the lower Dungeness valley). These changes have resulted in loss of flow capacity in the high flow channel and natural floodways, exacerbating peak flow conditions and promoting greater channel scour, localized channel aggradation or degradation, leaving less diversified and more unstable in-channel habitat conditions. In addition, loss of floodplain connectivity has reduced sediment storage capacity within the floodways, further promoting aggradation and instability. Losses in off-channel habitats and stable side channel complexes have also resulted. Affected watersheds: Dungeness, Quilcene, Dosewallips, Duckabush, Hamma Hamma, Skokomish rivers.	▪ Beaver management: Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management. ▪ CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Transportation infrastructure: Improve or remove transportation infrastructure within floodplains to restore more normative channel and floodplain function and connectivity. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Protect floodplains: Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides. ▪ Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. .	▪ Proper management of beaver populations can facilitate restoration of steam channels and off-channel habitats and reduce (and control) invasives in a balance that also provides for good agricultural management. ▪ CMZ enlargement more toward its natural size will help restore meander and natural channel patterns, provide greater channel capacity, provide for side channel development, and promote greater stability and function to the riparian zone. ▪ Floodplain restoration will increase flood and sediment storage and reduce in-channel impacts. ▪ Control of invasive vegetation will facilitate development of native vegetation, faster development of fully functioning riparian zones, and help provide more effective movements of juvenile salmonids into side channels and off-channels. ▪ Removal or upgrading of transportation infrastructure within the floodplains will promote restoration of floodplain and channel processes and functions. ▪ Protection and restoration of riparian zone will stabilize streambanks, reduce re-entrainment of terrace sediments, and diversify and improve quality of aquatic habitats.	▪ Rate and timeframe that degraded channels can be restored to more normative function to support and maintain life stage survival of salmonid species consistent with long-term viability and production levels desired by co-managers. ▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Time required to arrest re-activated paraglacial processes in Skokomish R. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Sufficient size of CMZ by reach. ▪ Future rates of human population growth in each watershed and associated pressures for development within the floodplains. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014b ▪ USBOR 2002 ▪ WDFW and PNPTT 2000 ▪ WDFW and PNPTT 2005 **Actions:** ▪ Cramer 2012 ▪ DRRWG 1997 ▪ HCCC 2005 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000

Freshwater Habitat: *Small stream floodplain conditions*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The floodplains of many small streams and rivers in the region have been heavily altered and/or disconnected from the active channels by the placement of roads and driveways, land conversion, streambank protection measures, and other land use practices. These changes have contributed to changes in flow characteristics in these streams (increasing peak flows and decreasing summer low flows), sediment loading and processing, wood structure within the channels, pool-riffle composition, distribution and abundance of off-channel habitats (ponds, alcoves, wetlands, and backwaters), among other changes. Affected watersheds: All streams smaller than the Hamma Hamma River in the region.	▪ Beaver management: Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management. ▪ CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Transportation infrastructure: Improve or remove transportation infrastructure within floodplains to restore more normative channel and floodplain function and connectivity. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Protect floodplains: Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides. ▪ Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here.	▪ CMZ enlargement more toward its natural size will help restore meander and natural channel patterns, provide greater channel capacity, provide for side channel development, and promote greater stability and function to the riparian zone. ▪ Restoration of large wood complexes will promote greater habitat diversity, promote side channel development, facilitate channel deepening, help develop vegetated islands, and help stabilize streambanks. ▪ Control of invasive vegetation will facilitate development of native vegetation, faster development of fully functioning riparian zones, and help provide more effective movements of juvenile salmonids into side channels and off-channels. ▪ Removal of key sediment deposits in areas of significant deposition will facilitate more natural channel development provide for greater flood capacity. ▪ Restoration of more normative flow regime will facilitate channel scour and development and help retain low flow channel connectivity. ▪ Protection and restoration of riparian zone will stabilize streambanks, reduce re-entrainment of terrace sediments, and diversify and improve quality of aquatic habitats.	▪ Rate and timeframe that degraded channels can be restored to more normative function to support and maintain life stage survival of salmonid species consistent with long-term viability and production levels desired by co-managers. ▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Sufficient size of CMZ by reach. ▪ Future rates of human population growth in each watershed and associated pressures for development within the floodplains. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Correa 2002 ▪ Correa 2003 ▪ Godaire and Bountry 2011 ▪ Haring 1999 ▪ HCCC 2005 ▪ Kuttel 2003 ▪ Latham 2004 ▪ May and Peterson 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ WDFW and PNPTT 2000 ▪ WDFW and PNPTT 2005 **Actions:** ▪ Anonymous 2013 ▪ Cramer 2012 ▪ DRRWG 1997 ▪ HCCC 2005 ▪ Latham 2004 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ WDFW and PNPTT 2000

<u>Freshwater Habitat:</u> *Access to instream habitats*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The ability of juvenile and adult salmonids to swim upstream to access spawning grounds and rearing areas is vital to salmonid recovery and long-term sustainability. Poorly designed or deteriorating culvert and bridge installations, as well as other barriers to upstream passage, can block or impede passage of juvenile and/or adults. In some cases, large beaver dams can also hinder or block upstream migrants, particularly migrant juvenile salmonids. In addition, while high waterfalls act to completely block upstream passage, smaller waterfalls and especially steep cascades can act as partial barriers to some species and life stages, particularly during certain seasons; SIT and WDFW (2010 and 2017) identified the South Fork Skokomish gorge cascades as an example of such a partial barrier, one that is being made worse by climate change. <u>Affected watersheds:</u> All streams and rivers in the region are affected to varying degrees.	▪ <u>Beaver dams:</u> Install and periodically maintain "beaver deceiver" devices in priority areas prone to extensive damming by beavers where upstream salmonid migrations likely are restricted, or install juvenile fish ladders structures using corrugated plastic pipe (as done by the Pacific Coast Salmon Coalition) in sites where warranted. ▪ <u>Natural barrier:</u> Assess passage effectiveness at potential partial natural barriers if a salmon recovery effort might be hindered by limited passage, or if climate change can be expect to worsen passage effectiveness (such as at the South Fork Skokomish R. gorge cascades), and as deemed warranted, implement remedial measures to improve passage. ▪ <u>Road crossings:</u> Periodically evaluate stream crossing structures for passage effectiveness, maintain crossing structures consistent with BMPs, remove crossing structures on closed or abandoned roads, replace or upgrade outdated structures on a priority basis.	▪ Remove stream crossing structures on abandoned or closed roads will facilitate improved migration of juvenile and adult salmonids to areas upstream. ▪ The redesign and rebuilding pf stream crossing structures to accommodate flows and fish passage will facilitate improved migration of juvenile and adult salmonids to areas upstream. ▪ The alteration of partial barriers to fish passage that are subject to the effects of climate change (due to change in the timing of runoff) will help to maintain connectivity along the river as it supported fish populations historically—without adverse effects to the biota by enabling the migration of invasive species.	▪ Up-to-date assessment of condition of road crossing with respect to fish passage effectiveness. ▪ Passage effectiveness of South Fork Skokomish River gorge cascades. ▪ Effects of climate change on fish passage effectiveness at sites where potential passage issues might exist. ▪ Funding levels for adequate restoration and recovery actions.	**<u>Issue:</u>** ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Kuttel 2003 ▪ Latham 2004 ▪ May and Peterson 2003 ▪ SIT and WDFW 2010 **<u>Actions:</u>** ▪ Cramer 2012 ▪ SIT and WDFW 2010

<u>Freshwater Habitat:</u> *Access to off-channel habitats*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The availability and accessibility of off-channel habitats (ponds and wetlands) are important determinants of the performance of some salmonid populations. Man-made structures or large beaver dams can block or hinder movements to these habitats of juvenile salmonids for seasonal rearing. Re-opening, improving accessibility, or by increasing the availability and quality of off-channel habitats can be effective ways to improve salmonid population performance for certain species. It is recognized that beaver dams and associated ponds are critical features of many lowland streams and provide important fish habitat, so care must be taken in attempting to improve fish passage in these areas. <u>Affected watersheds:</u> All streams and rivers in the region are affected to varying degrees but this issue is mainly applicable in low gradient reaches and stream valleys.	▪ <u>Beaver dams:</u> Install and periodically maintain "beaver deceiver" devices in priority areas prone to extensive damming by beavers where upstream salmonid migrations likely are restricted, or install juvenile fish ladders structures using corrugated plastic pipe (as done by the Pacific Coast Salmon Coalition) in sites where warranted. ▪ <u>Invasives:</u> Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ <u>Off-channel access:</u> Inventory off-channel habitats and assess connectivity between swales/egress channels and main stream channels. ▪ <u>Off-channel habitat:</u> Improve off-channel habitats by deepening and/or adding habitat structure where opportunities exist, or create new off-channel habitats where opportunity and favorable conditions exist by dredging, blasting, and/or installation of channel flow controls on small floodplain streams to create ponds (e.g., Cederholm et al. 1988; Pacific Coast Salmon Coalition). ▪ <u>Restore floodplains:</u> Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features.	▪ The restoration, enhancement, and maintenance of pathways of access between main stream channels and off-channel ponds and wetlands where road structures or invasive vegetation impedes passage will improve use of off-channel sites by some salmonid species, and potentially result in substantially improved performance of some salmonid species. ▪ The restoration, enhancement, and/or creation of off-channel habitats will facilitate improved access and use of off-channel habitats, and result in substantially improved performance of some salmonid species.	▪ Up-to-date assessments of the distribution of off-channel habitats within the watersheds and the effectiveness of juvenile fish passage into and out of the sites seasonally.	**<u>Issue:</u>** ▪ Anonymous 2013 ▪ Cederholm and Scarlet 1982 ▪ Cederholm and Scarlet 1991 ▪ Cederholm et al. 1988 ▪ Lestelle 2009 ▪ Peterson and Reid 1984 ▪ WRIA 21 Lead Entity 2011 **<u>Actions:</u>** ▪ Anonymous 2013 ▪ Cederholm and Scarlet 1982 ▪ Cederholm and Scarlet 1991 ▪ Cederholm et al. 1988 ▪ Lestelle 2009 ▪ Peterson and Reid 1984 ▪ WRIA 21 Lead Entity 2011

Freshwater Habitat: *Riparian conditions*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Riparian zones in all watersheds within the region have been impacted to varying degrees by a wide variety of land and water-use activities, which include logging and all types of land clearing and land conversion to support societal needs. These activities have removed or altered the riparian plant communities, modified riparian soil conditions and other associated land and water features, and disrupted natural ecological cycles, all of which affect how riparian zones function in support of salmonid populations. The current condition of riparian zones in the Hood Canal and eastern SJDF region varies greatly, ranging from areas with virtually no function to support salmonids to other areas (relatively few) having pristine (or close to it) conditions. Affected watersheds: All streams and rivers in the region are affected to varying degrees.	▪ Beaver management: Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management. ▪ Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here. ▪ Protect riparian: Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here.	▪ Proper management of beaver populations can facilitate restoration of steam channels and off-channel habitats and reduce (and control) invasives in a balance that also provides for good agricultural management. ▪ More diverse, old-growth characteristics of riparian forests will result in more diverse and higher quality salmonid habitats. ▪ Protection and restoration of riparian zone will stabilize streambanks, reduce re-entrainment of terrace sediments, and diversify and improve quality of aquatic habitats. ▪ Control of Japanese knotweed and reed canary grass will promote the restoration of native plant riparian zones, which will ultimately result in more diverse and higher quality salmonid habitats. ▪ Control beaver populations to limit their adverse effects on riparian corridors that are in the process of being restored to more normative conditions.	▪ Opportunities for riparian restoration given current land ownership and land uses. ▪ Balance between riparian restoration, related beaver activity, and protection of landowner properties from flooding due to beaver damming. ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Anonymous 2013 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000 ▪ WDFW and PNPTT 2005 **Actions:** ▪ Anonymous 2013 ▪ Cramer et al. 2012 ▪ DRRWG 1997 ▪ HCCC 2005 ▪ Latham 2004 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ Thompson et al. 2009 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000

