



MONITORING PROGRAM ANNUAL REVIEW

2016 Recommendations

Salmon Recovery Funding Board Monitoring Panel

August, 2016

2016 MONITORING PANEL

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EXECUTIVE SUMMARY

At the request of the Salmon Recovery Funding Board (SRFB), the SRFB Monitoring Panel conducted a comprehensive review of the board's monitoring program in 2016. This performance evaluation was completed for three of the four components of the monitoring program: Project Effectiveness Monitoring, Intensively Monitored Watersheds (IMW), and Status and Trends Fish Monitoring (also referred to as Fish In/Fish Out). The fourth component of the SRFB monitoring program, Implementation Monitoring, is conducted by RCO grants managers and was not evaluated by the monitoring panel.

During the course of the year, the monitoring panel met with the principal investigators of each monitoring component and provided guidance on the criteria on which each component would be evaluated. Completion of the annual report was included as a contract deliverable. The monitoring panel convened workshops with principal investigators to gain a deeper understanding of the entire SRFB monitoring program and to understand the technical underpinning of each component. The monitoring practitioners subsequently provided annual reports, participated in meetings and teleconferences, and provided a tour of the Big Beef Creek monitoring operations and restoration actions in the Hood Canal IMW complex.

Monitoring panel members individually evaluated each component and discussed potential modifications to the program. The panel members bring a diversity of background and experience and did not have unanimous perspectives on the monitoring projects. Divergent opinions are noted within the program discussions; however, the panel collectively agreed to the recommendations included in this report.

The assigned status of each project is listed in Table 1. The monitoring panel incorporated the same terminology for assigning status as that used by the SRFB Review Panel, i.e., clear, conditioned, or project of concern. Clear projects are those that are technically sound and the monitoring panel does not recommend any changes in how the program is being implemented in the coming year. Conditioned projects are recommended as clear to proceed if the principal investigators for the monitoring effort agree with specific conditions to be included within the 2017 contract. Projects of concern have technical weaknesses or concerns, which are specifically identified by the monitoring panel and which the panel believes cannot be rectified without extensively re-designing the project.

In the monitoring panel's 2016 review, two monitoring projects were identified as clear (Skagit IMW and the Status and Trends Fish Monitoring), five were conditioned (Asotin IMW, Hood Canal IMW, Lower Columbia IMW, Strait of Juan de Fuca IMW, and Project Effectiveness), and no projects were identified as projects of concern. The same projects which were conditioned

in 2016 were conditioned in the 2015 review process; however the panel felt that sufficient progress was made to warrant assigning a status of conditioned again in 2016, rather than project of concern. Progress made in addressing panel concerns is noted in the body of the report for these projects. One project, which received a clear status in 2015, was assigned a conditioned status in 2016 to more clearly articulate the need for a specific set of analyses for a more robust interpretation of the data. In identifying time-bound conditions to these projects in 2016, it is the panel’s expectation that the conditions will be met in 2017 or these projects may be identified as projects of concern in subsequent reviews.

Table 1: Summary of Monitoring Panel Recommendations

GENERAL RECOMMENDATIONS
<ol style="list-style-type: none"> 1. The SRFB should make tentative funding decisions on monitoring at the June meeting to allow for contracts to be in place by October 1. This idea was presented to the SRFB at the June 2016 meeting. 2. Beginning in 2017, the Governor’s Salmon Recovery Office should move the due date for the annual report for all principal investigators to December 31, with the expectation that the investigators will summarize data collected through September 30 of that year, unless an alternative data collection cutoff is mutually agreeable with Governor’s Salmon Recovery Office. The office should include a clear schedule of deliverables in the contract with each participating entity. In 2016, this reporting requirement should be streamlined, given the short time period since the last annual report was submitted to the panel (April 2016). Principal investigators should submit a progress report by December 31, 2016 focused on recent accomplishments and progress made in meeting any conditions applied during the current evaluation. 3. Continue to dedicate funding for IMW restoration treatments. 4. Truncate the current Project Effectiveness Monitoring in 2018 and develop a scope of work for an enhanced Project Effectiveness study to begin in 2019. 5. To minimize disruption of the SRFB Monitoring Program under the projected reduced funding level, the panel recommends the following in 2017: <ol style="list-style-type: none"> a. Defer monitoring of three project categories in Project Effectiveness Monitoring (livestock exclusion, riparian restoration, and acquisition). b. Defer two tasks in western Washington IMWs: 1) the EMAP/GRTS¹ habitat sampling in the Strait of Juan de Fuca IMW; and 2) Hydrogeomorphic surveys in the Hood Canal IMW, which are above and beyond the standard suite of habitat metrics included in the study.

¹Environmental Monitoring and Assessment Program/Generalized Random Tesselation Stratified

PROJECT RECOMMENDATIONS

Intensively Monitored Watersheds

Asotin IMW

STATUS: Conditioned

Monitoring Panel Recommendations: The panel recommends that the following language be included in the project agreement:

1. Commence post-treatment monitoring in 2017. Do not alter existing treatments unless absolutely necessary so the results of the study will reflect the efficacy of restoration actions without continued maintenance.
2. Steelhead abundance data should be aggregated over the entire watershed so it will be possible to determine if habitat structure additions have improved viable salmonid population (VSP) parameters at the population scale.
3. Over the duration of the study, abundance of steelhead smolt and adult should be estimated before and after restoration and summarized across all three branches of the Asotin Creek. If possible, smolt-to-adult return ratios should be calculated for fish occupying treatment and control reaches. Principal investigators should provide the “before” abundance figures in the progress report to be submitted by December 31, 2016. The report also should include an estimate of the amount of restoration needed and the amount of time needed, in order to see a response.

Hood Canal IMW

STATUS: Conditioned

Monitoring Panel Recommendations: The panel recommends that the following language be included in the project agreement:

1. Estimate the expected increase in smolt capacity potential following restoration, assuming all restoration is accomplished under fully seeded conditions. This can follow the approach used in the lower Columbia or Straits IMWs, using existing estimates of increases in Coho Salmon or steelhead (Roni et al. 2010) following removal of habitat bottlenecks. The results of this analysis shall be included in the progress report due December 31, 2016. This should allow project staff to determine if the restoration will produce sufficient additional Coho Salmon smolts at full seeding to detect population level changes in the treatment watersheds.
2. Project staff shall conduct a review of the experimental design and methods of analysis being used in the Hood Canal IMW to determine if a BACI design remains the best approach, given the constraints and difficulties that have been encountered to date. If restoration treatments continued to be applied over multiple years and if the reference watershed proves to be an imperfect control, another experimental design may be warranted. The review shall be included in the progress report due on December 31, 2016 and include alternatives to the BACI design, if warranted.

3. Limiting factors and specific restoration objectives for the coming year should be clearly

articulated in the December 2016 progress report. Limiting factors are not well-identified in the annual progress report submitted in April 2016 although multiple factors are alluded to (for example, it is not enough to say that increasing “complexity” is a goal without defining how complexity will be improved and measured). Refining limiting factors will clarify restoration objectives and ensure targeting of appropriate restoration projects in the systems. This will benefit potential project sponsors, the lead entity ranking committee(s), the SRFB Review Panel, and the SRFB Monitoring Panel in furthering appropriate restoration actions and evaluating IMW progress.

Lower Columbia IMW

STATUS: Conditioned

Monitoring Panel Recommendations: The monitoring panel recommends that the following language be included in the project agreement:

1. Principal investigators shall revisit and prioritize limiting factors and assess whether currently recorded population metrics are appropriate for measuring response. The monitoring panel requested this in 2015. In particular, the panel is interested in the IMW scientists’ opinions on which habitats and life stages are most limiting recovery at this time. This may be different than the list of parameters identified through the Limiting Factors Analysis that is included in the salmon recovery plan.
2. The schedule for restoration activities and evaluation period should be updated so the life expectancy of this IMW can be determined. In the progress report submitted by December 31, 2016, the project leads will:
 - a. Update Table 1 (Habitat restoration projects for Abernathy and Germany Creeks watersheds) to reflect their best assessment of when restoration treatment implementation will be complete. Given that the implementation of treatments hinges on available funding, it is acceptable to estimate the number of treatment years remaining, rather than a specific year by which it will occur.
 - b. Identify the number of years of post-treatment monitoring needed to detect a response. Update Table 8 (Planned time frame for evaluation of restoration actions: local versus watershed-scale responses of fish and habitat) accordingly.
3. Principal investigators shall provide guidance on restoration priorities in the coming year and propose an implementation schedule. In the annual report submitted by December 31, 2017, the IMW team will, at a minimum, identify types of restoration activities that address key limiting factors. This provides a starting point for potential project sponsors and reviewers to know that the sponsor is targeting a type of restoration at a location appropriate for the study design. Ideally, project scientists would suggest specific project ideas and possible locations based on their judgment of what would best advance study objectives. The 2009 restoration treatment plan forms a foundation for restoration work; however, the prioritization approach followed the

scoring process used by the Lower Columbia Fish Recovery Board, not the team of scientists that designed the IMW, suggesting that improved coordination is still needed.

4. The IMW team shall continue to participate in regular meetings and collaboration with the Lower Columbia Fish Recovery Board so that all parties understand the intended type of restoration treatment that will advance the study objectives. The monitoring panel recommends that the SRFB apply this same condition to the IMW funding that is disbursed to the Lower Columbia Fish Recovery Board. The coordination challenges that have existed between IMW monitoring team and the salmon recovery region are a shared responsibility.

Skagit IMW

STATUS: Clear

Monitoring Panel Recommendation: Continue support as currently scoped.

Strait of Juan de Fuca IMW

STATUS: Conditioned

Monitoring Panel Recommendations: The monitoring panel recommends that the following language be included in the project agreement:

1. Principal investigators will evaluate the necessity of including EMAP habitat data collection in the study and shall summarize their findings in the progress report submitted by December 31, 2016.
2. A description of how data will be archived in a location that it can be made accessible to interested parties in future years must be included in the December 31, 2016 progress report.

Project Effectiveness Monitoring

STATUS: Conditioned

Monitoring Panel Recommendations: The monitoring panel recommends that the following language be included in the project agreement:

The contractor should adhere to the sampling schedule modifications recommended by the monitoring panel (attached). Specifically,

1. As a cost saving measure, annual reporting shall be streamlined for the completion of this phase of the study. The annual reports due in December of 2016 and 2017 shall focus on describing progress made in addressing monitoring panel conditions listed below. Summary and analysis of data collected in 2016-2017 shall be incorporated in the 2018 final report.
2. The year in which each site is monitored for fish presence will occur as scoped in the original study design. In order to narrow the annual variation in target species presence over the sample period, the low-flow fish sampling window for each site shall not exceed a 2-month period.
3. Projects deferred in 2015 (acquisition, riparian restoration, and livestock exclusion) will continue to be deferred. A plan for completion of these project categories will be developed during the re-scoping exercise for Project Effectiveness Monitoring.
4. The contractor should prepare a plan for making all data and analyses from Phase 1 accessible upon its completion. This should be attached to the December 31, 2016 progress report.

Status and Trends Fish Monitoring

STATUS: Clear

Monitoring Panel Recommendation: Continue support of the Status and Trends Fish Monitoring conducted by Washington State Department of Fish and Wildlife.

INTRODUCTION

The SRFB Monitoring Panel was created in 2014 to advise the board on key elements of its monitoring program. This report addresses one of the core tasks assigned to the panel – to evaluate the performance of each component of the monitoring program and to provide guidance and funding recommendations to the SRFB. The following sections describe the annual review process and summarize the recommendations arising from the evaluation. The evaluation process is a central element of the SRFB’s adaptive management framework.

The SRFB Monitoring Program consists of the following four components:

- Implementation (compliance) Monitoring
- Project Effectiveness Monitoring
- Intensively Monitored Watersheds (IMWs)
- Status and Trends Fish Monitoring (also referred to as Fish In/Fish Out)

The Governor’s Salmon Recovery Office commissioned a report in 2014 that summarizes the current SRFB Monitoring Program (Crawford 2014). The 2014 report describes the evolution of each component of the monitoring program and provides greater detail on the operation of each component. Implementation Monitoring is conducted by RCO grants managers and was not evaluated by the monitoring panel.

The focus of the monitoring panel’s work and thus the recommendations within this report relate to Project Effectiveness Monitoring, Intensively Monitored Watersheds, and Status and Trends Fish Monitoring.

Project Effectiveness Monitoring has statewide geographic representation. Five IMWs were included in the review: four in western Washington (Hood Canal, lower Columbia River, Skagit River, and Strait of Juan de Fuca complexes) and one in eastern Washington (Asotin River IMW).

The Status and Trends Fish Monitoring is a statewide program conducted by Washington State Department of Fish and Wildlife, of which SRFB funds support 7 percent of the overall program. The SRFB funds directly support the following specific elements of the overall Fish In/Fish Out monitoring effort: Touchet River juvenile summer steelhead; Grays River juvenile coho salmon and steelhead; Wind River adult coho salmon; Salmon Creek adult and juvenile summer chum salmon; Snow Creek adult summer chum salmon, and Snow Creek adult and juvenile steelhead; and Duckabush River juvenile summer chum salmon, Chinook salmon, and steelhead.

EVALUATION PROCESS

GSRO asked the monitoring panel to evaluate the technical soundness of each of the monitoring components and to provide a set of recommendations to the SRFB that can be used to help inform monitoring program direction and funding. Specifically, GSRO asked the panel to provide recommendations to the board on the following:

- Is the SRFB's monitoring program asking the right questions?
- How well are the contractors performing the work? Are there recommended improvements needed?
- Should the SRFB continue to fund the current monitoring components or modify how they are funded or implemented?

In initiating the evaluation, the following questions framed the review:

- Is the monitoring component functioning at a satisfactory level overall?
- Does the composition and administrative structure of the project team facilitate the project's success?
- Are study objectives clearly identified and adhered to?
- Will the experimental design meet the study objectives?
- Are adequate quality control measures in place?
- Will the data and results be useful for salmon recovery?
- Is there a plan and vehicle for sharing the results of the findings?

In crafting the evaluation strategy, the panel also looked to the SRFB-commissioned Stillwater Sciences report (2013), which was the impetus for the creation of the monitoring panel and monitoring program review. Based on the technical expertise of the group, the recommendations within the Stillwater report, and guidance from GSRO, the monitoring panel developed a four-step process for evaluating the SRFB monitoring program: 1) Develop a suite of criteria by which to evaluate each monitoring component; 2) Clearly articulate these criteria and performance requirements to monitoring practitioners; 3) Evaluate each monitoring component based on the review

criteria; and 4) Make recommendations as appropriate for modifying the monitoring component and the review process in the coming year.

The monitoring panel updated the reporting requirements in the fall of 2015. An annual report was required for all projects and the annual assessment was removed as a contract deliverable. The panel developed a description of what should be included in the annual report which was shared with principal investigators in October 2015. This guidance was finalized in December, 2015 and incorporated clarifications based on feedback from project scientists.

To ensure that all panel members had a clear understanding of each element in the monitoring program, the panel met with science leads from all SRFB-funded monitoring studies for in-depth discussions in fall 2014 and spring 2015. In 2016, the monitoring panel focused effort on Project Effectiveness Monitoring and met three times to specifically discuss this study. One of those meetings included the principal investigators for that study and additional exchange of information occurred over e-mail.

Additionally, the panel met with Washington Department of Fish and Wildlife staff and Hood Canal IMW scientists to discuss the impacts of low escapement on that study. Several panel members also visited the field operations for the Hood Canal IMW. Scientists from each monitoring component were asked to provide an annual report summarizing progress during the past year.

Monitoring principal investigators submitted their annual reports in April 2016. Each monitoring panel member completed an independent review of each project. The panel met to collectively identify a status rating for each monitoring project and identify recommendations for the SRFB. The panel was not unanimous in all recommendations. When panel perspectives diverged, a democratic process followed and a majority vote was taken to assign project status.

Project status was documented in a comment form for each monitoring project (i.e., each IMW has its own comment form; there is a single form for the Status and Trends Fish Monitoring and one form for Project Effectiveness Monitoring). The comment forms include any condition language recommended for inclusion in the project agreement. Condition language for each project has been included in full in the body of this report, along with general observations and context about the research study. The comment forms follow the same terminology for assigning statuses used by the SRFB Review Panel i.e., clear, conditioned, or project of concern.

- **Clear projects** are those that are technically sound and the monitoring panel does not recommend any changes in how the program is being implemented in the coming year.
- **Conditioned projects** are those projects which are cleared to proceed with specific conditions to be included in the 2016 contract.
- **Projects of concern** have technical weaknesses or concerns specifically identified by the monitoring panel which the panel believes cannot be rectified without substantially re-designing the project.

RESULTS AND RECOMMENDATIONS

In the monitoring panel's 2016 review, two monitoring projects were identified as clear (Skagit IMW and the Status and Trends Fish Monitoring), five were conditioned (Asotin IMW, Hood Canal IMW, Lower Columbia IMW, Strait of Juan de Fuca IMW, and Project Effectiveness), and no projects were identified as projects of concern. The projects that were conditioned in 2016 were conditioned in 2015; however the panel felt that sufficient progress was made to warrant assigning a status of conditioned again in 2016, rather than a status of project of concern. Progress made in addressing panel concerns is noted in the body of the report for these projects. One project which received a clear status in 2015 was assigned a conditioned status in 2016 to more clearly articulate the need for a specific set of analyses that the panel expects will lead to a more robust interpretation of the data. In identifying time-bound conditions to these projects in 2016, it is the panel's expectation that the conditions will be met in 2017 or these projects may be identified as projects of concern in subsequent reviews.

The panel has summarized its findings into general recommendations, which are applicable to all three components of the SRFB Monitoring Program (Project Effectiveness, Intensively Monitored Watersheds, and Status and Trends Fish Monitoring), and recommendations specific to each component.

General Recommendations

- 1. The SRFB should make tentative funding decisions on monitoring at the June SRFB meeting to allow for contracts to be in place by October 1.**

The change in the funding decision date was requested by Washington Department of Ecology, which has administered the contracts to participating agencies in the western Washington Intensively Monitoring Watersheds. Delays in contracting have resulted in monitoring practitioners being faced with working without a contract or missing time-sensitive tasks during the contracting period. The SRFB was informed of the proposed change at the June 23, 2016 meeting. In future years, following tentative a tentative funding decision by the SRFB in June, the funding decision will be finalized by the RCO director after the funding award amount from the federal Pacific Coastal Salmon Recovery Fund is known.

- 2. Beginning in 2017, GSRO should move the due date for the annual report for all PIs to December 31 of each year, with the expectation that practitioners will summarize data collected through September 30 of each year, unless an alternative data collection cutoff is mutually agreeable with GSRO.**

The Governor's Salmon Recovery Office should include a clear schedule of deliverables in the contract with each participating entity. In 2016, this reporting requirement should be streamlined, given the short time period since the last annual report was submitted to the panel (April 2016). Principal investigators should submit a progress report by December 31, 2016 focused on recent accomplishments and progress made in meeting any conditions applied during the current evaluation.

An earlier reporting deadline will be necessary in order to provide recommendations to the SRFB in advance of a June funding decision. This will result in a foreshortened reporting period in 2016; the panel will ask principal investigators for a simplified progress report with the focus on describing progress made in addressing monitoring panel conditions applied during the current review.

- 3. Continue to dedicate funding for IMW restoration treatments.**

For the IMWs to be valuable, it is essential that sufficient restoration occurs to lead to a detectable change in the target species. When restoration treatments are delayed over many years, the study is more expensive and results are confounded due to other variables that contribute to changes (or lack of changes) in response variables. The SRFB's 2013 decision to dedicate up to \$2 million a year for restoration treatments for 3 years made a remarkable difference in the rate of restoration treatments in the IMWs. The panel recommends that this be continued until the IMWs have completed the amount of restoration necessary to detect a response to restoration. If the budget is insufficient to accommodate all planned monitoring tasks, it would be preferable to defer some monitoring tasks than protract the restoration treatment implementation. This and other possible approaches to cost savings are discussed in the following section.

4. Truncate the current Project Effectiveness Monitoring study in 2018 and develop a scope of work for an enhanced project effectiveness study to commence in 2019.

Based on the past several months of focused discussion on Project Effectiveness Monitoring, the panel concluded it would be advantageous to truncate the current study in 2018 and re-scope it to address limitations in the original design. The panel recommends that re-scoping Project Effectiveness Monitoring continue as a monitoring panel task in 2017, with periodic feedback from the SRFB Monitoring Subcommittee. The panel's suggestion for completing the current phase of work is detailed in the section on Project Effectiveness Monitoring below. The panel chair presented this concept to the SRFB at the June 2016 meeting.

5. Defer specific monitoring tasks to minimize disruption of the SRFB Monitoring Program under the projected reduced funding levels.