<u>Freshwater Habitat:</u> *Sediment supply, transport, and storage*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Erosion and sediment transport by rivers is one of the natural watershed processes that shape stream channels and floodplains, as well as associated habitats and aquatic biota, including salmonid populations. The sediment supply is produced from ongoing land erosion (e.g., landslides), as well as from the recapture of sediments (due to channel migration and avulsions) previously stored in flood plains and streambanks. Prior to the rapid alteration of watersheds by Euro-Americans, sediment transport from rivers was generally in equilibrium with sediment supply. Watershed alterations and management have disrupted the natural process, resulting in changes (often very significant ones) to the supply, storage, and transport of sediments. These changes had led to increased fine sediments levels within spawning gravels, channel and habitat instability, and in some cases, to severe channel aggradation (as in the Skokomish, Dungeness, and Quilcene rivers). The active channel width of the Tahuya River mainstem also appears to have increased significantly over the past 25 years, suggesting substantial aggradation. <u>Affected watersheds:</u> All streams and rivers in the region are affected to varying degrees.	▪ <u>Large wood:</u> Construct ELJs or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands. ▪ <u>Non-forest roads:</u> Assess conditions of existing non-forest road systems that might contribute sediments, identifying risk levels for sediment contributions, and implement identified remedial measures. ▪ <u>Non-road sediment:</u> Assess non-road related sediment sources that contribute sediments, identifying risk levels for sediment contributions to adjacent streams, and implement remedial measures. ▪ <u>Protect riparian:</u> Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ <u>Restore riparian:</u> Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ <u>Road Maintenance and Abandonment Plans (RMAP):</u> Complete the development of Road Maintenance and Abandonment Plans on all forest lands, and implement steps for upgrading, maintaining, or decommissioning of roads and road crossings. ▪ <u>Watershed analysis:</u> Prepare watershed analysis of the primary watershed processes that are affecting a watershed of concern if such analysis has never been done, or prepare an updated analysis if warranted. Such analysis will provide a landscape perspective for assessing the sediment budget, including rates of sediment supply and transport. Remedial measures can be formulated accordingly. ▪ <u>Streambank structure:</u> Implement streambank remediation measures if determined consistent with providing for normative channel pattern, structure, or function, as well as natural erosion rates and patterns (see Technique 12 in Cramer 2012). This may involve removal of hard bank armor and replacement with soft bank protection material more conducive to normative channel function and structure. It is noted that bank protection measures done as "restoration" are often inconsistent with process-based habitat restoration and may worsen channel conditions for salmonid habitat – careful planning is needed.	▪ Maintenance and continuation of efforts to improve forest management practices to reduce sediment yields from roads, clearcuts, and from areas prone to landslides will reduce sediment loading and gradually help facilitate equilibrium channel conditions consistent with the formation and maintenance of normative habitat conditions. ▪ Closure and obliteration of unneeded roads will reduce sediment loading to streams. ▪ Continuation of efforts to upgrade and improve BMPs for managing sediment yield from all types of land uses will produce reduced sediment loading to streams. ▪ Continued public education on ways of controlling sedimentation will aid in reducing sediment loading to streams. ▪ Efforts to improve knowledge and understanding about sources of sediment produced in the watershed will aid in reducing sediment loading to streams.	▪ Rate and timeframe that degraded channels can be restored to more normative function to support and maintain life stage survival of salmonid species consistent with long-term viability and production levels desired by co-managers. ▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Time required to arrest re-activated paraglacial processes in Skokomish R. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Sediment budgets within the watersheds. ▪ Current distribution of important sediment sources and rates of contribution from those sources. ▪ Funding levels for adequate restoration and recovery actions.	<u>**Issue:**</u> ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000 ▪ WDFW and PNPTT 2005 <u>**Actions:**</u> ▪ Cramer et al. 2012 ▪ DRRWG 1997 ▪ HCCC 2005 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000

Freshwater Habitat: ***Sediment supply, transport, and storage***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
	▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration.			

Freshwater Habitat: *Flow regime characteristics*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The rapid conversion of old-growth forests to young, managed stands, combined with extensive road networks, in many watersheds of the region altered to varying extents characteristics of the natural flow regime. Subsequently, land conversion in the lower valleys of most watersheds have caused further changes to flow regimes as lands were cleared and converted to agriculture, rural-residential areas, commercial properties, military installations, and urbanized areas. All of these changes have increased the amounts of impervious surfaces, thus changing runoff rates and patterns. The flow regimes in certain rivers have also been altered by dams and reservoirs (e.g., the Skokomish River) and water diversions for irrigation and other development (e.g., in the Dungeness River). In both the Skokomish and Dungeness rivers, the flow regimes have also been significantly altered due to loss of floodplain function, diking and levees, aggradation in the main river channels, and in the Dungeness River, by groundwater pumping associated with development. Attributes of the flow regime include flow magnitude, duration, timing, frequency and rate of change. The flow regime is a key driver of ecological riverine processes and associated habitat features. Changes in precipitation patterns associated with climate change are also affecting runoff patterns in the watersheds and altering	▪ Channel pattern: Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern. ▪ CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition. ▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration. ▪ Decommissioning: Decommission or remove roads of little use on public lands, or ones whose services can be provided on alternative roads. ▪ Dungeness Rule: Implement provisions of the Dungeness water rule adopted by WDOE in 2012. To the extent possible, purchase water credits from the water bank for protecting late summer low flows in the Dungeness River. Expand the rule to other areas of the Dungeness watershed as needed to ensure that minimum flows are maintained in the Dungeness River. ▪ Forest maturity: Manage for an increase in hydrologic maturity (older-age stands) of forested lands to the extent possible using incentives on private lands or through policy change on public lands. ▪ Protect floodplains: Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides. ▪ Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features. ▪ Road Maintenance and Abandonment Plans (RMAP): Complete the development of Road Maintenance and Abandonment Plans on all forest lands, and implement steps for upgrading, maintaining, or decommissioning of roads and road crossings. ▪ Runoff BMPs: Adopt or improve (i.e., update as needed) requirements for BMPs related to storm runoff management on agricultural, residential, commercial, or	▪ Development of more diverse stand age in the managed forest creating a greater mixture of hydrologic maturity on the landscape will promote a more normative flow regime. ▪ Reducing the footprint of roads in the managed areas of watersheds wherever possible will promote a more normative flow regime. ▪ Restoration of connections to floodplains that provide for increased flood capacity will promote a more normative flow regime. ▪ Enlarging CMZs and restoring normative meander patterns by reducing channel and flow constrictions will promote a more normative flow regime. ▪ Restore normative flow regime characteristics by reducing the rate of storm runoff associated with impervious surfaces will promote a more normative flow regime. ▪ Acquisition of floodplain lands and restoration of ecological functions of those lands will promote a more normative flow regime. ▪ Implementation of the flow provisions of the Cushman Settlement would promote a more normative flow regime in the Skokomish River. ▪ Implementation of the Dungeness Comprehensive Irrigation District Management Plan (CIDMP) would promote a more normative flow regime in the Dungeness River.	▪ Rate and timeframe that degraded channels can be restored to more normative function to support and maintain life stage survival of salmonid species consistent with long-term viability and production levels desired by co-managers. ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Sufficient size of CMZ by reach. ▪ Future rates of human population growth in each watershed and associated pressures for development within the floodplains. ▪ Status and willingness of parties to implement the CIDMP in the Dungeness basin. ▪ Status of the Dungeness flow rule for implementation in the Dungeness basin. ▪ Channel flow capacity amount in the lower Skokomish River; this uncertainty is hindering the implementation of one component of the flow regime to be applied under the Cushman Settlement. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Anchor 2022 ▪ DWE 2021 ▪ HCCC 2005 ▪ HDR 2006 ▪ Konrad 2003 ▪ Peters et al. 2011 ▪ PSP 2014a ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014b ▪ USBOR 2002 ▪ WDFW and PNPTT 2000 ▪ WDOE 2012 **Actions:** ▪ Anchor 2022 ▪ Cramer 2012 ▪ DRRWG 1997 ▪ DWE 2021 ▪ HCCC 2005 ▪ HDR 2006 ▪ Konrad 2003 ▪ Montgomery et al. 2003 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ USACOE 2014b ▪ WDFW and PNPTT 2000 ▪ WDOE 2012

Freshwater Habitat: ***Flow regime characteristics***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
flow regime characteristics. This has become especially evident in the Dungeness watershed where the frequency and severity of droughts have increased. Affected watersheds: All streams and rivers in the region are affected to varying degrees. The North Fork Skokomish River is affected by dam construction and operations – see Issue Dams and Reservoirs. The Dungeness watershed is particularly vulnerable to climate change effects that are increasing the frequency of drought. See the issue below on Climate Change.	urbanized lands, including all transportation corridors that produce pollutants, promoting greater increases in storm-water infiltration using various methods and greater capacity for storm-water detention or retention. ▪ Water rights: Purchase water rights in the Dungeness watershed and dedicate the water for environmental-related flow in the Dungeness River. ▪ Water storage with creation of off-channel reservoirs: Create off-channel water storage reservoirs that would be filled during winter and spring high flow runoff and then used to augment late summer instream flows. The proposed Dungeness Off-Channel Reservoir Project offers a storage concept that has broad support by state, local, and tribal officials in the Dungeness valley (see Anchor 2022).	▪ Implementation of the Dungeness Flow Rule would help ensure that minimum flows more consistent with the normative flow regime in the Dungeness River would be met. ▪ Continued implementation and improvement of runoff BMPs for urbanized lands would promote a more normative flow regime in developed watersheds.		

Freshwater Habitat: ***Water quality***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Runoff from lands where all types of land management practices can be sources of different types of pollutants, including fine sediment and various types of chemicals and heavy metals. Runoff from highways and well-traveled roads are particular sources of substances of concern. Urbanized areas, where parking lots and densely populated areas, are also known sources of pollutants, and particularly the pollutant 6PPD-quinone, which results from the wear of vehicular tires on highways, roads, and parking lots (e.g., McIntyre et al. 2021; Brinkmann et al. 2022). Logging and land conversions are major sources of increased sediments to streams and rivers. Loss of high quality riparian zones also causes elevated stream temperatures and sometimes reductions in dissolved oxygen, both of which reduce water quality. Affected watersheds: : Many of the streams and rivers in the region are affected to varying degrees with reduced water quality.	▪ Protect riparian: Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here. ▪ Runoff BMPs: Adopt or improve (i.e., update as needed) requirements for BMPs related to storm runoff management on agricultural, residential, commercial, or urbanized lands, including all transportation corridors that produce pollutants, promoting greater increases in storm-water infiltration using various methods and greater capacity for storm-water detention or retention. Studies show that 6PPD-quinone's toxic effects can be reduced or prevented through best practices for stormwater management, including certain green infrastructure installations that filter polluted stormwater through mixtures of soils and sand (SAM 2017; Puget Soundkeeper 2022). Research is also underway to alter chemical composition used in the manufacture of rubber tires.	▪ Continued improvements in forest management plans to promote more diverse stand age across the landscape (i.e., avoid cutting huge contiguous land parcels at the same time) will reduce fine sediment loading into streams. ▪ The promotion of diverse stand age in the managed forest will reduce fine sediment loading into streams. ▪ The restoration of riparian corridors having old-growth characteristics would help restore normative stream temperature regimes and reduce fine sediment loading. ▪ Improved measures to capture runoff from sites likely to contain pollutants, such as 6PPD-quinone, and routing into infiltration areas to reduce pollution of streams. ▪ In the long-term, find appropriate new composition for rubber tires to avoid use of chemicals related to 6PPD-quinone. ▪ Improved education of the public on sources of pollutants and how the public can help to reduce these sources will aid in reducing pollution of streams.	▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes, safe levels of pollutant concentrations, and channel functions. ▪ Future rates of human population growth in each watershed and associated pressures for development. ▪ Effects of low level pollutants on fish physiology, behavior, and performance. ▪ Funding levels for adequate restoration and recovery actions. ▪ Capability for reconstituting chemical composition used in manufacturing rubber tires.	**Issue:** ▪ Brinkmann et al. 2022 ▪ HCCC 2005 ▪ McIntyre et al. 2021 ▪ SAM 2017 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ US Salish Sea Technical Team 2012 ▪ USBOR 2002 ▪ WDFW and PNPTT 2000 **Actions:** ▪ FISRWG 1998 ▪ HCCC 2005 ▪ Puget Soundkeeper 2022 ▪ SAM 2017 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ US Salish Sea Technical Team 2012

<u>Freshwater Habitat:</u> ***Marine-derived nutrient loading and characteristics***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Some streams in the region have likely undergone reductions in marine-derived nutrients compared to their historic levels. This decline in nutrient levels (oligotrophication) has largely been man-caused as a result of the depletion of salmon populations due to harvesting and habitat loss and degradation. (Some systems have naturally relatively low nutrient levels—in these cases, they have often been reduced to even lower nutrient levels.) Oligotrophic ecosystems are nutrient-poor and are characterized by low annual rates of biotic production. The goal of nutrient supplementation (restoration) to is to increase the biological productivity of streams, riparian areas, upland areas, and estuaries by returning the nutrients originally supplied by anadromous fish carcasses back to the anadromous spawning zone of streams. Ideally, the ecosystem functions formerly supported by naturally spawning anadromous salmonids will be restored. Restoring this functionality will require restoring terrestrial and aquatic plant and animal communities in addition to anadromous fish. <u>Affected watersheds:</u> All streams where salmon spawning escapements are typically small.	▪ <u>Nutrient supplement:</u> Assess nutrient loading with marine-derived nutrients and nutrient processing in the watershed(s) of interest; as warranted, increase loading with fertilizer supplements or salmon carcasses. ▪ <u>Natural barrier:</u> Assess passage effectiveness at potential partial natural barriers if a salmon recovery effort might be hindered by limited passage, or if climate change can be expect to worsen passage effectiveness (such as at the South Fork Skokomish R. gorge cascades), and as deemed warranted, implement remedial measures to improve passage. ▪ <u>Road crossings:</u> Periodically evaluate stream crossing structures for passage effectiveness, maintain crossing structures consistent with BMPs, remove crossing structures on closed or abandoned roads, replace or upgrade outdated structures on a priority basis. ▪ <u>Cushman Settlement:</u> Restore salmon populations to the NF Skokomish River upstream of the Cushman Dams.	▪ Reforestation and restoration of wetlands (these solutions are addressed through related issues above) will help promote normative nutrient loading of streams. ▪ Stream fertilization, if deemed needed, would increase the aquatic productivity of stream rearing habitats. ▪ Recovery of salmon populations to higher levels as a result of varied restoration efforts will promote increased MDNs. ▪ Restore connectivity of stream systems where salmon access has been lost due to barriers would return MDNs to those areas and increase aquatic productivity.	▪ Current status of MDNs in many streams where salmon returns are low. ▪ Nutrient cycling and productivity of streams in the region.	**<u>Issue:</u>** ▪ Stockner 2003 ▪ Cederholm et al. 2000 **<u>Actions:</u>** ▪ Stockner 2003 ▪ Cederholm et al. 2000