In light of the news of reduced monitoring funding, the panel has attempted to identify tasks within the overall SRFB Monitoring Program that potentially could be eliminated or deferred with the least impact on the monitoring program and its ability to meet the board's monitoring objectives. The panel's suggestions are incorporated within the recommendations specific to each component, but can be highlighted as the following:

- a. Defer monitoring of three project categories in Project Effectiveness Monitoring (livestock exclusion, riparian restoration, and acquisition).
- b. Defer two tasks in western Washington IMWs in 2017: 1) Defer the EMAP/GRTS² habitat sampling in the Strait of Juan de Fuca IMW in 2017. Currently, similar data are collected under two separate protocols: EMAP/GRTS and Timber Fish and Wildlife. Principal investigators will evaluate the need for collecting data under both protocols over the coming year. 2) Defer additional hydrogeomorphic surveys in the Hood Canal IMW until the data are thoroughly analyzed and reported. Surveys have been done periodically in Hood Canal to characterize hydrogeomorphic parameters such as bedload movement, extent of wetted channel, etc. in Little Anderson, Seabeck, and Stavis Creeks. These

²Environmental Monitoring and Assessment Program/Generalized Random Tesselation Stratified

are in addition to the standard suite of habitat metrics included in the study. Only preliminary analysis has been completed to date.

The recommendations specific to the IMWs are based on input from the western Washington IMW Monitoring Oversight Committee; the panel believes it is imperative that input from the committee should inform any modification to the scope of its work necessitated by reduced funding.

Eliminating the Project Effectiveness Monitoring and IMW tasks in 2017 reduces the monitoring budget by about \$250,000 from the 2016 funding level. If these reductions are not needed in their entirety, the panel believes that the best monitoring investment of any remaining funds would be directed to IMW restoration treatments

Intensively Monitored Watersheds

The monitoring panel believes that the SRFB's Intensively Monitored Watershed monitoring component is a critical element in understanding the causal relationships and mechanisms affecting salmonid population trends and that IMWs will inform pathways to recovery for populations listed under the Endangered Species Act. Five IMWs in the SRFB IMW program were reviewed by the panel this year: Asotin, Hood Canal, lower Columbia River, Skagit River, and the Strait of Juan de Fuca.

Asotin IMW

The Asotin IMW project continues to be a well-managed, long-term investigation of restoration effectiveness at a somewhat limited scale. The study has developed important scientific information related to steelhead trout response to reach-scale restoration of post-assisted log structures in small to medium-sized streams. The study's approach is distinct from the four IMWs in western Washington in that it is primarily a tributary-scale evaluation of restoration actions (treatments and reference sites are all within the Asotin River system, but located in different tributaries) and thus it shares similarities with the Project Effectiveness Monitoring work.

Overall, the design is well-conceived; the survey of habitat conditions in the watershed is comprehensive and builds on collaboration with other monitoring approaches, such as the Columbia Habitat Monitoring Program (CHaMP) protocols employed in the Columbia River basin; the progress implementing treatments has been steadily

consistent and with adequate funding this should continue. Some commendable aspects of the study include the following:

- A broad spectrum of partnering organizations, including federal, state, and local entities. Most importantly, the project team has robust support and interaction with the regional salmon recovery organization that manages restoration funds. This has resulted in efficient and timely implementation of restoration treatments.
- The IMW maintains rigid control over the application of habitat treatments (not all IMWs have strict control over restoration actions).
- As the only SRFB-supported IMW east of the Cascade Mountains, it has the potential to provide unique information about vertically driven posts as large woody materials habitat improvements, a technique being used in other salmon and steelhead recovery efforts in the region.
- An experimental design (hierarchical staircase) has replaced the original Before-After-Control-Impact design, which proved to be sub-optimal. We applaud the project staff's willingness to recognize deficiencies in their original experimental design and adopt a new approach.
- An effective fish marking and recovery program has been implemented that enables tracking movements, growth rates, and productivity using Passive Integrated Transponder (PIT) tags, scale analyses, and steelhead population sampling.
- Broadly used, and thus comparable, habitat survey (CHaMP) methods are employed.
- Focus on a single species in a watershed where harvest, hatchery management, and water use are not confounding variables makes sense.
- A good track record of communication and outreach. The principal investigators provide detailed and timely reports that incorporate strong data analysis and interpretation. Investigators demonstrate willingness to try innovative analyses and look for ways to publish aspects of their work as the study is ongoing, such as the Wall et al. (2016) paper, which expands Net Rate of Energy Investment analyses from the habitat unit scale to the reach scale.

The monitoring panel notes that the engineering design of the post-assisted log structures is similar to techniques pioneered almost a century ago in the upper Midwest, which may not be appropriate to the flashy hydrological regimes of the Pacific

Northwest. However, the implementation of a similar restoration approach in the nearby John Day R. (Bridge Creek) and elsewhere in the region has claimed positive results (see Bouwes et al. 2016).

The monitoring panel recognizes the apparent positive response of steelhead to the post-assisted log treatments, which is consistent with studies on steelhead response to wood placement on the west side of the Cascades. So far, this study appears to be one of the few SRFB studies in which target species are responding favorably to restoration actions. Project leads have addressed our concern about the limited scale of treatment sites by expanding the distance over which post-assisted log structures are applied and increasing the amount of wood in the three treatment streams. The panel hopes the restoration actions are completed in 2016 as planned so that post-treatment monitoring of all sites can be fully implemented in 2017.

The panel also appreciates that steps are being taken to evaluate the relative importance of both physical habitat improvements and the benefits to stream food webs provided by coarse sediment storage behind created logjams, especially because it has become clear that both pools and suitable substrates for macroinvertebrate communities are lacking in the Asotin system. For this reason, the panel encourages the continuation of Net Rate of Energy Investment and habitat suitability modeling as described in the 2015 annual report. This appears to be one of the few studies where it might be possible to separate the habitat versus trophic benefits of log structure additions.

Several factors contribute to the organizational success of this study: the close coordination between the project scientists and the lead entity/regional salmon recovery board, strong support and collaboration with state and local restoration partners, diverse funding sources, and tight control over habitat treatments. The scientists that developed the restoration treatment plan also are implementing it, which provides a significant advantage. Some of these organizational attributes could be transferred to other IMW studies and be beneficial. Some of these factors, however, are more readily achieved by virtue of the study's smaller area, which brings its own limitations, as noted elsewhere.

Responsiveness to 2015 Monitoring Panel Comments

The annual report provided updated analyses. To date, most analyses of habitat and fish responses have focused on reach-scale effectiveness of treatments (e.g., frequency of large woody debris, pools, changes in thalweg, fish density and frequency) rather than

population level responses, which is in part a function of the geographical scale of the hierarchical staircase design. Fish populations show promise of responding to the restoration actions, but because they are not statistically significant, the investigators note that monitoring should continue to confirm the results.

Study Limitations and Concerns

The use of vertically driven fence posts to facilitate large woody debris retention, create sediment wedges, and form pools downstream from the structures is decades old³ and there are concerns that the structures will require frequent, expensive maintenance. Because the post-assisted log structures approach used in the Asotin is reminiscent of techniques pioneered in the upper Midwest a long time ago, it represents a departure from most large woody debris placement projects in the Pacific Northwest. For example, modern guidelines for large woody debris placement call for LWD to be scaled to the size of the channel. It is important that any fish population responses to the structures be well understood, and ecological processes be clearly identified in order for new insights to be applied to other LWD restoration projects in the region.

As noted above, the monitoring panel strongly supports investigators willingness to try innovative analyses and look for ways to publish aspects of their work as the study is ongoing, such as the Wall et al. (2016) paper. However, the panel cautions the principal investigators to not oversell the deliverables that can be expected and overstate the scale of inference of this work. For example, the suggestion in Wall et al. (2016) that their approach to expand their Net Rate of Energy Investment analyses from the habitat unit to the reach scale could be an alternative to Endangered Species Act viability analyses would not be appropriate without more testing and verification. Endangered Species Act viability analysis focuses on a much larger temporal and spatial scale.

Recommendation: CONDITIONED

The monitoring panel recommends that the following language be included in the Asotin IMW project agreement:

1. Commence post-treatment monitoring in 2017. Do not alter existing treatments unless absolutely necessary so the results of the study will reflect the efficacy of restoration actions without continued maintenance.

³Tarzwel, C. M. 1934. Stream improvement methods. Division of Scientific Inquiry, Bureau of Fisheries, Stream Improvement Bulletin R-4, Ogden, UT; Hunter, C. J. 1991. Better trout habitat: A guide to stream restoration and management. Island Press, Washington D.C.; Hunt, R. L. 1993. Trout stream therapy. University of Wisconsin Press, Madison, WI.

2. Steelhead abundance data should be aggregated over the entire watershed so it will be possible to determine if habitat structure additions have improved viable salmonid population parameters at the population scale.
3. Over the duration of the study, abundance of smolt and adult steelhead should be estimated before and after restoration and summarized across all three branches of the Asotin Creek. If possible, smolt-to-adult return ratios should be calculated for fish occupying treatment and control reaches. Principal investigators should provide the “before” abundance figures in the progress report to be submitted by December 31, 2016. The report also should include an estimate of the amount of restoration needed, and the amount of time needed, in order to see a response.

In addition to the conditions recommended for inclusion in the practitioner’s contract above, the monitoring panel makes the following suggestions for enhancing the approach of this monitoring component:

1. Although the primary focus of the IMW has been to assess the physical habitat improvements resulting from the post-assisted log structure additions, the evaluation of food web benefits of increased sediment storage is quite important and should be continued. The panel strongly supports the trophic modeling and macroinvertebrate sampling elements of this study.
2. Project staff should attempt to track steelhead smolt-to-adult return rates even though survival outside the Asotin subbasin is not part of this IMW investigation. Smolt-to-adult return rates are a common currency in tracking population status, and including this metric along with on-site density and production estimates would further strengthen the study in relation to other investigations in nearby river basins.
3. Along with habitat use, fish movement data are critical to understanding how juvenile steelhead respond to habitat treatments. The panel would like to see more information on juvenile distribution and residence time by year class/size. Also, it would be very helpful to know what proportion of the *Oncorhynchus mykiss* population are considered resident (i.e., rainbow trout) versus anadromous (i.e., steelhead)? Is it possible that habitat restoration projects would change that proportion in addition to affecting overall productivity?

4. It is not clear that length of fish in samples over time equates to growth because there is no guarantee that fish occupying a site have resided there throughout the sampling interval. Actual growth can be determined only by multiple measurements of individual fish. It is possible that limited growth data can be gleaned from passive integrated transponder tag data.

Hood Canal IMW

Within the SRFB portfolio of IMWs, the Hood Canal IMW is the best example of small watersheds in Puget Sound with expanding urban development; the small streams that are being studied once constituted important spawning and rearing areas for populations of coho, chum, steelhead, and cutthroat trout throughout the southern Salish Sea. Additionally, the presence of the Big Beef Creek Research Station with its history of federal, state, and university involvement helps to provide a focal point for long-term population-level investigations. The existing monitoring infrastructure here provides a long time series of data at the mouth of the primary study basin, which allows for robust data collection with high confidence at a lower cost.

The Hood Canal IMW faces daunting challenges, two of which include a very prolonged restoration application schedule and chronic underescapement of the primary target species – coho salmon. These challenges weaken the power of the design and make a before-after-control-impact experimental design hard to apply. Some factors contributing to the protracted implementation of restoration include funding limitations, coordination difficulties with partner organizations, reluctance by landowners to grant access or enter into conservation easements, and (as the panel learned in the spring 2016 field tour) implementation of unplanned “restoration” actions by locals without consultation or permits. The investigators’ efforts to explore analyses other than the tradition before-after-control-impact tests also may provide useful information.

The floodplain reconnection work in lower Big Beef Creek appears well designed and the recognition that extreme flow events, both high and low, may be critical to freshwater survival has helped identify opportunities for habitat improvements and design restoration treatments. The Hood Canal IMW team has made progress in identifying habitat limiting factors. In addition, it has improved its understanding of salmonid life histories and population dynamics in the IMW streams. It is also noteworthy that the team is paying close attention to species (chum and cutthroat) that were not the initial focus of the study.

The SRFB decision to dedicate project money to IMW restoration treatments has dramatically increased the pace of restoration treatments in the Hood Canal IMW. The previous disconnect between IMW researchers and restoration implementation is being addressed, though it is unfortunate that a restoration strategy was not developed earlier in the project. In fairness, the importance of flow extremes in the watersheds had not yet been realized. The planned restoration actions in 2016 combined with the recent LWD treatment likely will have a significant geomorphic effect on a critical low gradient reach, leaving the project poised to provide important information on the biotic response in the coming years. While low escapement is a more difficult issue, project scientists met with the monitoring panel to discuss the scale of the problem. Increased number of adults on the spawning grounds would allow for a better understanding of where current escapement levels are on the stock-recruit curve and help reveal whether changes in capacity or productivity could be detected at this site following restoration. Given the low projections for adult coho returns in 2016, and the challenges that co-managers have had in reaching harvest agreements, the panel concluded this issue could not be resolved in 2016.

Responsiveness to Monitoring Panel Comments

In the annual report, the authors provided a clear and concise summary of the work to date, including relevance to other similar watersheds. While the panel was somewhat disappointed by the paucity of recent results presented in the annual report, the project team was otherwise responsive to 2015 monitoring panel comments. The inclusion of Appendix A to address the 2015 monitoring panel information request was very helpful. The field visit with members of the monitoring panel was highly valuable and also much appreciated.

Study Limitations and Concerns

The panel's primary concern is whether changes to habitat via restoration will be extensive enough to detect a fish response, and whether there will be enough fish present to respond to improved habitat. The panel would like to see details of how much restoration has been done, what is planned, and whether it will be possible to determine a watershed-scale response in either productivity or capacity. This assessment should include estimates of expected increases in fish numbers (see Roni et al. 2010), which should help determine whether the study will be able to detect a watershed-scale response to restoration or not. The annual report states "Lack of restoration continues to be the main issue limiting the impact of the Hood Canal IMW study. The treatment watersheds have simply not yet received the level of restoration

that we would expect to generate a measurable increase in salmonid abundance or survival. Although the panel remains optimistic that major restoration will occur in the coming years, we emphasize that the recent SRFB investment in IMW restoration is insufficient to implement each of these projects.” These statements imply that a significant amount of restoration needs to take place rather quickly in order for the study to eventually reach a satisfactory conclusion. That project leads have suggested the SRFB budget for the Hood Canal IMW is insufficient for implementing restoration at a meaningful scale to permit scientific evaluation should be addressed.

Another challenge is whether high variability in escapement and low adult return rates will impede detection of changes in productivity and/or capacity following restoration treatment. Harvest management issues, at both the local and regional scale, further complicate this IMW. The difficulty with trying to limit the harvest of adult salmon before they enter the IMW watersheds is influenced by treaty agreements with Hood Canal tribes and an incongruity between the scale of harvest zoning and the ability to limit terminal fisheries adjacent to the mouths of the streams.

The observation that surface flows are often disrupted in parts of the streams during low flow periods is troubling. While last year’s drought may have been an anomaly, it appears that summer drying is fairly commonplace and that coarse and fine sediment accumulations are contributing to the problem of maintaining surface flow. Discharges great enough to mobilize and flush some of this sediment are needed, but big flood events may jeopardize houses and other capital developments. Restoring and maintaining surface flow in the small streams will be one of the most important challenges facing the Hood Canal IMW.

The monitoring infrastructure at the mouth of Big Beef Creek, which makes it possible to maintain the long time series of data, also alters floodplain ecosystem processes at a critical location in the watershed. The fish trap, because it can be operated only at low and moderate flows, limits the ability of the facility to detect fall migrant Coho Salmon, which the Strait IMW has shown to be significant contributors to adult recruitment.

The history of restoration in these watershed, especially how projects have been chosen and implemented, has confounded the before-after-control-impact experimental design and reminds us that IMWs are not just tests of how well scientists can monitor watersheds, different treatments, and document change. Whether desirable or not, these large scale studies include many elements that are beyond the control of the

principal scientists. In such circumstances, these studies are a test of how the salmon restoration programs in Washington can be monitored.

Recommendation: CONDITIONED

The monitoring panel recommends that the following language be included in the Hood Canal IMW project agreement:

1. Estimate the expected increase in smolt capacity potential, assuming all restoration is accomplished under fully seeded conditions. This might follow an approach taken in the lower Columbia or Straits IMWs, using existing estimates of increases in coho or steelhead (Roni et al. 2010). The results of this analysis shall be included in the progress report due December 31, 2016. This should allow us to determine if the project will be likely to detect population level changes.
2. Project staff shall conduct a review of the experimental design and methods of analysis being used in the Hood Canal IMW to determine if a before-after-control-impact design remains the best approach, given the constraints and difficulties that have been encountered to date. If restoration treatments continued to be applied over multiple years and if the reference watershed proves to be an imperfect control, another approach may be warranted. This review shall be included in the 2016 progress report.
3. Limiting factors and restoration objectives for the coming year should be clearly articulated in the progress report submitted on December 31, 2016. Limiting factors were not well-identified in the annual progress report submitted on April 15, 2016 although multiple factors are alluded to. It is not enough to say that increasing “complexity” is a goal without defining how complexity will be measured. Refining limiting factors will clarify restoration objectives and ensure targeting of appropriate restoration projects in the system. This will benefit potential project sponsors, the lead entity ranking committee(s), the SRFB Review Panel, and the SRFB Monitoring Panel in furthering appropriate restoration actions and evaluating IMW progress. The panel appreciates the emphasis on restoring natural processes and agrees that what is most limiting in the system may fluctuate even on an annual basis. However, additional sideboards on restoration objectives are warranted to promote successful implementation of study goals.

In addition to the conditions recommended for inclusion in the practitioner's contract above, the panel offered several suggestions for enhancing the analysis and reporting of this monitoring component in the comment form provided to the monitoring team. The panel also suggests the following:

1. If the budget permits, juvenile coho should be tagged with passive integrated transponders and checked for fall emigration, considering the importance of fall migrants in the nearby Strait IMW.
2. If resources and capacity allow, it would be useful to determine if fall outmigration is a significant life history strategy in the system. This determination could be accomplished by either a scale analysis of adult fish or a mark-recapture using partial traps in the fall.

Lower Columbia IMW

The lower Columbia IMW is a valuable study with multi-organization support, good experimental design, and pre-treatment data. The study focuses on multiple anadromous species (Chinook, coho, and steelhead) instead of targeting only one as some other IMWs are doing. The study intends to not only test whether restoration treatments lead to a response but to understand the mechanisms for the response. The addition of a life-cycle framework adds a useful dimension to the project.

Fish demographic information is generally good thanks to the long-term fish counts in the three watersheds. The study has a better-than-average time series of conditions before treatment but implementation of restoration treatments has occurred only in the past several years, so it is too early to see a response. Because the time series of pre-treatment smolt data spans several fish generations, this study is positioned to know how much post-treatment monitoring will be required. However, a very extended (and still ongoing) habitat restoration period has made it difficult to estimate the time required to statistically evaluate population level effects of different restoration activities. Project leads should specify when the treatment period will end and when the post-treatment evaluation will be complete. On the other hand, the investigators seem to have carefully considered matching appropriate fish response metrics to the type of restoration action being implemented at a site. The recent upswing in Chum Salmon adult returns suggests that potentially limiting factors for this species may need to be examined, if Chum Salmon become an important member of the salmonid community.

Responsiveness to 2015 Monitoring Panel Requests

Both the 2016 annual report and 2015 study plan are well written and thorough. The report detailed restoration actions, monitoring approach, monitoring responses, updates for 2015, and a useful discussion section that includes a schedule for data analysis and reporting. The report provided valuable documentation and evaluation of the current state of the lower Columbia IMW and in turn, serves as a useful form of communication to interested stakeholders.

While this IMW has struggled with a lag in restoration actions to date, the transparency of such reporting facilitates management decisions with respect to funding. Despite the slow start on implementing restoration treatments, this project now seems on track to determine response of coho and steelhead to restoration actions at a watershed and reach scale. It has both a project and watershed-scale component and the 2015 (Zimmerman et al. 2015) study plan does a nice job of outlining power/sample size estimation and estimating the level of fish response expected based on restoration.

The 2015 Monitoring Panel questions were, for the most part, well addressed in Appendix B of the annual report. The annual report did a nice job of documenting progress and ongoing challenges as follows:

- Per the panel's request for more detailed explanation of potentially confounding conditions in Abernathy Creek (dewatering and hatchery impacts). The 2016 annual report addresses those conditions and comments directly or describes the schedule for doing so (e.g., the passage evaluation).
- The evaluation of restoration projects on Abernathy Creek provided a helpful snapshot status with a realistic, cautionary note about correlation vs. causation. However, justification for continuing the Abernathy Creek part of the overall study plan was not explicitly addressed. Were near-term and planned projects reviewed against revised project goals to see if they merit continuation?
- Based on thorough response in Appendix B, it appears that improvement has been made in coordination between the IMW researchers and the Lower Columbia Fish Recovery Board, the restoration lead, but that room for improvement persists. Clarification on behalf of both parties may be warranted.
- Modification to future summer flow analyses to determine if low flow conditions resulting from the Abernathy Fish Technology Center withdrawals are causing adverse impacts. The authors also openly discussed the challenge of calculating the proportion of natural spawners comprised of hatchery-origin recruits in an integrated hatchery steelhead program.