Freshwater Habitat: ***Dams and reservoirs***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Two major dams were built on the North Fork Skokomish River in the late 1920s. Those dams inundated much of the upper North Fork, forming one major and one smaller reservoir. The dams served to divert most of the North Fork flow out of the Skokomish watershed to Hood Canal for electric power generation, significantly altering the Skokomish River flow regime. No provisions for fish passage were provided at the dams, and combined with the flow diversion, resulted in the demise of the spring Chinook run into the North Fork and a loss in abundance of other salmonid populations. Although the Cushman Settlement, agreed on in 2009, will provide for fish passage and reintroduction of fish runs to the upper North Fork, the reservoirs will remain in place for at least the next 40 years. Smaller dams have also been built on the Little Quilcene River and Union River, which serve to divert water for municipal purposes. Affected watersheds: This issue only applies directly to the Skokomish River. The dams in the Quilcene and Union drainage do not inundate historic habitat.	▪ Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration. Note: whether spring Chinook will be reintroduced upstream of the upper North Fork dam is in question as of 2022 due to concerns by Olympic National Park about potential impacts on the small resident Chinook population in Cushman Reservoir.	▪ Restore normative flow regime to promote channel and habitat reformation, channel flow capacity, and re-creation of normative queues for biological responses. ▪ Restore floodplain function and connectivity in the Skokomish River and tributaries. ▪ Restore the fluvial geomorphic processes in the watershed channels, channel form and function, and sediment movement. ▪ Provide for effective upstream and downstream passage of migrant salmonids at the Cushman dam sites ▪ Provide for conservation hatchery facilities within the North Fork subbasin to support an integrated population component of early-timed Chinook .	▪ Effectiveness (extent and rate) of new flow regime to restore channel characteristics and flow capacity in the NF and lower mainstem. ▪ Effectiveness of new flow regime to remediate sediment deposits sufficiently or will other strategies be needed? ▪ Number of years needed to attain substrate and channel characteristics required to support viable life histories of naturally reproducing Chinook. ▪ Migration effectiveness of adult Chinook to base of lower Cushman Dam ▪ Trapping effectiveness of adult Chinook at the base of Cushman Dam ▪ Downstream passage effectiveness of juveniles through Lake Cushman and through the trapping facility ▪ Impact of loss of productive stream habitat through inundation, and ability of re-introduced population to perform with reduced habitat.	**Issue:** ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 **Actions:** ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017

Freshwater Habitat: *Climate change*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Accelerated rates of climate change are unambiguously well documented and salmon recovery planners are urged by NOAA Fisheries, as well as Washington State resource agencies, to account for climate change in their planning. Efforts to restore stream habitat will be inadequate without accounting for climate change. Stream systems in Western Washington will be directly affected by climate change through alterations in the amount and timing of streamflow and sediment yield, as well as by an increase in average air temperature. These changes in turn will affect water temperature regimes and habitat quantity, distribution, stability, and quality. Actions aimed at ameliorating the effects of climate change should protect existing core habitats that support populations of concern and aim to restore normative in-channel, floodplain, sediment supply and transport, and flow regime characteristics as quickly as possible. Affected watersheds: All streams and rivers to some extent. Certain species, i.e., summer chum, summer steelhead, and spring Chinook are expected to be affected the most. The Dungeness watershed is particularly vulnerable to climate change effects that are increasing the frequency of drought.	▪ Dungeness Rule: Implement provisions of the Dungeness water rule adopted by WDOE in 2012. To the extent possible, purchase water credits from the water bank for protecting late summer low flows in the Dungeness River. Expand the rule to other areas of the Dungeness watershed as needed to ensure that minimum flows are maintained in the Dungeness River. ▪ Water rights: Purchase water rights and dedicate those rights to conservation. ▪ Water storage with creation of off-channel reservoirs: Create off-channel water storage reservoirs that would be filled during winter and spring high flow runoff and then used to augment late summer instream flows. The proposed Dungeness Off-Channel Reservoir Project offers a storage concept that has broad support by state, local, and tribal officials in the Dungeness valley (see Anchor 2022). ▪ All actions related to protection and restoration of normative floodplain conditions will provide resilience to ecological processes that can be affected by climate change. ▪ All actions related to protection and restoration of riparian zones will provide resilience to ecological processes that can be affected by climate change. ▪ All actions related to restoration of normative sediment supply and transport characteristics will provide resilience to ecological processes that can be affected by climate change. ▪ All actions related to restoration of normative flow regime characteristics will provide resilience to ecological processes that can be affected by climate change. ▪ Anticipate that passage effectiveness at the South Fork Skokomish R. gorge cascades will worsen for re-introduced spring Chinook, assess potential remedial measures, and implement those measures as warranted.	▪ Maintain and promote aggressive approaches to salmon habitat restoration and protection priorities that account for climate change. (Actions shown here address what can be done locally to ameliorate effects of climate change on salmonid habitat.)	▪ Short-term and long-term effects of climate change on climate patterns, streamflow patterns, mass wasting and sediment loading, riparian and upland forest composition, channel dynamics, and aquatic species composition and performance.	**Issue:** ▪ Lestelle et al. 2014 ▪ DWE 2021 ▪ Salathé et al. 2014 ▪ SIT and WDFW 2010 and 2017 ▪ Snover et al. 2013 **Actions:** ▪ Anchor QEA 2022 ▪ DWE 2021 ▪ Lestelle et al. 2014 and 2018 ▪ Salathé et al. 2014 ▪ SIT and WDFW 2010 and 2017 ▪ Snover et al. 2013

Natal Estuarine: *Tidal flow regime and connectivity*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Tidal flow regimes, including both freshwater input and saltwater tidal exchange, have been altered in many of the estuarine features of the region as a result of changes in the stream's flow regime, barriers to tidal exchange (such as by diking and placement of roads or highways within or across the estuary), aggradation and progradation, and loss of wetlands, changes in delta area or structure, or loss in channel area due to diking and/or filling. These changes often have resulted in loss of tidal prism, affecting estuarine sediment transport, tidal flow dynamics and patterns, and salinity structure, which can alter wetland vegetation types and estuarine nutrient dynamics and food webs. Tidal flow regimes have also been affected by construction of tidal gates. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees. Two priority natal stream-mouth estuaries have been identified to be Duckabush River (https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp) and Snow-Salmon Creek (Snow-Salmon Creek forum synthesis, HCCC [2021}).	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportation infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore tidal flow regime and connectivity. ▪ Dike breaching and dike removal will help restore tidal flow regime and connectivity. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore tidal flow regime and connectivity. ▪ Restoration of connectivity to historic channels and flow pathways will help restore tidal flow regime and connectivity. ▪ Restoration of more normative freshwater flow regimes will help restore tidal flow regime and connectivity. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore tidal flow regime and connectivity.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ HCCC 2021 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **Actions:** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ HCCC 2021 ▪ PSNERP 2012 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

<u>Natal Estuarine:</u> *Sediment supply and transport*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Erosion and sediment transport by rivers is one of the natural watershed processes that shape stream channels and floodplains and the associated habitats and aquatic biota. Prior to the rapid alteration of watersheds by Euro-Americans, sediment transport from rivers is believed to have generally been in equilibrium with sediment supply in the rivers and streams of the region. Watershed alterations and management have disrupted these processes, resulting in changes—often very significant ones, to the sediment supply, storage, and movement to the estuaries--and in their transport from the rivers. Consequently, aggradation and, in many cases, unusually high rates of progradation have occurred to the estuaries of most rivers in the region, affecting channel connectivity, wetland and marsh composition, and eelgrass beds on the outer deltas. Aggradation has been particularly severe in some parts of the Skokomish estuary. Progradation has occurred to the rivers on the west side of Hood Canal, as well as in the Dungeness River and Jimmycomelately Creek. <u>Affected watersheds:</u> The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Channel rehab:</u> Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Hydraulic mod:</u> Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Re-vegetation:</u> Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Transportations infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore a more natural sediment supply and processing. ▪ Dike breaching and dike removal will help restore a more natural sediment supply and processing. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore a more natural sediment supply and processing. ▪ Restoration of connectivity to historic channels and flow pathways will help restore a more natural sediment supply and processing. ▪ Restoration of more normative freshwater flow regimes will help restore a more natural sediment supply and processing. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore a more natural sediment supply and processing.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**<u>Issue:</u>** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ HCCC 2005 ▪ WDFW and PNPTT 2000 **<u>Actions:</u>** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ PSNERP 2012 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

Natal Estuarine: *Estuarine wetlands*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Historically, estuarine wetlands were well distributed and very abundant throughout the Puget Sound coastline, including in Hood Canal and along the eastern SJDF. These wetland areas were, and continue to be, highly important to estuarine and nearshore food webs and to the growth, survival, and production of juvenile salmonids. Extensive loss of estuarine wetlands has occurred over many areas of Puget Sound and in the many stream-mouth estuaries due to diking, draining, and filling. There have also been changes in the accessibility of many wetlands to juvenile salmonids as a result of diking and tidal gates. Some estuaries have undergone extensive changes in composition of types of wetlands as a result of changes in tidal flow and freshwater inputs, affecting the biological function of existing wetlands. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees. Two priority natal stream-mouth estuaries have been identified to be Duckabush River (https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp) and Snow-Salmon Creek (Snow-Salmon Creek forum synthesis, HCCC [2021}).	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportation infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore estuarine wetlands and associated functions. ▪ Dike breaching and dike removal will help restore estuarine wetlands and associated functions. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore estuarine wetlands and associated functions. ▪ Restoration of connectivity to historic channels and flow pathways will help restore estuarine wetlands and associated functions. ▪ Restoration of more normative freshwater flow regimes will help restore estuarine wetlands and associated functions. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore estuarine wetlands and associated functions.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ HCCC 2005 ▪ WDFW and PNPTT 2000 **Actions:** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ PSNERP 2012 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

Natal Estuarine: *Shoreline and channel conditions*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Estuarine shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, and transportation corridors. Such changes were particularly significant in all of the major river-mouths of Hood Canal (i.e., west-side rivers) and in the Dungeness River. Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees. Two priority natal stream-mouth estuaries have been identified to be Duckabush River (https://wdfw.wa.gov/species-habitats/habitat-recovery/puget-sound/psnerp) and Snow-Salmon Creek (Snow-Salmon Creek forum synthesis, HCCC [2021}).	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Transportation infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area. Also, actions directed at restoring and protecting the freshwater flow regime and the freshwater sediment supply, storage, and transport processes are applicable.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore natural channel features and associated salmon habitats. ▪ Dike breaching and dike removal will help restore natural channel features and associated salmon habitats. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore natural channel features and associated salmon habitats. ▪ Restoration of connectivity to historic channels and flow pathways will help restore natural channel features and associated salmon habitats. ▪ Restoration of more normative freshwater flow regimes will help restore natural channel features and associated salmon habitats. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore natural channel features and associated salmon habitats. ▪ Removal of shoreline armoring and other man-made structures will help restore natural channel features and associated salmon habitats.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will affect tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **Actions:** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ PSNERP 2012 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

<u>Natal Estuarine:</u> *Water quality*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The water quality of stream-mouth estuaries and the nearshore environment can be affected by various pollutants, originating either within the adjacent watersheds or from accidental spills due to recreational, industrial, or military activities associated with boating or shipping activity. <u>Affected watersheds:</u> The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Pollution control:</u> Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. Also, actions directed at restoring and protecting freshwater water quality are applicable.	▪ Continued improvements in forest management plans to promote more diverse stand age across the landscape (i.e., avoid cutting huge contiguous land parcels at the same time) will reduce fine sediment loading into streams. ▪ The promotion of diverse stand age in the managed forest will reduce fine sediment loading into streams. ▪ The restoration of riparian corridors having old-growth characteristics would help restore normative stream temperature regimes and reduce fine sediment loading. ▪ Improved measures to capture runoff from sites likely to contain pollutants, such as 6PPD-quinone, and routing into infiltration areas to reduce pollution of streams and adjacent estuarine habitats. ▪ Improved education of the public on sources of pollutants and how the public can help to reduce these sources will aid in reducing pollution of streams.	▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Future rates of human population growth in each watershed and associated pressures for development. ▪ Effects of low level pollutants on fish physiology, behavior, and performance. ▪ Funding levels for adequate restoration and recovery actions.	**<u>Issue:</u>** ▪ Brinkmann et al. 2022 ▪ HCCC 2005 ▪ McIntyre et al. 2021 ▪ SAM 2017 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ US Salish Sea Technical Team 2012 ▪ USBOR 2002 ▪ WDFW and PNPTT 2000 **<u>Actions:</u>** ▪ FISRWG 1998 ▪ HCCC 2005 ▪ Puget Soundkeeper 2022 ▪ SAM 2017 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ US Salish Sea Technical Team 2012

Natal Estuarine: *Riparian conditions*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Riparian zones bordering stream-mouth estuaries and the shorelines of the marine nearshore environment of the region have been impacted to varying degrees by a wide variety of land-use activities, which include logging and all types of land clearing and land conversion to support societal needs. These activities have removed or altered riparian plant communities, which affect how riparian zones function in support of salmonid populations. The current condition of estuarine and nearshore riparian zones in the Hood Canal and eastern SJDF region varies greatly, ranging from areas with virtually no function to support salmonids to other areas that are virtually pristine (or close to it). Affected watersheds: The large majority of the natal estuaries in the region have been affected to varying degrees.	▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Restore riparian: Restore more normative riparian vegetation characteristics (considering riparian distribution, continuity, size of stands, and stand composition) using passive or active management methods.	▪ More diverse, old-growth characteristics of riparian forests will result in more diverse and higher quality salmonid habitats. ▪ Protection and restoration of riparian zone will stabilize streambanks, reduce re-entrainment of terrace sediments, and diversify and improve quality of aquatic habitats. ▪ Control of Japanese knotweed and reed canary grass will promote the restoration of native plant riparian zones, which will ultimately result in more diverse and higher quality salmonid habitats. ▪ Restoration of native plant communities to the riparian corridors along stream-mouth estuaries will ultimately result in more diverse and higher quality salmonid habitats.	▪ Opportunities for riparian restoration given current land ownership and land uses. ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization and their effects on riparian communities in the estuarine zone. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **Actions:** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

<u>Non-Natal Estuarine and Nearshore:</u> *Tidal flow regime and connectivity*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The tidal flow regimes, including both freshwater input and saltwater tidal exchange, have been altered in many of the estuarine features of the region as a result of changes in the stream's flow regime, barriers to tidal exchange, and loss of wetlands, delta area, or channel area due to diking and/or filling. These changes often have resulted in loss of tidal prism, affecting estuarine sediment transport, tidal flow patterns, salinity structure, which can alter wetland vegetation types and estuarine nutrient dynamics and food webs. Tidal flow regimes have also been affected by construction of tidal gates. <u>Affected areas:</u> Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Channel rehab:</u> Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ <u>Hydraulic mod:</u> Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Trans infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore tidal flow regime and connectivity. ▪ Dike breaching and dike removal will help restore tidal flow regime and connectivity. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore tidal flow regime and connectivity. ▪ Restoration of connectivity to historic channels and flow pathways will help restore tidal flow regime and connectivity. ▪ Restoration of more normative freshwater flow regimes will help restore tidal flow regime and connectivity. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore tidal flow regime and connectivity.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**<u>Issue:</u>** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **<u>Actions:</u>** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

<u>Non-Natal Estuarine and Nearshore:</u> *Sediment supply and transport*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Beaches and other shoreforms important to juvenile salmonids and forage fish are maintained by sediment sources along Puget Sound and the eastern SJDF transported by tidal and wave action within the region. In Puget Sound, beaches consist of two primary types: 1) those associated with coastal bluffs (called bluffbacked beaches), where the coastline has retreated landward; and 2) those associated with barrier beaches, where sediment has been deposited seaward of the original coastline. These beaches and other associated shoreforms (spits, barrier bars, and tombolos), which are affected by changes in sediment supply and transport processes, are vulnerable to degradation if the sediment sources are altered or if the transport processes are altered. Shoreline armoring, including the use of bulkheads, road locations, and nearshore fill can disrupt these processes and alter the stability of the beaches and other associated features for salmonid and forage fish use, as well as the productivity of these areas to produce forage for juvenile salmonids. <u>Affected areas:</u> Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Beach nourishment:</u> The intentional placement of sand and/or gravel on the upper portion of a beach where historic supplies have been eliminated or reduced. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Groin removal:</u> Removal or modification of groins and similar nearshore structures built on bluff-backed beaches or barrier beaches in Puget Sound. ▪ <u>Large wood:</u> Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Re-vegetation:</u> Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Trans infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.	▪ Removal of bulkheads, shoreline armoring, and other obstructions to sediment transport (jetties and breakwaters), and associated restoration of natural shoreline features will restore normative sediment supply and transport needed for beach and barrier embayment features. ▪ Protection of drift cells and bluffs from shoreline alterations and stabilization will maintain normative sediment supply and transport needed for beach and barrier embayment features. ▪ Restoration of natural sediment processing rates within barrier embayments and shoreline inlets will restore these features ecological functions. ▪ In severe cases where degradation of natural sediment supply and transport rates have occurred, use of periodic beach nourishment actions to replenish sediment supplies can help maintain some level of important ecological function.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**<u>Issue:</u>** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **<u>Actions:</u>** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

<u>Non-Natal Estuarine and Nearshore:</u> *Small embayments and open inlet shoreforms*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Puget Sound, including Hood Canal and the eastern SJDF, historically contained hundreds of small, protected embayments and open inlets along the coastlines. Many of these were in the form of stream-mouth estuaries and barrier lagoons. Many of these features included a barrier beach that wholly or partially enclosed a lagoon or estuary. (Small embayments are often referred to as pocket estuaries.) The amount of freshwater influences within these features varies widely. Most of these embayments and inlets historically contained estuarine wetlands. A large percentage of these landforms have been degraded, or lost entirely, through nearshore filling, transportation corridors, or shoreline armoring. <u>Affected areas:</u> Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ <u>Armor removal:</u> Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ <u>Berm/dike removal:</u> Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ <u>Channel rehab:</u> Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ <u>Debris removal:</u> The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ <u>Hydraulic mod:</u> Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ <u>Invasives:</u> Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ <u>Large wood:</u> Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity. ▪ <u>Protection:</u> Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ <u>Re-vegetation:</u> Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ <u>Topo restoration:</u> Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ <u>Trans infrastructure:</u> Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.	▪ Removal of bulkheads, shoreline armoring, and other obstructions to sediment transport (jetties and breakwaters), and associated restoration of natural shoreline features will help restore small embayment and open inlet shoreform features. ▪ Protection of drift cells and bluffs from shoreline alterations and stabilization will help restore small embayment and open inlet shoreform features. ▪ Restoration of natural sediment processing rates within barrier embayments and shoreline inlets will help restore small embayment and open inlet shoreform features. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore natural channel features and associated salmon habitats.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**<u>Issue:</u>** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **<u>Actions:</u>** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

Non-Natal Estuarine and Nearshore: *Estuarine wetlands*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Historically, estuarine or tidal wetlands were well distributed and very abundant throughout the Puget Sound coastline, including in Hood Canal and along the eastern SJDF. These wetland areas were, and continue to be, highly important to estuarine and nearshore food webs and to the growth, survival, and production of juvenile salmonids. Extensive loss of estuarine wetlands has occurred over many areas of Puget Sound and in the many stream-mouth estuaries due to diking, draining, and filling. There have also been changes in the accessibility of many wetlands to juvenile salmonids as a result of diking and tidal gates. Some estuaries have undergone extensive changes in composition of types of wetlands as a result of changes in tidal flow and freshwater inputs. Affected areas: Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function. ▪ Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. ▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Trans infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore estuarine wetlands and associated functions. ▪ Dike breaching and dike removal will help restore estuarine wetlands and associated functions. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore estuarine wetlands and associated functions. ▪ Restoration of connectivity to historic channels and flow pathways will help restore estuarine wetlands and associated functions. ▪ Restoration of more normative freshwater flow regimes will help restore estuarine wetlands and associated functions. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore estuarine wetlands and associated functions.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **Actions:** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

Non-Natal Estuarine and Nearshore: *Shoreline modifications*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Estuarine and nearshore shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, transportation corridors, and construction of overwater structures such as docks, piers, and marinas. Shoreline armoring has been particularly severe in the southern end of Discovery Bay, parts of Admiralty Inlet, along some areas of northern Hood Canal, and especially along the southern parts of Hood Canal where it is almost continuous. Many overwater structures also occur in some of these areas and in some locations within Sequim Bay. Affected areas: Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines. ▪ Beach nourishment: The intentional placement of sand and/or gravel on the upper portion of a beach where historic supplies have been eliminated or reduced. ▪ Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal. ▪ Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ Groin removal: Removal or modification of groins and similar nearshore structures built on bluff-backed beaches or barrier beaches in Puget Sound. ▪ Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete. ▪ Large wood: Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. ▪ Re-vegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation. ▪ Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here. ▪ Trans infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.	▪ Reclamation of estuarine area lost to land conversions and diking will help restore natural channel features and associated salmon habitats. ▪ Dike breaching and dike removal will help restore natural channel features and associated salmon habitats. ▪ Removal or alteration of transportation infrastructure (such as bridges and causeways) will help restore natural channel features and associated salmon habitats. ▪ Restoration of connectivity to historic channels and flow pathways will help restore natural channel features and associated salmon habitats. ▪ Restoration of more normative freshwater flow regimes will help restore natural channel features and associated salmon habitats. ▪ Restoration of more normative sediment loading regimes from the watershed upstream will help restore natural channel features and associated salmon habitats. ▪ Removal of shoreline armoring and other man-made structures will help restore natural channel features and associated salmon habitats.	▪ Sediment delivery rates from the watershed upstream of the estuary and how these rates affect aggradation and progradation in the estuary. ▪ Changes in the freshwater flow regime and how these will tidal flow in the estuary. ▪ Effectiveness of new flow regime to accelerate sediment routing and transport in the lower river valley and through the estuary in the Skokomish River. ▪ Long-term constraints placed on estuary restoration by transportation infrastructure and dikes that will not be altered. ▪ Short-term and long-term effects of climate change, including potential sea-level rise. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Clancy et al. 2009 ▪ Correa 2002 ▪ Correa 2003 ▪ Haring 1999 ▪ HCCC 2005 ▪ Peters et al. 2011 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Todd et al. 2006 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000 **Actions:** ▪ Cereghino et al. 2012 ▪ Clancy et al. 2009 ▪ HCCC 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ USACOE 2014a ▪ WDFW and PNPTT 2000

Non-Natal Estuarine and Nearshore: *Water quality*

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
The water quality of stream-mouth estuaries and the nearshore environment can be affected by various pollutants, originating either within the adjacent watersheds or from accidental spills due to recreational, industrial, or military activities associated with boating or shipping activity. Affected areas: Extensive amounts of the shoreline within the region have been altered to varying extents.	▪ Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore. ▪ Pollution control: Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem. ▪ Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs. Also, actions directed at restoring and protecting freshwater water quality are applicable.	▪ Continued improvements in forest management plans to promote more diverse stand age across the landscape (i.e., avoid cutting huge contiguous land parcels at the same time) will reduce fine sediment loading into streams. ▪ The promotion of diverse stand age in the managed forest will reduce fine sediment loading into streams. ▪ The restoration of riparian corridors having old-growth characteristics would help restore normative stream temperature regimes and reduce fine sediment loading. ▪ Improved measures to capture runoff from sites likely to contain pollutants and routing into infiltration areas will reduce pollution of streams. ▪ Improved education of the public on sources of pollutants and how the public can help to reduce these sources will aid in reducing pollution of streams.	▪ Relative impacts between sediment sources (slope versus in-channel). ▪ Hydrologic impacts on basin and sub-basin scales from forest management, rural residential development, and urbanization. ▪ Significance of sub-basin erosion and deposition to geomorphic and biological processes. ▪ Short-term and long-term effects of climate change. ▪ Feasibility for implementing projects on a scale necessary to re-establish normative physical processes and channel functions. ▪ Future rates of human population growth in each watershed and associated pressures for development. ▪ Effects of low level pollutants on fish physiology, behavior, and performance. ▪ Funding levels for adequate restoration and recovery actions.	**Issue:** ▪ Brinkmann et al. 2022 ▪ HCCC 2005 ▪ McIntyre et al. 2021 ▪ SAM 2017 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ US Salish Sea Technical Team 2012 ▪ USBOR 2002 ▪ WDFW and PNPTT 2000 **Actions:** ▪ FISRWG 1998 ▪ HCCC 2005 ▪ Puget Soundkeeper 2022 ▪ SAM 2017 ▪ Shared Strategy 2005 ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017 ▪ Thompson et al. 2009 ▪ US Salish Sea Technical Team 2012

Assessments for Improved Recovery Planning: ***Adult migrant staging to freshwater and vulnerability to harvest***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
There is a need to better understand the distribution and staging patterns of adult coho as they near their natal streams and rivers to assist harvest managers in designating harvest area boundaries and associated fishing regulations. Although the coho spawning escapement goal is defined for the entirety of Hood Canal, fishing regulations are generally established to avoid overfishing subpopulations or stream-specific stocks. Maintaining stock diversity and population structure within the region is an important aspect of management. The same need exists to know about summer chum staging patterns. This issue recognizes that this data gap exists and some form of assessment work may be needed. Relevant areas: Potentially many of the streams in Hood Canal.	▪ Assess adult salmon staging: Assess staging behavioral patterns of coho and summer chum as they approach their natal streams, assessing spatial patterns and distributions in relation to the stream mouths and environmental queues or factors that affect those patterns and distributions.	▪ A well-designed assessment to investigate staging behavior and patterns for species of concern (summer chum and coho) would inform co-managers about the potential to overharvest some components of the returning adult runs.	▪ Return timing, distribution along the shorelines, and schooling behaviors of adult coho and summer chum returning to natal streams in Hood Canal. ▪ Methods to make accurate assessments of staging patterns and behaviors are not established for the area.	▪ Personal communications with biologists in the region.