- The report provided additional detail on data management and response to the monitoring panel questions in Appendices. With respect to providing publicly accessible data, this appears to be an area that requires future clarification by the monitoring panel.

Project Limitations and Concerns

The study continues to lack focus in some of its objectives. For example, nutrient enhancement studies were initiated two years ago without being identified as a limiting factor and the current status of nutrient supplementation is uncertain.

The limited annual data updates and analyses are of concern. And as in other western Washington IMWs, the Generalized Random Tessellation Stratified/Environmental Monitoring and Assessment Program approach is being used for habitat monitoring, but it does not appear that the habitat data have been rolled up to apply to all reaches in the watershed. This needs to be done for this and other IMWs using a similar approach.

Recommendation: CONDITIONED

The monitoring panel recommends that the following language be included in the lower Columbia IMW project agreement:

1. Principal investigators shall revisit and prioritize limiting factors and assess whether currently recorded population metrics are appropriate for measuring response. The monitoring panel requested this in 2015. In particular, the panel is interested in the IMW scientists' opinions on which habitats and life stages are most limiting recovery at this time. This may be different than the list of parameters identified through the Limiting Factors Analysis that is included in the salmon recovery plan. This should be included in the progress report due on 12/31/16.
2. The schedule for restoration activities and evaluation period should be updated so the life expectancy of this IMW can be determined. In the progress report submitted by December 31, 2016, the project leads will:
 - a. Update Table 1 (Habitat restoration projects for Abernathy and Germany creek watersheds) to reflect their best assessment of when restoration treatment implementation will be complete. Given that the implementation of treatments hinges on available funding, it is acceptable to estimate the number of treatment years remaining, rather than a specific year by which it will occur.

- b. Identify the number of years of post-treatment monitoring needed to detect a response. Update Table 8 (Planned time frame for evaluation of restoration actions: local versus watershed-scale responses of fish and habitat) accordingly.
3. Principal investigators shall provide guidance on restoration priorities in the coming year and propose an implementation schedule. In the progress report submitted by December 31, 2016, the IMW team will, at a minimum, identify types of restoration activities that address key limiting factors. This provides a starting point for potential project sponsors and reviewers to know that the sponsor is targeting a type of restoration at a suitable location that is appropriate for the study design. Ideally, project scientists would suggest specific project ideas and possible locations based on their judgment of what would best advance study objectives. The 2009 restoration treatment plan forms a foundation for restoration work; however, the prioritization approach followed the scoring process used by the Lower Columbia Fish Recovery Board, not the team of scientists that designed the IMW, suggesting that improved coordination is still needed.
4. The IMW team shall continue to participate in regular meetings and collaboration with the Lower Columbia Fish Recovery Board so that all parties understand the intended type of restoration treatment that will advance the study objectives. The monitoring panel recommends that the SRFB apply this same condition to the IMW funding that is disbursed to the Lower Columbia Fish Recovery Board. The coordination challenges that have existed between IMW monitoring team and the salmon recovery region are a shared responsibility.

Skagit IMW

The Skagit IMW remains one of the most valuable members of the SRFB IMW portfolio. The Skagit IMW includes a long time series of monitoring before implementation of big restoration projects, works from a comprehensive set of data-driven hypotheses, and relies on strong collaborative effort with federal agencies, Washington Department of Fish and Wildlife, and Native American tribes. The sampling approach is sound and results are compelling. It is the only Washington IMW that examines restoration effectiveness in a large estuary, and it is one of the few IMWs that has shown a statistically positive response to restoration by the target species – Chinook salmon. The cooperators in the study have made genuine contributions to improving estuarine

habitats and reducing competition among juvenile Chinook. They are on track to determining both local and system level responses to different types of tidal delta restoration actions.

The current study plan allows principal investigators to apply restoration at a landscape scale as a means to determine if population bottlenecks can be reduced or eliminated via improvements in estuary connectivity and habitat structure. The SRFB funds for this IMW are limited to data collection; however, there is a broader benefit due to the extensive collaboration from other entities and effective organization within this IMW. The investigators have done a good job of analyzing results and overall, this project has an excellent record of peer-reviewed publication and other forms of technical transfer. Just as important, the monitoring results suggest other questions likely be important in other watersheds. In particular, their work highlights the importance of life history diversity and density dependence in regulating juvenile Chinook salmon population dynamics. It is noteworthy that individual projects have led to increased carrying capacity on the order of tens of thousands of fish, exceeding recovery plan estimates. The focus of most restoration work has been on improving habitats in the Skagit River tidal delta. Somewhat less attention has been paid to the importance of nearby pocket estuaries.

The Skagit IMW has broad applicability to other large river estuaries with estuarine depended salmon. It focuses on two key recovery questions that are not being addressed by other watershed-scale monitoring projects: Is capacity and connectivity in estuaries limiting Chinook salmon productivity? Will the estuarine system and Chinook populations respond to estuary restoration?

As in other western Washington IMWs, the main weakness of this program is related to the pace of restoration implementation in the basin. While there have been significant investments in estuary restoration in the Skagit during the past decade, some projects have been slow to implement and there have been significant hurdles with landowner willingness.

Recommendation: CLEAR

The Skagit IMW should be continued as currently scoped by the study's principal investigators.

The panel made several suggestions to the principal investigators in the comment form on ways that the annual reporting could be enhanced. Chief among them are the following:

1. Beginning in 2017, annual reports should incorporate any new data available at the time of report. The report due on December 31 of each year should summarize data collected through September 30 of that same year.
2. In the progress report due December 31, 2016, please specify: 1) when you anticipate the completion of restoration treatments (either by date or number of years of planned treatment remaining); and 2) By what date you anticipate seeing a response to treatments.

Strait of Juan de Fuca IMW

This IMW is an important part of the suite of IMWs in western Washington, providing valuable insight into the response of coho and steelhead trout populations to habitat restoration treatments. Overall, the population and habitat survey methods are scientifically sound. It is one of the few, unique opportunities to use a before-after-control-impact, although the early implementation of restoration projects in treatment sections (which was not a decision by the monitoring team) compromised the ability to collect pre-treatment data and response of some metrics is a simple post-treatment trend analysis. The large scale of the restoration treatment for the watershed is a strength – most of the anadromous zone of the watershed has been treated, making it more likely that a change or population response to treatments can be detected. Although most of the restoration treatments for the basins already have been completed, the IMW research team was, for the most part, closely coordinated with the restoration actions. The detailed life history data for both Coho Salmon and steelhead trout generated in this IMW are outstanding, and the findings are relevant for other IMWs as well as restoration practitioners and fishery managers throughout the region.

As one of the first IMWs implemented, the Strait of Juan de Fuca study not only helped set an example for other IMW projects but it also has been a testing ground for how to actually implement key restoration treatments, such as placement of large woody debris structures. This has provided good “lessons learned” to other practitioners. The project also has detected alternative Coho Salmon life histories as an ancillary benefit of monitoring. This discovery has pushed biologists in other watersheds to look for that same life history. The detailed modeling of the factors affecting steelhead survival by life

history type is extremely valuable. Two key strengths of this project are the strong suite of collaborators working on the IMW and the ability to adapt to challenges.

This initial focus of this IMW was to evaluate the effect of increasing the amount of large wood load in two treatment watersheds while not treating the adjacent reference watershed. Wood placement (primarily by helicopter) has been completed and the project is in the post-treatment evaluation phase. Over the course of the project, significant movement of early migrant coho and steelhead was found in fall. This behavior took place in all three watersheds. While the primary goal of the study has remained the assessment of effects of wood addition on stream habitat and fish populations, the observation that fall emigration constitutes an important component of life history strategy and contribution to adult returns. This result has shifted the emphasis of the IMW somewhat to gaining a better understanding of life history diversity on population response to in-stream habitat improvements. Fall emigration of juvenile salmonids also had been detected in the Hood Canal and lower Columbia IMWs, but research on the Strait IMW remains the most complete and it has important implications for other restoration projects that focus on in-stream habitat improvements.

So far the fish monitoring results have failed to show a strong response to experimental treatments, even though restoration of large wood has been fairly extensive in the two treatment watersheds. Nevertheless, data suggests that habitat conditions are improving. However, the annual report states “Additional monitoring of two to three generations (6 to 9 years for Coho Salmon and longer for steelhead) is needed to confirm that these initial [increasing] trends are the result of restoration actions implemented in East Twin and Deep Creek.” In effect, this will require monitoring to continue in the Strait IMW through at least the mid-2020s. Project leads admit that “The spatial scale of the Strait’s habitat restoration, while large, is still not necessarily enough yet to effect a large enough change relative to the natural variation seen with most watershed and fish metrics.” This statement suggests that additional work on identifying the most sensitive fish and habitat metrics is needed, particularly if another 10-15 years of funding for monitoring is not forthcoming. It also should be noted that in the 2013 synthesis report the Straits IMW team had suggested additional treatments in East Twin (salmon carcasses) and Deep Creek (winter habitat), which appear to be limiting coho production in these two watersheds. The panel saw no mention of this in the 2016 report, which left the panel wondering whether these proposed activities were considered limiting factors or whether there were any plans for additional restoration. These questions will need to be resolved with the monitoring team in 2017.

Responsiveness to 2015 Panel Comments

The panel had comments to the investigators in 2015, such as documenting the data collected, developing a schedule for evaluating the fish responses to treatments, and analyzing existing data.

- The April 2016 annual report provided a table of data collected and narrative for evaluating fish responses. Project leads identify several analytical milestones: (1) updated fish tagging, movement, and adult spawning results, to be completed by June 2016, (2) analysis of restoration mediated habitat changes in East Twin Creek to be completed by December 2017, (3) analysis of restoration mediated habitat changes in Deep Creek to be completed by December 2019, and (4) a final report to be completed by December 2021. It is gratifying to see a schedule for completing the analyses, and the panel hopes that each milestone includes a description of how data will be archived in a location that it can be made accessible to interested parties in future years. The monitoring panel's 2015 condition requested that the updated analysis be reported in the annual report submitted in June 2016. The annual report's Appendix B does include 2012 and 2013 data, however it is unclear in the report if the data points added in Figure B1 of this appendix encompass the entirety of the data backlog or if additional data still need to be analyzed. Regrettably, the annual report did not update figures and tables with data collected in 2014 or 2015 nor did it provide any additional analyses.
- The development of a functional database management system is a great advancement in support of the Strait of Juan de Fuca IMW and potentially other monitoring programs.