<u>Assessments for Improved Recovery Planning:</u> ***Genetic characterization of summer chum harvests by area or subarea in HC and SJDF***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Recent analyses on the performance of the various summer chum subpopulations have relied on fishery run reconstruction methods that have been employed for decades. Those methods make assumptions about the distribution of the catch contributions (such as incidental harvest) of various subpopulations in the different harvest areas. Genetic sampling of the catches in the different fisheries would enable harvest managers to better understand the distributions of the summer chum subpopulations in the various areas that are subject to harvest. Such data would be important to improve run reconstruction methods and future analyses to evaluate subpopulation performance as recovery efforts (including habitat restoration) progress. <u>Relevant areas:</u> All summer chum stocks, but mainly those in Hood Canal.	▪ <u>Assess summer chum genetics:</u> Assess stock composition of the catches of summer chum in different fisheries within Hood Canal and the eastern SJDF using genetic stock identification methods. No assessment work has been done on this issue since the 2015 prioritization report was issued.	▪ Assessment of the genetic composition of summer chum caught in various commercial fisheries in the region would help co-managers to prepare improved methods of run reconstruction for more accurate estimates of recruitment by stock.	▪ The existing method of doing run reconstruction applies assumptions about distribution and composition of the stocks within the harvest areas.	▪ Lestelle et al. 2014

<u>Assessments for Improved Recovery Planning:</u> ***Species and stock-specific juvenile habitat use and residency in estuarine and nearshore habitats***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
There is still a need to better understand how juvenile salmonids in the Hood Canal and eastern SJDF use natal and non-natal estuarine and nearshore habitats during their residency and emigration periods. Many of the modeling analyses that have been performed on summer chum and Chinook in the region have relied on data collected in the 1970s and early 1980s, which in the case of chum, focused on fall chum and on areas in the northern parts of Hood Canal. The Chinook analyses have generally relied on data collected in northern Puget Sound and in British Columbia. It is important to fill this data gap to better ensure that recovery planning in this region is based on region-specific information and on data applicable to summer chum. It is noted that the recent surge in productivity with many summer chum stocks is due to a PDO effect, providing good opportunity to collect field data pertaining to habitat use by summer chum stocks. Relatively recent work was conducted by the Wild Fish Conservancy on nearshore utilization patterns in mid-Hood Canal and Dabob Bay (Tuohy et al. 2019) but significant uncertainties remain, particularly with regard to use of natal estuarine and associated delta habitats. <u>Relevant areas:</u> The entire region of interest in this report.	▪ <u>Natal/non-natal estuarine and nearshore juvenile assess:</u> Assess the use of different estuarine and nearshore habitats by juvenile chum and Chinook within all major subregions and embayments in Hood Canal and the eastern SJDF (including Admiralty inlet) based on field sampling. Sampling should be performed over the range of all statistical weeks when age-0 fish of each species and run-type can be present, using more than one gear-type. The assessment should include: arrival time, residency time, period of use, relative abundance, stock and reproductive (natural or hatchery) origin, and size and growth. Some of this work for summer chum was done relatively recently by the Wild Fish Conservancy as reported on by Tuohy et al. (2019). That work was focused in the vicinity of Dabob Bay and significant information gaps remain. It bears noting that alternative hypotheses have been proposed for the role of natal subestuarine areas to wild juvenile salmon production, particularly for summer chum, in Hood Canal. Lestelle et al. (2018) and more recent analysis (in progress) suggest that natal subestuaries and nearshore areas in the vicinity of those habitats are particularly important to summer chum performance. Alternatively, Daubenberger et al. (2017) and Tuohy et al. (2019), proposed that habitats not associated with natal subestuaries were most important to summer chum performance. A well-designed assessment to resolve these differing hypotheses is needed. There remains a need for focused work on juvenile summer chum use of natal subestuaries, particularly on those subestuaries on the Union, Skokomish, Duckabush, Quilcene, and Snow-Salmon watersheds. ▪ <u>Estuarine and nearshore summer chum early growth rates</u>: Assess the early-estuarine/marine growth patterns from otoliths or scales during periods of warm and cool PDO. Such an assessment was originally proposed by Brian Beckman (NOAA) during the climate forum held by HCCC in March, 2017. The study would help understand the role of nearshore habitats near natal streams in affecting subpopulation performance related to the PDO. It would help in identifying causal mechanisms to differential survival among subpopulations and how these factors should be considered in recovery and maintenance of recovery.	▪ Completion of an up-to-date synthesis how juvenile salmon use the estuaries and nearshore areas of the region would be informative to recovery planners in the region. ▪ Well-designed assessment work would improve knowledge about how juvenile salmonids use the nearshore habitats of Hood Canal, Admiralty Inlet, and the eastern SJDF.	▪ Patterns and extent of use of the estuarine and nearshore environment by stocks produced in and outside of the region of interest in this report are uncertain. ▪ Doing this type of assessment work is difficult and generally expensive—it is uncertain what level of effort is needed to produce significant improvement in understanding about this issue. ▪ The existing state of understanding about how juvenile salmon use the estuaries and nearshore areas of the region of interest is not well established and could benefit from an up-to-date synthesis of information.	▪ Daubenberger et al. 2013 ▪ Daubenberger et al. 2017 ▪ Fletcher et al. 2013 ▪ Greene et al. 2012 ▪ Lestelle et al. 2005 ▪ Lestelle et al. 2018 ▪ Tuohy et al. 2019

<u>Assessments for Improved Recovery Planning:</u> ***Forage fish spawning distribution assessment***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Little information exists on the spawning distribution of forage fish within Hood Canal and the eastern SJDF (including Admiralty Inlet). There is strong evidence that forage fish populations throughout Puget Sound are in sharp decline, affecting food webs that help support salmon populations. There is a need to assess spawning distributions of key species in this region, and if possible, to assess spawning stock sizes. This information would inform planning for protection and restoration actions aimed at maintaining and improving stock size of forage fish species. <u>Relevant areas:</u> The entire region of interest in this report.	▪ <u>Forage fish assess:</u> Assess spawning distributions of forage fish species in the region. This assessment could expand on the work reported by Daubenberger et al. (2017).	▪ Well-designed assessment work would improve knowledge about the spawning distributions and habitats of forage fish in Hood Canal, Admiralty Inlet, and the eastern SJDF and assist planners and managers in targeting restoration work and in protecting important habitats.	▪ Up-to-date understanding about spawning distributions and habitats being used by forage fish in the region.	▪ Daubenberger et al. 2017 ▪ Personal communications with biologists in the region.

Assessments for Improved Recovery Planning: ***Resolution of questions about stock characteristics for fall Chinook recovery in Skokomish R***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Questions and controversy have existed about whether the existing George Adams stock is an appropriate stock source for recovering a late-timed Chinook stock in the Skokomish River (see the 2010 and 2017 versions of the recovery plan; SIT and WDFW [2010 and 2017]). The 2017 version of the recovery plan set forth an approach for addressing the matter. Relevant areas: Recovery planning in the Skokomish River watershed.	▪ Skokomish stock issue: Formulate one or more alternatives for experimentally developing and evaluating life history characteristics for a Chinook stock that could be used in recovering a late-timed Chinook population in the Skokomish River. This might include a stock source other than the one currently produced in the Skokomish River. The experimental plan would identify evaluation criteria and procedures to use in the evaluation. This issue is currently being addressed through on-going work in the Skokomish River (see SIT and WDFW [2017]).	▪ Formulation of an experimental plan to address the suitability of George Adams fish for recovering a true late-timed Chinook stock in the Skokomish River would inform co-managers and NOAA Fisheries about possible options and provide direction for initiating efforts at the appropriate time.	▪ Feasibility for recreating Chinook life histories that would be adapted to the normal flow patterns in the Skokomish River.	▪ PSP 2014b ▪ SIT and WDFW 2010 ▪ SIT and WDFW 2017

Assessments for Improved Recovery Planning: ***Resolution of questions about stock characteristics for Chinook recovery in Mid Hood Canal rivers***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Questions and controversy have existed about whether the Chinook returning to Mid-Hood Canal rivers, believed to be sourced to George Adams Hatchery stock, can perform in a manner to achieve recovery. Alternative hypotheses about this matter have been put forth. This issue was originally described in the 2015 prioritization report. Relevant areas: Recovery planning for the Hamma Hamma, Duckabush, and Dosewallips rivers.	▪ Mid HC stock issue: The comanagers jointly addressed this issue through a field study to assess habitat characteristics in the mid-Hood Canal rivers and a related synthesis of available information on what is known about the historical Chinook in the rivers and the current use of the rivers by Chinook. The recently issued report (Meridian and Mid-Hood Canal Work Group [2022]) has been submitted to NMFS. The report findings were inconclusive about the historical run-type. The most relevant conclusion from that analysis was that the historical stocks, if they were naturally sustained, were small; if a reintroduction effort was to be undertaken, it would likely be unsuccessful at recreating a sustainable population. Consequently, no reintroduction effort is currently being contemplated by the comanagers.	▪ The 2015 prioritization report stated for this: "Convene a multi-agency forum to review all available information applicable to identifying the stock lineage and life history patterns of Chinook produced in or using the Mid Hood Canal rivers, as well as other factors that might be affecting the stocks, then develop a plan for resolving this uncertainty. Resolution of this uncertainty could facilitate progress in recovery." The objective was essentially met by the Mid-Hood Canal Work Group in 2021 and 2022 as reported in Meridian and Mid-Hood Canal Work Group (2022 2022). Consequently, all issues are regarded as having low importance to the Mid Hood Canal Chinook stocks as well as associated actions.	▪ Historic use of the Mid Hood Canal rivers by Chinook and the role of these spawning groups in the metapopulation dynamics of Hood Canal and Puget Sound Chinook. ▪ Uncertainties were discussed in Meridian and Mid-Hood Canal Work Group (2022 2022)	▪ PSP 2014a ▪ Meridian and Mid-Hood Canal Work Group 2022 2022 ▪ Ruckelshaus et al. 2006

<u>Assessments for Improved Recovery Planning:</u> ***Perform diagnosis/prioritization analyses for summer chum watersheds where native stocks extirpated***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Recovery planning and analyses of action effectiveness for summer chum subpopulations have been based to a large extent on EDT analyses, which were first performed over 15 years ago. These analyses were only performed for the stocks (and associated watersheds) that were extant. Similar analyses had not been performed on the other watersheds where the stocks had been determined to be extirpated: Dungeness River, Chimacum Creek, Big Beef Creek, Tahuya River, Dewatto River, and Skokomish River. Questions have been raised about why reintroduction efforts in Big Beef Creek and Tahuya River have been generally unsuccessfully and what is needed to advance recovery in those streams. This issue was originally described in the 2015 prioritization report. <u>Relevant areas:</u> Recovery planning for summer chum stocks that have been extirpated.	▪ <u>Summer chum diagnosis:</u> The 2015 prioritization report proposed that a quantitative limiting factors analysis be performed to diagnose habitat conditions in summer chum streams, and their stream-mouth estuaries, that had not yet been analyzed. These streams included Dungeness River, Chimacum Creek, Big Beef Creek, Dewatto River, Tahuya River, and Skokomish River. The analysis should provide a means of summarizing restoration and protection priorities to help guide recovery planning. This assessment was recently completed and is contained in a report prepared by ICF and Biostream Environmental (2022). The assessment includes an updated analysis of the eight subpopulations that had previously been analyzed (see Lestelle et al. 2005), and incorporated new and updated information, as well as the new analysis for the six subpopulations that had not yet been analyzed. The results of this work have been incorporated into this updated prioritization report.	▪ Completion of diagnostic limiting factors analyses and associated prioritization would aid in restoration and protection planning on these streams.	▪ Explicit diagnoses and watershed-specific priorities for habitat restoration do not exist for the streams listed in the issue.	▪ Personal communications with biologists in the region. ▪ ICF and Biostream Environmental 2022

Assessments for Improved Recovery Planning: ***Hood Canal floating bridge***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
Evidence had been collected indicating that the Hood Canal floating bridge may be a cause of mortality to emigrating steelhead smolts (Moore et al. [2013]). This information, together with data from the 520 floating bridge on Lake Washington, gives reason to ask whether similar kinds of impacts might be occurring to other species, particularly to juvenile coho and Chinook. Possible impacts to other species, notably summer chum, also need to be considered. Relevant areas: Primarily relevant to the entirety of Hood Canal south of the Hood Canal floating bridge	▪ HC Bridge: Assess effects of the Hood Canal floating bridge on the migration and feeding behaviors of juvenile salmonids belonging to stocks of concern and on how the bridge might be causing increased mortality in the vicinity of the bridge. Substantial assessment work and research has occurred since the 2015 prioritization report. The on-going work has been done primarily by the Port Gamble S'Klallam Tribe, NMFS, Long Live the Kings, and WDFW, in partnership with the Hood Canal Coordinating Council and other state and federal agencies. Findings have been reported in various documents, including Daubenberger et al. (2020) and Moore and Berejikian (2022). The work has confirmed that very substantial impacts on steelhead smolt survival are occurring as a result of the bridge infrastructure. Impacts to other species, including chum, are also believed to be occurring. Continued research and assessment of impacts is occurring. Phase 2 is underway with engineers designing guidance structures for migrating juvenile salmonids intended to reduce steelhead mortality.	▪ Success in doing a well-designed assessment to improve knowledge about potential effects of the bridge on migrating juvenile salmonids would help resolve this uncertainty and give guidance to planners on the potential need for remediation.	▪ Recently published papers on apparent impacts to Hood Canal steelhead raise significant questions about the extent of effects that might be occurring on these stocks as well as on other species.	▪ Daubenberger et al. 2020 ▪ Moore et al. 2010 ▪ Moore et al. 2012 ▪ Moore et al. 2013 ▪ Moore and Berejikian 2022

<u>Assessments for Improved Recovery Planning:</u> ***Summer chum assessment and formulation of reintroduction criteria***

Issue and Affected Areas	Actions	Objectives	Uncertainties	Sources
This issue consists of two sub-issues. The first was that there remained questions about the presence of summer chum in the Dungeness R and how they should be addressed for the sake of recovery. The second sub-issue involves criteria that should be considered in deciding to initiate, or re-initiate, a reintroduction effort in any of the streams where the stock had previously been determined to be extirpated; this would include the Dungeness stock, as well as those in Hood Canal that would be the highest priority candidates (i.e., Big Beef Cr and Dewatto R). This issue was originally described in the 2015 prioritization report. <u>Relevant areas:</u> Dungeness R and to the streams and rivers where summer chum have been extirpated.	▪ <u>Assess Dungeness R sum chum:</u> Increase efforts to assess summer chum abundance in the Dungeness R during the period of favorable PDO and to collect genetic data on the stock. Historical evidence has been brought forward that confirms that a subpopulation of summer chum existed in the Dungeness R and that it was substantial in size. The Jamestown S'Klallam Tribe, in partnership with the other comanagers, is proceeding with planning for a possible reintroduction of summer chum into the Dungeness R in 2024 (personal communications with Randy Johnson and Aaron Brooks with the Jamestown S'Klallam Tribe). See ICF and Biostream Environmental (2022) for an analysis of historical performance of the subpopulation based on EDT modeling. ▪ <u>Sum chum reintroduction criteria:</u> Formulate criteria to be used in deciding on when, and where, reintroduction efforts should be initiated, or re-initiated, for summer chum recovery. The comanagers are proceeding (at the time of preparing this report) with discussions for a potential reintroduction to Dewatto R and potentially to Big Beef Cr in Hood Canal. As noted above, the comanagers are also proceeding with steps to initiate a reintroduction to the Dungeness River in the eastern SJDF.	▪ Improved assessment of summer chum in the Dungeness River would aid recovery planners in understanding the current status of the stock. ▪ Formulation of updated criteria for continuing or initiating reintroduction efforts in watersheds where extirpations are believed to have occurred would help planners to plan for reintroduction.	▪ Uncertainty has existed about the current distribution and abundance of Dungeness summer chum—more frequent surveys could help to resolve this uncertainty. Note: this uncertainty has been reduced as of 2022 because it is now largely accepted that any summer chum in the Dungeness R are rare and are most likely strays. ▪ A timeline and criteria for initiating new reintroduction efforts do not exist. This uncertainty is reduced for Dungeness as of 2022 because the comanagers have prepared a draft HGMP – target for initiating the reintroduction is 2024. Discussions are still underway for a timeline for a reintroduction to either Big Beef Cr or to Dewatto R.	▪ Personal communications with biologists in the region. ▪ ICF and Biostream Environmental 2022 ▪ Lestelle et al. 2014 and 2018

Appendix C – List of Issues

Type	Issue	Issue description
FW	Large stream channels	Large river channels in the region have lost structural and habitat diversity compared to their historic condition to varying extents depending on river, resulting in changes in channel stability, changes in substrate stability, loss of pool habitat and other habitat types, and coarsening of channel substrates (or fining of substrates in some cases), and in one river (Skokomish R.), a major increase in flood frequency now exists due to extreme aggradation that has occurred. Aggradation has also been significant in the lower Dungeness and Big Quilcene rivers. In the most altered reaches of these rivers, historic pool-riffle morphology has devolved into plane-bed morphology with elongated riffle/glide sections; also channel sinuosity and total channel length have been reduced (with corresponding losses in habitat diversity and quantity).
FW	Small stream channels	Many small streams that flow directly to the marine environment, as well as small streams tributary to the major river channels in the region, have lost structural and habitat diversity compared to their historic condition, resulting in changes in channel stability, changes in substrate stability, loss of pool habitat and other habitat types, and coarsening of channel substrates (or fining of substrates in some cases). Depending on the types of factors operating on the channel and the valley and geology characteristics, the channel may also be downcut (entrenched or incised) or it may be aggraded (e.g., much of the Tahuya River and the lower portion of Big Beef Creek) in response to alterations.
FW	Large stream floodplains	Major parts of the floodplains of large river channels in the region have been disconnected from the active channels within the alluvial valleys due to various channel and flood control measures. To a large extent, these floodplains have been converted to agriculture, rural residential lands, or urbanized areas (as in the lower Dungeness valley). These changes have resulted in loss of flow capacity in the high flow channel and natural floodways, exacerbating peak flow conditions and promoting greater channel scour, localized channel aggradation or degradation, leaving less diversified and more unstable in-channel habitat conditions. In addition, loss of floodplain connectivity has reduced sediment storage capacity within the floodways, further promoting aggradation and instability. Losses in off-channel habitats and stable side channel complexes have also resulted. From Cramer (2012): Natural, undeveloped floodplains and CMZs provide important functions including flood energy dissipation, flood water storage, natural sediment transport conditions, nutrient exchange, creation and maintenance of complex habitats, and resiliency to disturbance. Floodplains often provide refuge areas for aquatic species during floods and are excellent habitat for a wide variety of species.
FW	Small stream floodplains	The floodplains of many small streams and rivers in the region have been heavily altered and/or disconnected from the active channels by the placement of roads and driveways, land conversion, streambank protection measures, and other land use practices. These changes have contributed to changes in flow characteristics in these streams (increasing peak flows and decreasing summer low flows), sediment loading and processing, wood structure within the channels, pool-riffle composition, distribution and abundance of off-channel habitats (ponds, alcoves, wetlands, and backwaters), among other changes. From Cramer (2012): Natural, undeveloped floodplains and CMZs provide important functions including flood energy dissipation, flood water storage, natural sediment transport conditions, nutrient exchange, creation and maintenance of complex habitats, and resiliency to disturbance. Floodplains often provide refuge areas for aquatic species during floods and are excellent habitat for a wide variety of species.
FW	Access to in-stream	The ability of juvenile and adult salmonids to swim upstream to access spawning grounds and rearing areas is vital to salmonid recovery and long-term sustainability. Poorly designed or deteriorating culvert and bridge installations, as well as other barriers to upstream passage, can block or impede passage of juvenile and/or adults. In some cases, large beaver dams can also hinder or block upstream migrants, particularly migrant juvenile salmonids. In addition, while high waterfalls act to completely block upstream passage, smaller waterfalls and especially steep cascades can act as partial barriers to some species and life stages, particularly during certain seasons; SIT and WDFW (2010) identified the South Fork Skokomish gorge cascades as an example of such a partial barrier, one that may be made worse by climate change.

Type	Issue	Issue description
FW	Access to off-channels	The availability and accessibility of off-channel habitats (ponds and wetlands) are important determinants of the performance of some salmonid populations. Man-made structures or large beaver dams can block or hinder movements to these habitats of juvenile salmonids for seasonal rearing. Re-opening, improving accessibility, or by increasing the availability and quality of off-channel habitats can be effective ways to improve salmonid population performance for certain species. It is recognized that beaver dams and associated ponds are critical features of many lowland streams and provide important fish habitat, so care must be taken in attempting to improve fish passage in these areas.
FW	Riparian	Riparian zones in all watersheds within the region have been impacted to varying degrees by a wide variety of land and water-use activities, which include logging and all types of land clearing and land conversion to support societal needs. These activities have removed or altered the riparian plant communities, modified riparian soil conditions and other associated land and water features, and disrupted natural ecological cycles, all of which affect how riparian zones function in support of salmonid populations. The current condition of riparian zones in the Hood Canal and eastern SJDF region varies greatly, ranging from areas with virtually no function to support salmonids to other areas (relatively few) having pristine (or close to it) conditions.
FW	Sediment processes	Erosion and sediment transport by rivers is one of the natural watershed processes that shape stream channels and floodplains, as well as associated habitats and aquatic biota, including salmonid populations. The sediment supply is produced from ongoing land erosion (e.g., landslides), as well as from the recapture of sediments (due to channel migration and avulsions) previously stored in flood plains and streambanks. Prior to the rapid alteration of watersheds by Euro-Americans, sediment transport from rivers was generally in equilibrium with sediment supply. Watershed alterations and management have disrupted the natural process, resulting in changes (often very significant ones) to the supply, storage, and transport of sediments. These changes had led to increased fine sediments levels within spawning gravels, channel and habitat instability, and in some cases, to severe channel aggradation (as in the Skokomish, Dungeness, and Quilcene rivers). The active channel width of the Tahuya River mainstem also appears to have increased significantly over the past 25 years, suggesting substantial aggradation.
FW	Flow regime	The rapid conversion of old-growth forests to young, managed stands, combined with extensive road networks, in many watersheds of the region altered to varying extents characteristics of the natural flow regime. Subsequently, land conversion in the lower valleys of most watersheds have caused further changes to flow regimes as lands were cleared and converted to agriculture, rural-residential areas, commercial properties, military installations, and urbanized areas. All of these changes have increased the amounts of impervious surfaces, thus changing runoff rates and patterns. The flow regimes in certain rivers have also been altered by dams and reservoirs (e.g., the Skokomish River) and water diversions for irrigation and other development (e.g., in the Dungeness River). In both the Skokomish and Dungeness rivers, the flow regimes have also been significantly altered due to loss of floodplain function, diking and levees, aggradation in the main river channels, and in the Dungeness River, by groundwater pumping associated with development. Attributes of the flow regime include flow magnitude, duration, timing, frequency and rate of change. The flow regime is a key driver of ecological riverine processes and associated habitat features.
FW	Water quality	The water quality of streams and groundwater can be affected by various point and non-point pollutants originating from a large variety of societal activities associated with forest, agricultural, and industrial practices, rural-residential areas, urbanized areas, and transportation corridors. A full range of these activities takes place within the Hood Canal and eastern SJDF region to varying degrees depending on watershed. Degraded water quality, in the form of elevated water temperatures and reduced dissolved oxygen levels, also occurs as a result of riparian vegetation removal, stream flow reductions, and runoff carrying elevated organic loads.