Project Limitations and Concerns

The IMW scientists should further estimate how much restoration would be enough to reasonably detect a response. Although the question was discussed, it remains largely unanswered.

It is concerning that restoration actions in Twin Creeks (Table 1 of the report: large woody debris in 2002-2006, culvert correction 2007, road decommissioning in 2009-2010, more large woody debris in 2011) will not be evaluated until December 2017. That would be 6-15 years after the restoration actions, which does not seem like a reasonable schedule. Deep Creek suffers from the same lack of analysis and reporting, with proposed results in 2019 even though restoration actions were initiated in 1997, 2005, 2009-2011, and 2007-2010 (Table 1). Although IMWs require time for projects to be implemented and habitats to respond, the protracted delay in evaluation relative to

analyses conducted in other IMWs warrants concern. This was a serious concern raised in 2015, but it is unclear if it has been resolved in 2016.

The 2016 annual report states investigators are not able to identify what resources may be limiting migrant production or survival. This is a concern given restoration activities were initiated in 1996 at Deep Creek and 2000 in East Twin Creek. Although having 4-5 years of post-treatment monitoring, investigators alluded to the need to conduct additional surveys of early summer emergent fry densities and migration patterns to “improve understanding of density-dependent processes” for steelhead in both East and West Twin. Are these studies planned? If so, how will the results be applied to restoration objectives or future monitoring activities?

Two habitat monitoring approaches are in use in the study: Timber, Fish and Wildlife, and Environmental Monitoring and Assessment Program, which points to potential inefficiencies. The project mainly relies on the Timber, Fish and Wildlife habitat data. Timber, Fish and Wildlife sites monitored by the tribe cover most if not all of anadromous zone and restoration project sites; Environmental Monitoring and Assessment Program monitoring conducted by Washington Department of Fish and Wildlife does not occur at the same sites as fish sampling. Principal investigators need to determine if the Environmental Monitoring and Assessment Program monitoring is necessary. Finally, it appears that there is not adequate funding for data synthesis, which is true for other western Washington IMWs as well. Streamlining the habitat monitoring would be a good way to fund much needed synthesis work, as well as supplement fall tagging activities.

As was identified in 2015, monitoring data of various types are scattered among a rather large group of federal, state, tribal, and private organizations without a central data clearinghouse. Without some attempt to maintain a centralized database and location for archived reports, publications, and presentations there is a risk that an important component of the monitoring program could be lost if support for maintaining the data at a particular cooperating entity vanishes.

Recommendation: CONDITIONED

The monitoring panel recommends that the following language be included in the Strait of Juan de Fuca IMW project agreement:

1. Principal investigators will evaluate the necessity of including Environmental Monitoring and Assessment Program habitat data collection in the study and

shall summarize their findings in the progress report submitted by December 31, 2016.

2. A description of how data will be archived in a location that can be made accessible to interested parties in future years must be included in the December 31, 2016 progress report.

Project Effectiveness Monitoring

The monitoring panel believes that Project Effectiveness Monitoring is an important component of the SRFB Monitoring Program. The current SRFB Project Effectiveness Monitoring study was one of the first efforts to design a single monitoring program to investigate the effectiveness of different restoration and protection techniques that was directly connected to making decisions about what kind of projects to fund. It has provided useful information on the localized (reach-scale) effects of different kinds of restoration treatments, initially addressing eight different categories of restoration.

Now over a decade old, the study has matured and it is now time for a deeper evaluation of the project. The panel noted in its 2015 recommendations to the SRFB that in 2016 the panel would focus additional review on the Project Effectiveness Monitoring component. The board also asked the panel in fall of 2015 to begin working with the project scientists as soon as possible on specific aspects of the study design, primarily the approach to fish sampling, to which the panel had recommended changes in approach. The panel's budget was exhausted in the fall of 2015 and work on evaluating the project effectiveness component began in earnest in early February 2016 after the panel membership was established and contracts in place. The panel has had multiple interactions with the principal investigators since February of 2016, both in person and via conference calls and exchange of written materials.

As a result of the 2016 review process, the monitoring panel recommends major changes to the SRFB's Project Effectiveness Monitoring. The changes are based in design modification deemed necessary to address study limitations described below; the panel is convinced that the current design challenges cannot be resolved within the current framework. The key recommended elements of change can be summarized as:

1. Truncate the current SRFB Project Effectiveness Monitoring study in 2018 (i.e. 2018 would be the last year of field data collection; compilation of data and preparation of the annual report may extend into 2019). Monitoring of some

project types have ended, some are due to end soon, and some are scheduled to continue through 2025 (the current schedule is attached). After careful discussion with project leads and evaluating the statistical impacts of moving some data collection points to an earlier year, the panel selected 2018 as an optimal date at which to end the current study in order to more quickly establish an enhanced study design for the next phase of Project Effectiveness Monitoring. Project types currently projected to continue through 2025 can be incorporated into a modified design without any loss of data continuity.

2. Continue monitoring fish presence on the schedule that was included in the original study design. However, the low-flow sampling window should be tightened to a 2-month period.
3. Continue to defer all project types deferred in the 2015 evaluation (livestock exclusion, riparian restoration, and acquisition).
4. Conduct an in-depth data synthesis and interpretation of the initial phase of project effectiveness work (Phase I). This effort will be distinct from the annual report produced to summarize the 2018 field activities and thus the panel recommends that this be conducted as a stand-alone scope of work.
5. Scope a subsequent reach scale study with design modification to continue Project Effectiveness Monitoring (Phase 2). The scoping exercise should evaluate elements remaining unfinished in the Phase 1 scope of work, as well as consideration of new project types. The panel recommends that this scoping effort begin upon approval of the SRFB and continue through 2017. The monitoring panel will play a key role in shaping the Phase 2 design and will invite participation from additional subject matter experts. Chief design modifications which currently are recommended include:
 - a. Two or more years of pre-restoration treatment data, particularly for fish presence/absence.
 - b. Modifications to the timing of fish sampling.
 - c. Stratification of project sites by geography, project type, species and run-timing, and stream size. Stratification recommendations will need to be cautiously balanced with funding constraints and sample size requirements.

6. The panel will work with the Governor’s Salmon Recovery Office and the SRFB to structure project eligibility for projects to be included in the effectiveness monitoring study to ensure success within the funding process. The revised study design will require longer advance planning for project sponsors to ensure the 2-plus years of pre-project fish monitoring and will require longer project implementation than is allowed under SRFB eligibility criteria.
7. The panel will assist the Governor’s Salmon Recovery Office in developing a scope of work for Phase 2 effectiveness monitoring. The scope of work will be scripted on critical elements deemed essential to the monitoring panel for a success study, while leaving some elements of implementation and analysis to the discretion of the project team selected by the Governor’s Salmon Recovery Office to complete the work. The administrative overhead costs for the current effort seem high relative to other monitoring components funded by the SRFB and this will be reviewed when developing the scope of work for Phase 2.

The recommended approach to completing Phase 1 and initiating Phase 2 will bring the habitat assessment and summer fish snorkeling to a close and allow for post-treatment evaluation. During the next year the panel will establish a schedule for completion of the data synthesis over the life of the Phase 1 study, final Phase 1 report, and opportunities identified for publicizing the lessons learned from this decade-long effort.

Some of the issues that the panel has discussed with the current Project Effectiveness Monitoring team have included the effectiveness of fish snorkel surveys, carrying out fish surveys at comparable stream flows during the summer period, the potential value of winter sampling (not now included in the program) to the assessment of year-round restoration effectiveness, and establishing an appropriate post-treatment monitoring time frame for projects that seek to protect or restore riparian vegetation and may take a long time to produce desired results. Further consideration of these issues will be addressed as Phase 2 is scoped.

Responsiveness to 2015 Monitoring Panel Comments

The TetraTech and Natural Systems Design project team continues to implement well organized and orchestrated annual data collection and reporting. Investigators have done an excellent job summarizing completed work in annual progress reports and in meeting the monitoring objectives. The strengths of this component include consistency of staffing, methodology, and approach for collecting monitoring data. The contractors are experienced and capable of continuing to collect the monitoring data that has been

established under this program. The panel unanimously feels that the project team has done an excellent job of collecting data and reporting the results per the original study design they were given. The design modifications recommended by the panel were beyond the contractor's power to control or change.

The project leads have been very responsive to monitoring panel information requests and focused meetings to consider future direction of the study.

Study Limitations and Concerns

As noted above, the current SRFB Project Effectiveness Monitoring study was one of the first efforts to design a single monitoring program to investigate the effectiveness of different restoration and protection actions. It was an enormous leap of progress over the scatter-shot effectiveness monitoring that occurred on a project-by-project basis and did not allow for aggregation of data to support SRFB decision-making. It also was done for the same level of expense currently being used on individual Project Effectiveness Monitoring. While the original project effectiveness study furthered the body of scientific knowledge in a cost-effective manner, knowledge has advanced during the past decade. For example, other efforts to understand effectiveness of restoration have been initiated, technologies for tracking fish use and behavior have expanded, experimental designs such as the hierarchical staircase design offer different possibilities for analytical power, opportunities for meta-analyses are more common, and the scientific literature has grown. Based on the knowledge in hand, the panel has identified two chief concerns that limit the current phase of the study.

- Only 1 year of pre-project data. This may be acceptable for habitat parameters, but there is often too much variability in fish variables for this to lead to meaningful results in a reasonable amount of time.
- Inadequate stratification by:
 - Project type
 - Geography and environmental influence
 - Species assemblage
 - Life history/run timing of target species
 - Stream size

It is apparent from summary data in the 2015 report that while various restoration treatments have resulted in some habitat benefits, there have for the most part not been significant observed improvements in fish populations. Two alternative conclusions are that the restoration actions have failed to have a very significant impact on target species, or that the monitoring metrics and sampling schedule have not been up to the task of detecting meaningful changes. This shortcoming will be considered in detail as the monitoring panel develops a framework for Phase 2 of the program and identifies new metrics of success that will be tracked during the next phase. As the monitoring panel develops recommendations for Phase 2, several considerations will be taken into account, including the seasonality and mode of fish sampling. It is important that seasonal fish sampling be scheduled to better align with restoration objectives on a project-by-project basis, according to target species. For juvenile salmonids, timing of snorkel surveys would be post-emergence for ocean-type fall Chinook salmon, the summer period for stream-type Chinook, steelhead and coho. Off-channel habitats should be surveyed during the winter for floodplain reconnection projects where improving winter habitat is a restoration objective. As projects are added to the monitored portfolio, emphasis should be on adding streams with ongoing or supporting research; a completely randomized design may not be the most desirable approach.

The timing of the fish monitoring is of particular concern as the “summer” sampling has occurred from June until October. Summer sampling should be restricted to mid-July to mid-September. In response to earlier panel concerns about the timing of fish sampling, and the challenges posed by a single-season sample point, the project team suggested an additional fish monitoring point in winter or spring. Given further discussion between the panel and the project team and the panel’s recommendation to curtail the current phase of work, the panel has rejected the idea of adding an additional fish sampling point. There are some other recommendations for fish monitoring (mobile passive integrated transponder tag detection) that should be considered for the future iteration of the Project Effectiveness Monitoring, but not in the current program. If the only metric for fish response to restoration activities is juvenile abundance based on snorkel surveys, then population estimates should be validated. Otherwise, numbers of fish observed should be considered an index under a specific set of described conditions (i.e., time of year and discharge).

The 2015 annual report made broad statements about fish use as it related to restoration and lacked an in-depth discussion of results and what they signify. There was little discussion of uncertainty around the modeled relationships, and few insights provided to the reader if one year or two years with slightly different results might

swing conclusions in the opposite direction. The lack of context regarding larger population/demographic variability within the studied populations limits the value of fish use assessment under this monitoring component.

Recommendation: CONDITIONED

The monitoring panel recommends that the following language be include in the project agreement for Project Effectiveness Monitoring.

The contractor should adhere to the sampling schedule modifications recommended by the monitoring panel (attached). Specifically:

1. As a cost saving measure, annual reporting shall be streamlined for the completion of this phase of the study. The annual reports due in December of 2016 and 2017 shall focus on describing progress made in addressing monitoring panel conditions listed below. Summary and analysis of data collected in 2016-2017 shall be incorporated in the 2018 final report.
2. The contractor will prepare a plan for making all data and analyses from Phase 1 accessible upon its completion. This should be attached to the December 31, 2016 progress report.
3. The year in which each site is monitored for fish presence will occur as scoped in the original study design. In order to narrow the annual variation in stream flow over the sample period, the low-flow fish sampling window for each site shall not exceed a 2-month period.
4. Projects deferred in the 2015 evaluation (acquisition, riparian restoration, and livestock exclusion) will continue to be deferred. A plan for completion of these project categories will be developed during the re-scoping exercise for Project Effectiveness Monitoring.

Status and Trends Fish Monitoring (Fish In/Fish Out)

The Status and Trends Fish Monitoring is often referred to as Fish In/Fish Out because it measures adults as they move into freshwater and juveniles as they migrate out to the ocean. The status and trends monitoring is an essential component of the SRFB Monitoring Program. It provides data critical to understanding long term, watershed-

scale status and trends of salmon populations. Data on salmon population abundance and productivity serve as foundational information used by the IMWs and Project Effectiveness Monitoring programs, salmon recovery decisions, and to manage commercial and sport fisheries. These data are also important elements in National Oceanic and Atmospheric Administration's 5-year status review for Endangered Species Act-listed species and provide basic data needed to assess the four viable salmonid population parameters, which are used to determine listing status under the Endangered Species Act.

Although the SRFB funding comprises less than 10 percent of the overall program budget, it serves as an important component of the annual funding and is highly leveraged by other funding sources. Washington Department of Fish and Wildlife and collaborators do a good job of managing and reporting on this monitoring. The relatively small investments by the SRFB to support this kind of monitoring provide significant benefits to the region overall.

In 2015, the Washington Department of Fish and Wildlife approached the Governor's Salmon Recovery Office and the panel about adjusting the reporting schedule to allow for more in-depth analysis of all four sites funded by the SRFB. As a result, the current review is focused on the agency's Chum Salmon monitoring on the Duckabush River. Reports for the other three sites funded by the SRFB will be submitted to the monitoring panel during the next six months; review of these efforts will be addressed in the panel's review cycle beginning in January 2017. The panel finds this new approach to reporting on SRFB expenditure at these sites terrifically useful and greatly appreciates the initiative taken by Joe Anderson and the Washington Department of Fish and Wildlife team engaged in Fish In/Fish Out monitoring to propose this approach. The panel will continue to work with the department to glean the most useful information informing salmon recovery monitoring relevant for the SRFB.

The Duckabush Fish In/Fish Out team is doing excellent work and this is one of the few studies that is attempting to contrast the life histories and survival of summer and fall Chum Salmon. The study appears to be well-designed and the focused report from this year summarizing the Duckabush screw trap data was extremely useful. It is gratifying to see that the summer chum stock in the Duckabush is meeting conservation goals. The report presented exactly the type of analysis that the panel is interested in seeing from the Fish In/Fish Out program and the analysis demonstrates the powerful nature of cumulative annual data to tell important ecological stories that are relevant to management concerns. Without studies such as this one, which can distinguish between

the two stocks and also separate wild from hatchery fish, it is easy to see how incorrect management assumptions could be made. The panel is pleased to see that trap efficiency estimates are conducted periodically (every few days) throughout the season - many fry/smolt trapping programs fail due to efficiency tests not conducted frequently enough or throughout the season.

In summary, this project is an essential part of the SRFB's monitoring program and should continue to be supported. Washington Department of Fish and Wildlife staff provides thoughtful and timely responses to the monitoring panel's clarifying questions – a positive indication of a well-functioning program. Monitoring efforts should be reviewed and field protocols should be consistent with those conducted for Project Effectiveness Monitoring, where possible. It also will provide the baseline data should a large-scale restoration occur in the estuary or elsewhere in basin. If additional monitoring funds are available, the panel supports expansion of Status and Trends Fish Monitoring.

Recommendation: CLEAR

The Status and Trends Fish Monitoring conducted by Washington Department of Fish and Wildlife should be continued. If additional monitoring funds are available, the panel supports expansion of Status and Trends Fish Monitoring.

The panel offers several suggestions for enhancing the approach of this monitoring component as noted in the comment form to principal investigators. Most significantly among these:

1. The panel is pleased to see the level of analysis and reporting for this site and is looking forward to reports for the other three sites. However, some level of annual report for the overarching program still is necessary as an introduction to the site-specific analyses/reports. The annual Fish In/Fish Out overview should be submitted by December 31, 2016. This need not be elaborate; a 3- to 5-page document will suffice. In the overview, the project lead should address information relevant to the overall monitoring effort, such as:
 - a. How the SRFB-funded sites fits within the larger Washington Department of Fish and Wildlife Status and Trends Fish Monitoring.
 - b. Distribution of effort/budget across the four sites funded by SRFB.

- c. A description of project objectives for the coming year (e.g., which species will be targeted for analysis at each site).
- d. Describe progress related to any comments made by the monitoring panel in the previous year. Suggestions made in 2015 still need to be addressed, specific to data backlogs and quality assurance and control (i.e., each region had their own quality assurance and control procedures and some weren't very robust).

REFERENCES

- Anderson, J., K. Krueger, W. Ehinger, S. Heerhartz, C. Kinsel, T. Quinn, R. Bilby, and G. Volkhardt. Hood Canal Intensively Monitored Watershed Study Plan. Submitted to: Salmon Recovery Funding Board Monitoring Panel. June 30, 2015.
- Bennett, S., Bouwes, N., and R. Camp. 2015. Asotin Creek Intensively Monitored Watershed. Updated Study Plan. Prepared for: Snake River Salmon Recovery Board, Dayton, WA, and Recreation and Conservation Office, Olympia, WA. July 10, 2015.
- Bouwes, N., *et al.* 2016. Ecosystem experiment reveals benefits of natural and simulated beaver dams to a threatened population of steelhead (*Oncorhynchus mykiss*). *Nature. Science Report* 6: 28581. doi:10.1038/srep28581.
- Crawford, B. 2015. The 2004-2014 Monitoring Program. Washington Salmon Recovery Funding Board. February 25, 2015.
- Greene, C. E. Beamer, and J. Anderson. 2015. Study Plan and Summary of Results for the Skagit River Estuary Intensively Monitored Watershed Project. February, 2015.
- Roni, P., M. McHenry, T. Bennett, J. Hall, and W. Ehinger. 2015. Study Plan for the Strait of Juan de Fuca Intensively Monitored Watershed. Prepared for the Salmon Recovery Funding Board. June, 2015.
- Roni, P., G. Pess, S. T. Beechie and S. Morley. 2010. Estimating changes in coho salmon and steelhead abundance from watershed restoration: how much restoration is needed to measurably increase smolt production? *North American Journal of Fisheries Management* 30:1469–1484.
- Salmon Recovery Funding Board. 2014. SRFB Strategic Plan. Updated March 20, 2014. Available online at: www.rco.wa.gov/documents/strategy/srfb-strategic-plan.pdf
- Stillwater Sciences 2013. Monitoring Investment Strategy for the Salmon Recovery Funding Board. Final Report. December 2013. Available online at: www.rco.wa.gov/documents/monitoring/SRFB_MonitoringStrategyFinal.pdf
- Tarzwel, C. M. 1934. Stream improvement methods. Division of Scientific Inquiry, Bureau of Fisheries, Stream Improvement Bulletin R-4, Ogden, UT; Hunter, C. J.

1991. Better trout habitat: A guide to stream restoration and management. Island Press, Washington D.C.; Hunt, R. L. 1993. Trout stream therapy. University of Wisconsin Press, Madison, WI.

TetraTech EC. 2015. Project Effectiveness Monitoring Program. 2014 Annual Report.