Type	Issue	Issue description
FW	MD Nutrients	Some streams in the region have likely undergone reductions in marine-derived nutrients compared to their historic levels. This decline in nutrient levels (oligotrophication) has largely been man-caused as a result of the depletion of salmon populations due to harvesting and habitat loss and degradation. (Some systems are naturally relatively low nutrient levels—in these cases, they have often been reduced to even lower nutrient levels.) Oligotrophic ecosystems are nutrient-poor and are characterized by low annual rates of biotic production. The goal of nutrient supplementation (restoration) to is to increase the biological productivity of streams, riparian areas, upland areas, and estuaries by returning the nutrients originally supplied by anadromous fish carcasses back to the anadromous spawning zone of streams. Ideally, the ecosystem functions formerly supported by naturally spawning anadromous salmonids will be restored. Restoring this functionality will require restoring terrestrial and aquatic plant and animal communities in addition to anadromous fish.
FW	Dams & reservoirs	Two major dams were built on the North Fork Skokomish River in the late 1920s. Those dams inundated much of the upper North Fork, forming one major and one smaller reservoir. The dams served to divert most of the North Fork flow out of the Skokomish watershed to Hood Canal for electric power generation, significantly altering the Skokomish River flow regime. No provisions for fish passage were provided at the dams, and combined with the flow diversion, resulted in the demise of the spring Chinook run into the North Fork and a loss in abundance of other salmonid populations. Although the Cushman Settlement, agreed on in 2009, will provide for fish passage and reintroduction of fish runs to the upper North Fork, the reservoirs will remain in place for at least the next 40 years. Smaller dams have also been built on the Little Quilcene River and Union River, which serve to divert water for municipal purposes.
FW	Climate change	Accelerated rates of climate change are unambiguously well documented and salmon recovery planners are urged by NOAA Fisheries, as well as Washington State resource agencies, to account for climate change in their planning. Efforts to restore stream habitat will be inadequate without accounting for climate change. Stream systems in Western Washington will be directly affected by climate change through alterations in the amount and timing of streamflow and sediment yield, as well as by an increase in average air temperature. These changes in turn will affect water temperature regimes and habitat quantity, distribution, stability, and quality. Actions aimed at ameliorating the effects of climate change should protect existing core habitats that support populations of concern and aim to restore normative in-channel, floodplain, sediment supply and transport, and flow regime characteristics as quickly as possible.
NE	Tidal flow regime	Tidal flow regimes, including both freshwater input and saltwater tidal exchange, have been altered in many of the estuarine features of the region as a result of changes in the stream's flow regime, barriers to tidal exchange (such as by diking and placement of roads or highways within or across the estuary), aggradation and progradation, and loss of wetlands, changes in delta area or structure, or loss in channel area due to diking and/or filling. These changes often have resulted in loss of tidal prism, affecting estuarine sediment transport, tidal flow dynamics and patterns, and salinity structure, which can alter wetland vegetation types and estuarine nutrient dynamics and food webs. Tidal flow regimes have also been affected by construction of tidal gates.
NE	Sediment processes	Erosion and sediment transport by rivers is one of the natural watershed processes that shape stream channels and floodplains and the associated habitats and aquatic biota. Prior to the rapid alteration of watersheds by Euro-Americans, sediment transport from rivers is believed to have generally been in equilibrium with sediment supply in the rivers and streams of the region. Watershed alterations and management have disrupted these processes, resulting in changes—often very significant ones, to the sediment supply, storage, and movement to the estuaries--and in their transport from the rivers. Consequently, aggradation and, in many cases, unusually high rates of progradation have occurred to the estuaries of most rivers in the region, affecting channel connectivity, wetland and marsh composition, and eelgrass beds on the outer deltas. Aggradation has been particularly severe in some parts of the Skokomish estuary. Progradation has occurred to the rivers on the west side of Hood Canal, as well as in the Dungeness River and Jimmycomelately Creek.

Type	Issue	Issue description
NE	Estuarine wetlands	Historically, estuarine wetlands were well distributed and very abundant throughout the Puget Sound coastline, including in Hood Canal and along the eastern SJDF. These wetland areas were, and continue to be, highly important to estuarine and nearshore food webs and to the growth, survival, and production of juvenile salmonids. Extensive loss of estuarine wetlands has occurred over many areas of Puget Sound and in the many stream-mouth estuaries due to diking, draining, and filling. There have also been changes in the accessibility of many wetlands to juvenile salmonids as a result of diking and tidal gates. Some estuaries have undergone extensive changes in composition of types of wetlands as a result of changes in tidal flow and freshwater inputs, affecting the biological function of existing wetlands.
NE	Shorelines and channels	Estuarine shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, and transportation corridors. Such changes were particularly significant in all of the major river-mouths of Hood Canal (i.e., west-side rivers) and in the Dungeness River.
NE	Water quality	The water quality of stream-mouth estuaries and the nearshore environment can be affected by various pollutants, originating either within the adjacent watersheds or from accidental spills due to recreational, industrial, or military activities associated with boating or shipping activity.
NE	Riparian	Riparian zones bordering stream-mouth estuaries and the shorelines of the marine nearshore environment of the region have been impacted to varying degrees by a wide variety of land-use activities, which include logging and all types of land clearing and land conversion to support societal needs. These activities have removed or altered riparian plant communities, which affect how riparian zones function in support of salmonid populations. The current condition of estuarine and nearshore riparian zones in the Hood Canal and eastern SJDF region varies greatly, ranging from areas with virtually no function to support salmonids to other areas that are virtually pristine (or close to it).
NS	Tidal flow regime	The tidal flow regimes, including both freshwater input and saltwater tidal exchange, have been altered in many of the estuarine features of the region as a result of changes in the stream's flow regime, barriers to tidal exchange, and loss of wetlands, delta area, or channel area due to diking and/or filling. These changes often have resulted in loss of tidal prism, affecting estuarine sediment transport, tidal flow patterns, salinity structure, which can alter wetland vegetation types and estuarine nutrient dynamics and food webs. Tidal flow regimes have also been affected by construction of tidal gates.
NS	Sediment processes	Beaches and other shoreforms important to juvenile salmonids and forage fish are maintained by sediment sources along Puget Sound and the eastern SJDF transported by tidal and wave action within the region. In Puget Sound, beaches consist of two primary types: 1) those associated with coastal bluffs (called bluffbacked beaches), where the coastline has retreated landward; and 2) those associated with barrier beaches, where sediment has been deposited seaward of the original coastline. These beaches and other associated shoreforms (spits, barrier bars, and tombolos), which are affected by changes in sediment supply and transport processes, are vulnerable to degradation if the sediment sources are altered or if the transport processes are altered. Shoreline armoring, including the use of bulkheads, road locations, and nearshore fill can disrupt these processes and alter the stability of the beaches and other associated features for salmonid and forage fish use, as well as the productivity of these areas to produce forage for juvenile salmonids.
NS	Embayments & inlets	Puget Sound, including Hood Canal and the eastern SJDF, historically contained hundreds of small, protected embayments and open inlets along the coastlines. Many of these were in the form of stream-mouth estuaries and barrier lagoons. Many of these features included a barrier beach that wholly or partially enclosed a lagoon or estuary. (Small embayments are often referred to as pocket estuaries.) The amount of freshwater influences within these features varies widely. Most of these embayments and inlets historically contained estuarine wetlands. A large percentage of these landforms have been degraded, or lost entirely, through nearshore filling, transportation corridors, or shoreline armoring.

Type	Issue	Issue description
NS	Estuarine wetlands	Historically, estuarine or tidal wetlands were well distributed and very abundant throughout the Puget Sound coastline, including in Hood Canal and along the eastern SJDF. These wetland areas were, and continue to be, highly important to estuarine and nearshore food webs and to the growth, survival, and production of juvenile salmonids. Extensive loss of estuarine wetlands has occurred over many areas of Puget Sound and in the many stream-mouth estuaries due to diking, draining, and filling. There have also been changes in the accessibility of many wetlands to juvenile salmonids as a result of diking and tidal gates. Some estuaries have undergone extensive changes in composition of types of wetlands as a result of changes in tidal flow and freshwater inputs.
NS	Shorelines	Estuarine and nearshore shorelines have been extensively altered in Hood Canal and the eastern SJDF as a result of shoreline protection measures, land use conversions, transportation corridors, and construction of overwater structures such as docks, piers, and marinas. Shoreline armoring has been particularly severe in the southern end of Discovery Bay, parts of Admiralty Inlet, along some areas of northern Hood Canal, and especially along the southern parts of Hood Canal where it is almost continuous. Many overwater structures also occur in some of these areas and in some locations within Sequim Bay.
NS	Water quality	The water quality of stream-mouth estuaries and the nearshore environment can be affected by various pollutants, originating either within the adjacent watersheds or from accidental spills due to recreational, industrial, or military activities associated with boating or shipping activity.
A	Adult staging	There is a need to better understand the distribution and staging patterns of adult coho as they near their natal streams and rivers to assist harvest managers in designating harvest area boundaries and associated fishing regulations. Although the coho spawning escapement goal is defined for the entirety of Hood Canal, fishing regulations are generally established to avoid overfishing subpopulations or stream-specific stocks. Maintaining stock diversity and population structure within the region is an important aspect of management. A similar need may exist to know about summer chum staging patterns. This issue recognizes that this data gap exists and some form of assessment work may be needed.
A	Sum chum genetics	Recent analyses on the performance of the various summer chum subpopulations have relied on fishery run reconstruction methods that have been employed for decades. Those methods make assumptions about the distribution of the catch contributions (such as incidental harvest) of various subpopulations in the different harvest areas. Genetic sampling of the catches in the different fisheries would enable harvest managers to better understand the distributions of the summer chum subpopulations in the various areas that are subject to harvest. Such data would be important to improve run reconstruction methods and future analyses to evaluate subpopulation performance as recovery efforts (including habitat restoration) progress.
A	Juv habitat use/residency	There is a need to better understand how juvenile salmonids in the Hood Canal and eastern SJDF (including Admiralty Inlet) use estuarine and nearshore habitats during their residency and emigration periods. Many of the modeling analyses that have been performed on summer chum and Chinook in the region (such as the various EDT analyses) have relied on data collected in the 1970s and early 1980s, which in the case of chum focused on fall chum and on areas in the northern parts of Hood Canal. The Chinook analyses have generally relied on data collected in northern Puget Sound and in British Columbia. It is important to fill this data gap to better ensure that recovery planning in this region is based on region-specific information and on data applicable to summer chum. It should be noted that the recent surge in productivity with many summer chum stocks is due to a PDO effect, providing good opportunity to collect field data pertaining to habitat use by summer chum stocks.
A	Skok Chin stock issue	Questions and controversy exist about whether the existing George Adams stock is an appropriate stock source for recovering a late-timed Chinook stock in the Skokomish River (also, see the 2010 version of the recovery plan). How this stock question could be resolved scientifically has not been clearly formulated for the sake of recovery. There is a need to formulate a scientifically-based approach that could be implemented experimentally to better inform recovery planners.

Type	Issue	Issue description
A	Mid HC Chin stock issue	Questions and controversy exist about whether the Chinook returning to Mid-Hood Canal rivers, believed to be sourced to George Adams Hatchery stock, can perform in a manner to achieve recovery (see M&AM summary report for Mid-Hood Canal Chinook). Alternative hypotheses about this matter have been put forth, but to date no approach has been advanced for resolving this uncertainty. There is a need to formulate an agreed-upon approach between the co-managers and NOAA Fisheries to resolve this matter. It has been suggested that an experimentally-based approach could be implemented to inform recovery planners and advance recovery actions.
A	Sum chum asess, reintro	This issue consists of two subissues. The first is that there remain questions about the presence of summer chum in the Dungeness River and how they should be addressed for the sake of recovery. Effort to quantify quantification of spawners could be increased to gain greater certainty about their presence, abundance, and genetic profile. The second subissue involves criteria that should be considered in deciding to initiate, or re-initiate, a reintroduction effort in any of the streams where the stock had been determined to be extirpated; this would include the Dungeness stock, as well as those in Hood Canal that would be highest priority (Big Beef Cr and Dewatto R).
A	Sum chum diagnoses	Recovery planning and analyses of action effectiveness for summer chum subpopulations have been based to a large extent on EDT analyses, which were first performed over 10 years ago. These analyses were only performed for the stocks (and associated watersheds) that were extant. Similar analyses have not been performed on the other watersheds where the stocks had been determined to be extirpated, such as in Chimacum Creek, Big Beef Creek, Tahuya River, and Dewatto River. Recently, questions have been raised about why reintroduction efforts in Big Beef Creek and Tahuya River have been generally unsuccessfully and what is needed to advance recovery in those streams. There is a need to perform some form of analysis to diagnose conditions in these watersheds and prioritize habitat restoration measures for the sake of recovery planning.
A	Forage fish distribution	Little information exists on the spawning distribution of forage fish within Hood Canal and the eastern SJDF (including Admiralty Inlet). There is strong evidence that forage fish populations throughout Puget Sound are in sharp decline, affecting food webs that help support salmon populations. There is a need to assess spawning distributions of key species in this region, and if possible, to assess spawning stock sizes. This information would inform planning for protection and restoration actions aimed at maintaining and improving stock size of forage fish species.
A	HC floating bridge	Evidence has been collected indicating that the Hood Canal floating bridge may be a cause of mortality to emigrating steelhead smolts. This information, together with data from the 520 floating bridge on Lake Washington, gives reason to ask whether similar kinds of impacts might be occurring to species, particularly to juvenile coho and Chinook.