Zimmerman, M., K. Krueger, W. Ehinger, B. Bilby, J. Walter, and T. Quinn. 2015. Intensively Monitored Watersheds Program: Lower Columbia River Study Plan Update, 2015. Prepared for the Washington Salmon Recovery Funding Board

ATTACHMENT A: PROJECT EFFECTIVENESS SAMPLING SCHEDULE

NOTE: Dark grey indicates that sampling was discontinued because monitoring showed success for those categories

Project #	Project Name	Listings	Stream	Category	Target Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
02-1444	Little Skookum Valley, Phase 2 Riparian	PS Threatened	Little Skookum Creek	MC-2 Instream	Coho	Year 0	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed			
02-1463	Salmon Creek	Coast No Listing	Salmon Creek	MC-2 Instream	Coho	Year 0	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed				
02-1515	Upper Trout Creek Restoration	Lower Col Threatened	Trout Creek	MC-2 Instream	Steelhead	Year 0	Deferred	2nd year 0	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	
02-1561	Edgewater Park Off-Channel Restoration	PS Threatened	Skagit River	MC-2 Instream	Chinook	Year 0	Year 1	none	Year 3	None	Year 5	None	None	None	none	Year 10	Completed				
04-1209	Chico Creek Instream Habitat Restoration	PS Threatened	Chico Creek	MC-2 Instream	Chum		Year 0	2nd year 0	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	
04-1338	Lower Newaukum Restoration	PS Threatened	Newaukum Creek	MC-2 Instream	Chinook		1/	1/	Deferred	Years 0 & 1 ^{1/}	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed	
04-1448	PUD Bar Habitat Enhance.	Lower Col Threatened	Grays River	MC-2 Instream	Chum		Year 0	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed			
04-1575	Upper Washougal River LWD Placement	Lower Col Threatened	Washougal River	MC-2 Instream	Steelhead		Year 0	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed			
04-1589	Dungeness River Railroad Bridge Restoration	PS Threatened	Dungeness River	MC-2 Instream	Chinook		Year 0	2nd year 0	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed	
04-1660	Cedar Rapids Floodplain	PS Threatened	Cedar River	MC-2 Instream	Chinook		Year 0	2nd year 0	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	
05-1533	Doty Edwards Cedar Creek	Lower Col Threatened	Cedar Creek	MC-2 Instream	Chinook			Year 0	Deferred	Year 1	None	Year 3	none	Year 5	None	None	None	None	Year 10	Completed	

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Project #	Project Name	Listings	Stream	Category	Target Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
07-1803	Skookum Reach Restoration	PS Threatened	SF Nooksack River	MC-2 Instream	Chinook					Year 0	Deferred	Year 1	none	Year 3	None	Year 5	None	None	None	Year 9	
11-1315	Eagle Island		NF Lewis River	MC-2 Instream	Fall Chinook, Steelhead, and Coho										Year 0	None	Year 1	None	Year 3	Year 4	
11-1354	Lower Dosewallips		Doeswallips River	MC-2 Instream	Summer Chum										Year 0	None	Year 0*	None ^{2/}	Year 1	Year 2	
12-1334	Upper Elochoman		Elochoman River	MC-2 Instream	Chinook, Coho										Year 0	None	None	None ^{2/}	Year 1	Year 2	
12-1657	George Creek		George Creek	MC-2 Instream	Steelhead										Year 0	Year 1	None	Year 3	None	Year 5	
SF-F3 P2BR	South Fork Asotin Creek Lower 1		Asotin Creek	MC-2 Instream	Steelhead									Year 0	Year 1	None	Year 3	None	Year 5	None	
SF-F3 P3BR	South Fork Asotin Creek Lower 2		Asotin Creek	MC-2 Instream	Steelhead									Year 0	Year 1	None	Year 3	None	Year 5	None	
SF-F4 P1	South Fork Asotin Creek Upper 1		Asotin Creek	MC-2 Instream	Steelhead									Year 0	Year 1	None	Year 3	None	Year 5	None	
SF-F4 P2	South Fork Asotin Creek Upper 2		Asotin Creek	MC-2 Instream	Steelhead									Year 0	Year 1	None	Year 3	None	Year 5	None	
Tucannon PA 3	Tucannon PA 3		Tucannon River	MC-2 Instream	Summer Steelhead, Spring Chinook										Year 0	Year 1	Year 1*	Year 3	None	Year 5	
Tucannon PA 26	Tucannon PA 26		Tucannon River	MC-2 Instream	Summer Steelhead, Spring Chinook										Year 0	Year 1	None	Year 3	None	Year 5	
Tucannon PA 14	Tucannon PA 14		Tucannon River	MC-2 Instream	Summer Steelhead, Spring Chinook										Year 0	Year 1	Year 1*	Year 3	None	Year 5	

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AEM	Eightmile Ranch		Chewuch River	MC-2 Instream	Spring Chinook, Steelhead								Year 0	Year 1	None	Year 3	none	Discontinued			
AEM	RM 10 Mainstem		Chewuch River	MC-2 Instream	Spring Chinook, Steelhead								Year 0	Year 1	None	Year 3	none	Discontinued			
02-1625	SF Skagit Levee Setback Acq & Rest.	PS Threatened	Skagit River	MC-5 Channel	Chinook	Year 0	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed				
04-1596	Lower Tolt River Floodplain Reconnect.	PS Threatened	Tolt River	MC-5 Channel	Chinook		Year 0	2nd year 0	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	
05-1398	Fenster levee setback	PS Threatened	Green River	MC-5 Channel	Chinook			Year 0	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	
05-1521	Raging River Preston Reach	PS Threatened	Raging River	MC-5 Channel	Chinook			Year 0	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	Completed		
05-1466	Lower Boise Creek Construction	PS Threatened	Boise Creek	MC-5 Channel	Chinook			Year 0	Deferred	Deferred	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	Year 8	
06-2223	Greenwater R ELJ & Road Decommis.	PS Threatened	Greenwater River	MC-5 Channel	Chinook				Year 0	Deferred	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	Year 8	
07-2020	Reecer Creek Floodplain Restoration	Mid Col Threatened	Reecer Creek	MC-5-Channel	Steelhead					Year 0	Deferred	Deferred	Year 1	None	Year 3	None	Year 5	None	None	Year 8	
06-2250	Chinook Bend Levee Removal	PS Threatened	Snoqualmie River	MC-5 Channel	Chinook				Year 0	Deferred	Year 1	None	Year 3	None	Year 5	None	None	None	None	Year 10	
02-1561	Edgewater Park Off-Channel Restoration	PS Threatened	Skagit River	MC-6 Connectivity	Chinook	Year 0	Year 1	Year 2	None	None	Year 5	None	None	None	None	Year 10	Completed				
04-1461	Dryden Fish Enhance.	U Col Endangered	Wenatchee River	MC-6 Connectivity	Chinook		Year 0	Deferred	Year 1	Year 2	none	None	Year 5	None	None	None	None	Year 10	Completed		

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04-1573	Lower Washougal Restoration Phase 1 Site 1	Lower Col Threatened	Washougal River	MC-6 Connectivity	Chinook		Year 0	Deferred	Year 1	Year 2	None	None	Year 5	None	None	None	None	Year 10	Completed		
05-1546	Gagnon CMZ Off Channel	U Col Endangered	Wenatchee River	MC-6 Connectivity	Chinook			Year 0	Year 1	Year 2	None	None	Year 5	None	None	None	None	Year 10	Completed		
06-2277	Upper Klickitat R. Enhance. Phase 2	Mid Col Threatened	Klickitat River	MC-6 Connectivity	Steelhead				Year 0	Deferred	Deferred	Deferred	Year 1	Year 2	None	None	Year 5	None	None	Year 8	
04-1563	Germany Creek Conservation Restoration	Lower Col Threatened	Germany Creek	MC-6 Connectivity	Chum					Year 0	Year 1	Year 2	None	None	Year 5	None	None	None	None	Year 10	
06-2190	Riverview Park Restoration	PS Threatened	Green/Duwamish	MC-6 Connectivity	Chinook				Year 0	Year 0	Deferred	Deferred	Deferred	Deferred	Year 1	Year 2	None	None	Year 5	None	
06-2239	Fender Mill Floodplain Restoration Phase 1	U Col Endangered	Methow River	MC-6 Connectivity	Chinook				Year 0	None	Deferred	Year 1	Year 2	None	None	Year 5	None	None	None	Year 9	
07-1691	Lockwood Creek Phase 3		Lockwood and Riley Creek	MC-6 Connectivity	Coho					Year 0	Year 1	Year 2	None	None	Year 5	None	None	None	None	Year 10	
10-1765	Eschbach Park		Naches River	MC-5/6 Floodplain	Spring Chinook, Steelhead, Coho, Bull Trout, Lamprey									Channel Creation	Year 0	Year 1	None	Year 3	None	Year 5	
11-1354	Lower Dosewallips		Dosewallips River	MC-5/6 Floodplain	Summer Chum										Year 0	None	Year 0*	None ^{2/}	Year 1	Year 2	
12-1307	Billys Pond		Yakima River	MC-5/6 Floodplain	Coho, Steelhead										Year 0	Year 1	None	Year 3	None	Year 5	
12-1438	Nason Creek		Nason Creek	MC-5/6 Floodplain	Spring Chinook, Steelhead									Channel Creation	Year 0	None	Year 1	None	Year 3	Year 4	

AEM	Meacham Creek 2.4-5.0		Meacham Creek	MC-5/6 Floodplain	Spring Chinook															Year 3	Year 2	Year 1	Year 1	None	Year 3	
AEM	Mill Creek		Mill Creek	MC-5/6 Floodplain	Steelhead															Year 2	Year 1	Year 1	None	Year 3	Year 4	
AEM	Pond Series 2		Yankee Fork	MC-5/6 Floodplain	Steelhead															Year 1	Year 1	Year 2	Year 3	None	Year 5	
AEM	Preachers Cove		Yankee Fork	MC-5/6 Floodplain	Steelhead															Year 2	Year 1	Year 1	Year 2	Year 3	Year 4	

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12-1657	George Creek		George Creek	MC-5/6 Floodplain	Steelhead									Channel Remeander	Year 0	Year 1	None	Year 3	None	Year 5	
Tucannon PA 26	Tucannon PA 26		Tucannon River	MC-5/6 Floodplain	Summer Steelhead, Spring Chinook									Levee Setback	Year 0	Year 1	None	Year 3	None	Year 5	
AEM	Boat Launch		Wenatchee River	MC-5/6 Floodplain	Spring Chinook								Year 0	Year 1	Year 2	None	None	Year 5	None	Year 7	
AEM	Pioneer Side Channel		Wenatchee River	MC-5/6 Floodplain	Spring Chinook									Year 0	Year 1	Year 2	None	None	Year 5	None	
AEM	Chewuch Rivermile 10 Side Channel		Chewuch River	MC-5/6 Floodplain	Spring Chinook								Year 0	Year 1	Year 2	None	None	Year 5	None	Year 7	
AEM	Tucannon PA 24		Tucannon River	MC-5/6 Floodplain	Summer Steelhead, Spring Chinook											Year 2	Year -1	Year 1	None	Year 3	