Appendix D – List of Actions

Code	Action	Action description
Freshwater		
FW-2	Beaver dams	Beaver dams: Install and periodically maintain "beaver deceiver" devices in priority areas prone to extensive damming by beavers where upstream salmonid migrations likely are restricted, or install juvenile fish ladders structures using corrugated plastic pipe (as done by the Pacific Coast Salmon Coalition) in sites where warranted.
FW-3	Beaver mgmt	Beaver mgmt: Develop and implement as warranted beaver management measures, including use of beaver deceivers, beaver pond levelers (elevation control devices), repellant, or trapping. Beaver activity is consistent with achieving normative channel and habitat characteristics, though private property protection and riparian protection (during re-establishment phase) may warrant some level of active management.
FW-4	Channel pattern	Channel pattern: Strategically remove channel constrictions and impediments to meanders to restore channel capacity and develop more normative channel pattern and avulsion pattern, e.g., by dike removal, use of setback levees, road relocations, lengthening and/or raising bridges, or rebuilding the channel pattern.
FW-5	CMZ	CMZ: Enlarge existing active channel migration zone (because it has been reduced by human activities) through regulatory, incentive, education programs, or land acquisition.
FW-6	Cushman Settlement	Cushman Settlement: Implement all provisions of the Cushman Settlement for the Skokomish River, providing for upstream and downstream fish passage, flow regime restoration, fish population supplementation, and habitat restoration.
FW-7	Decommissioning	Decommissioning: Decommission or remove roads of little use on public lands, or ones whose services can be provided on alternative roads.
FW-8	Dungeness water storage	Dungeness water storage: Create off-channel water storage reservoirs that would be filled during winter and spring high flow runoff and then used to augment late summer instream flows. The proposed Dungeness Off-Channel Reservoir Project offers a storage concept that has broad support by state, local, and tribal officials in the Dungeness valley (see Anchor 2022).
FW-9	Dungeness Rule	Dungeness Rule: Implement provisions of the Dungeness water rule adopted by WDOE in 2012. To the extent possible, purchase water credits from the water bank for protecting late summer low flows in the Dungeness River. Expand the rule to other areas of the Dungeness watershed as needed to ensure that minimum flows are maintained in the Dungeness River.
FW-10	Forest maturity	Forest maturity: Manage for an increase in hydrologic maturity (older-age stands) of forested lands to the extent possible using incentives on private lands or through policy change on public lands.
FW-11	Invasives	Invasives: Inventory and control invasives such as knotweed and canary reed grass. Periodic maintenance activities at prior restoration sites may be necessary until invasives are controlled. Activities listed for riparian protection and restoration also apply here.
FW-12	Large wood	Large wood: Construct ELJs or place large wood in appropriate locations of the river to facilitate sediment storage and processing and normative channel patterns (including bed elevations), and where appropriate, to recreate stable side channels, backwaters, or stable vegetated islands.
FW-13	Natural barrier	Natural barrier: Assess passage effectiveness at potential partial natural barriers if a salmon recovery effort might be hindered by limited passage, or if climate change can be expect to worsen passage effectiveness (such as at the South Fork Skokomish R. gorge cascades), and as deemed warranted, implement remedial measures to improve passage.
FW-14	Non-forest roads	Non-forest roads: Assess conditions of existing non-forest road systems that might contribute sediments, identifying risk levels for sediment contributions, and implement identified remedial measures.
FW-15	Non-road sediment	Non-road sediment: Assess non-road related sediment sources that contribute sediments, identifying risk levels for sediment contributions to adjacent streams, and implement remedial measures.

Code	Action	Action description
FW-16	Nutrient supplement	Nutrient supplement: Assess nutrient loading with marine-derived nutrients and nutrient processing in the watershed(s) of interest; as warranted, increase loading with fertilizer supplements or salmon carcasses.
FW-17	Off-channel access	Off-channel access: Inventory off-channel habitats and assess connectivity between swales/egress channels and main stream channels.
FW-18	Off-channel habitat	Off-channel habitat: Improve off-channel habitats by deepening and/or adding habitat structure where opportunities exist, or create new off-channel habitats where opportunity and favorable conditions exist by dredging, blasting, and/or installation of channel flow controls on small floodplain streams to create ponds (e.g., Cederholm et al. 1988; Pacific Coast Salmon Coalition).
FW-19	Protect floodplains	Protect floodplains: Protect existing riparian and floodplain lands from land conversions or loss of watershed function through regulatory, incentive, education programs, land acquisition or land set asides.
FW-20	Protect riparian	Protect riparian: Increase protection of riparian lands through regulatory, incentive (e.g., conservation easements), land purchases, and education and outreach programs.
FW-21	Restore floodplains	Restore floodplains: Restore more normative floodplain characteristics and function by restoring wetlands, ponds, overflow channels, riparian forest, and/or size of floodplains; this includes connectivity of off-channel features.
FW-22	Restore riparian	Restore riparian: Restore more normative riparian forest characteristics (considering forest distribution, continuity, size, and stand composition) using passive or active management methods. Activities listed for protection of riparian lands also apply here.
FW-23	RMAP	RMAP: Complete the development of Road Maintenance and Abandonment Plans (RMAP) on all forest lands, and implement steps for upgrading, maintaining, or decommissioning of roads and road crossings.
FW-24	Road crossings	Road crossings: Periodically evaluate stream crossing structures for passage effectiveness, maintain crossing structures consistent with BMPs, remove crossing structures on closed or abandoned roads, replace or upgrade outdated structures on a priority basis.
FW-25	Runoff BMPs	Runoff BMPs: Adopt or improve (i.e., update as needed) requirements for BMPs related to storm runoff management on agricultural, residential, commercial, or urbanized lands, including all transportation corridors that produce pollutants, promoting greater increases in storm-water infiltration using various methods and greater capacity for storm-water detention or retention.
FW-26	Sediment deposits	Sediment deposits: Strategically address key sediment deposits that constrict channel, limit flood capacity, or promote channel instability as part of an overall approach to restoring normative channel function.
FW-1	Streambank structure	Streambank structure: Implement streambank protection measures as warranted consistent with providing for normative channel pattern, structure, or function, as well as natural erosion rates and patterns (see Technique 12 in Cramer 2012).
FW-27	Trans infrastructure	Trans infrastructure: Improve or remove transportation infrastructure within floodplains to restore more normative channel and floodplain function and connectivity.
FW-28	Water rights	Water rights: Purchase water rights in the Dungeness watershed and dedicate the water for environmental-related flow in the Dungeness River.
FW-29	Watershed analysis	Watershed analysis: Prepare watershed analysis of the primary watershed processes that are affecting a watershed of concern if such analysis has never been done, or prepare an updated analysis if warranted. Such analysis will provide a landscape perspective for assessing the sediment budget, including rates of sediment supply and transport. Remedial measures can be formulated accordingly.
Natal Estuarine		
NE-1	Armor removal	Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines.
NE-2	Berm/dike removal	Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal.

Code	Action	Action description
NE-3	Channel rehab	Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function.
NE-4	Debris removal	Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore.
NE-5	Hydraulic mod	Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat.
NE-6	Invasives	Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete.
NE-7	Pollution control	Pollution control: Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem.
NE-8	Protection	Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs.
NE-9	Restore riparian	Restore riparian: Restore more normative riparian vegetation characteristics (considering riparian distribution, continuity, size of stands, and stand composition) using passive or active management methods.
NE-10	Revegetation	Revegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation.
NE-11	Topo restoration	Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here.
NE-12	Trans infrastructure	Trans infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.
Non-natal estuarine and nearshore		
NS-1	Armor removal	Armor removal: Removal, modification, or relocation of erosion protection structures such as rock revetments, bulkheads, and concrete walls on channels and shorelines.
NS-2	Beach nourishment	Beach nourishment: The intentional placement of sand and/or gravel on the upper portion of a beach where historic supplies have been eliminated or reduced.
NS-3	Berm/dike removal	Berm/dike removal: Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal.
NS-4	Channel rehab	Channel rehab: Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function.
NS-5	Debris removal	Debris removal: The removal of solid waste (including wood waste), debris, and derelict or otherwise abandoned items from the nearshore.
NS-6	Groin removal	Groin removal: Removal or modification of groins and similar nearshore structures built on bluff-backed beaches or barrier beaches in Puget Sound.
NS-7	Hydraulic mod	Hydraulic mod: Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat.
NS-8	Invasives	Invasives: Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after construction is complete.
NS-9	Large wood	Large wood: Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity.
NS-10	Pollution control	Pollution control: Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem.

Code	Action	Action description
NS-11	Protection	Protection: Increase protection of landforms of concern through regulatory, incentive (e.g., conservation easements), land acquisition, and education and outreach programs.
NS-12	Revegetation	Revegetation: Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation.
NS-13	Topo restoration	Topo restoration: Dredging, excavation and /or filling to remove or add layers of surface material so that beaches, banks, tidal wetlands, or mudflats can be created. Dredging to reshape a delta cone built through progradation is included here.
NS-14	Trans infrastructure	Trans infrastructure: Modification of transportation corridor infrastructure, including all structures associated with roads, railroads, and bridges, by removal, relocation, or modifying to provide for increased ecological functions within an estuary or along the nearshore area.
Assessment		
A-1	Adult staging	Assess adult salmon staging: Assess staging behavioral patterns of coho and summer chum as they approach their natal streams, assessing spatial patterns and distributions in relation to the stream mouths and environmental queues or factors that affect those patterns and distributions.
A-2	Forage fish assess	Forage fish assess: Assess spawning distributions of forage fish species in the region. Senate Bill 5166 currently working its way through the Washington State legislature would provide funding for this action.
A-3	HC Bridge	HC Bridge: Assess effects of the Hood Canal floating bridge on the migration and feeding behaviors of juvenile salmonids belonging to stocks of concern and on how the bridge might be causing increased mortality in the vicinity of the bridge.
A-4	Mid HC stock issue	Mid HC stock issue: Convene a multi-agency forum to review all available information applicable to identifying the stock lineage and life history patterns of Chinook produced in or using the Mid Hood Canal rivers, as well as other factors that might be affecting the performance of naturally produced Chinook in these rivers. Identify approaches and steps to resolving uncertainties about these matters. Identify the underlying hypotheses that are assumed (or applied) under different approaches that either are currently, or could be, used in moving forward with recovery work. Implement steps to resolving these uncertainties.
A-5	Nearshore juv assess	Nearshore juvenile assess: Assess the use of different estuarine and nearshore habitats by juvenile chum (including both summer and fall races) and juvenile Chinook within all major subregions and embayments in Hood Canal and the eastern SJDF (including Admiralty inlet) based on field sampling and observation. Sampling should be performed over the range of all statistical weeks when age-0 fish of each species and race can be present, using more than one gear-type. The assessment should include: arrival time, residency time, period of use, relative abundance, stock and reproductive (natural or hatchery) origin, and size and growth.
A-6	Nearshore synthesis	Nearshore synthesis: Prepare a synthesis of past (including recent) assessments on how juvenile salmonids use the estuarine and nearshore areas of Hood Canal and the eastern SJDF (including Admiralty Inlet), producing a current, up-to-date understanding of how estuarine, nearshore, and pelagic waters within the geographic area of interest are likely being used by the different salmon species, both at the habitat-type scale and the broader scale.
A-7	Skok stock issue	Skok stock issue: Formulate one or more alternatives for experimentally developing and evaluating life history characteristics for a Chinook stock that could be used in recovering a late-timed Chinook population in the Skokomish River. This might include a stock source other than the one currently produced in the Skokomish River. The experimental plan would identify evaluation criteria and procedures to use in the evaluation.

Code	Action	Action description
A-8	Sum chum diagnosis	Sum chum diagnosis: Carry out some form of a quantitative limiting factors analysis to diagnose habitat conditions in summer chum streams, and their stream-mouth estuaries, that have not yet been analyzed. These streams include Chimacum Creek, Big Beef Creek, Dewatto River, and Tahuya River. Other streams that might be considered are the Dungeness River, Thordyke Creek, Stavis Creek, Anderson Creek, and Big Mission Creek. The analysis should provide a means of summarizing restoration and protection priorities to help guide recovery planning.
A-9	Sum chum genetics	Assess summer chum genetics: Assess stock composition of the catches of summer chum in different fisheries within Hood Canal and the eastern SJDF using genetic stock identification methods.
A-10	Spawner assess	Assess Dungeness R sum chum: Increase efforts to assess summer chum abundance in the Dungeness River during the period of favorable PDO and to collect genetic data on the stock.
A-11	Reintroduce criteria	Sum chum reintroduction criteria: Formulate criteria to be used in deciding on when, and where, reintroduction efforts should be initiated, or re-initiated, for summer chum recovery.