Final

Updated Proposed Action

for the

FCRPS Biological Opinion Remand

U.S. Army Corps of Engineers
Bureau of Reclamation
Bonneville Power Administration

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APPENDICES

I. Introduction and Overview

In June 2003, the Federal District Court reviewed the *NOAA Fisheries 2000 Federal Columbia River Power System* (FCRPS) *Biological Opinion* (2000 BiOp) in *National Wildlife Federation vs. National Marine Fisheries Service*. The court found NOAA Fisheries improperly relied on actions that had not undergone Endangered Species Act (ESA) consultation or were otherwise not "reasonably certain to occur." The court ***remanded*** the 2000 BiOp to NOAA Fisheries for revisions. In the meantime, the court left the 2000 BiOp in place, and the US Army Corps of Engineers (Corps), Bureau of Reclamation (Reclamation) and the Bonneville Power Administration (BPA), collectively known as the Action Agencies, continue their implementation efforts under the 2000 BiOp.

To lay the groundwork for the new BiOp in response to the judicial remand, NOAA Fisheries has revised and updated its jeopardy analysis for listed salmon and steelhead. Based on this new information, the Action Agencies prepared this Updated Proposed Action (UPA) for NOAA Fisheries' consideration. To a large extent, this UPA continues the implementation of the actions contained in the 2000 BiOp.[1] It continues to focus on actions that will contribute toward meeting the performance standards described in the 2000 BiOp, but also includes specific actions designed to address the new jeopardy analysis and remand directions from the court. The Action Agencies have chosen to address these actions as a single proposed action referred to as the Updated Proposed Action, or UPA.

Adaptive Management and the 2000 BiOp

The 2000 BiOp included a list of Reasonable and Prudent Alternative (RPA) actions to avoid jeopardy to listed salmon and steelhead. However, it also relied on a performance-based approach, including hydropower survival and population performance standards to be achieved over a 10-year period. As new information became available or experience was gained, the BiOp contemplated that RPA actions would change through adaptive management to ensure progress toward performance standards (2000 FCRPS BiOp, Section 9.1.4).

For the past 3 years, the Action Agencies have documented and made adjustments to the initial RPA actions in annual implementation plans and progress reports, and these changes have been reviewed by NOAA Fisheries in their annual findings letters.

The Corps and Reclamation are authorized by Congress to operate and maintain the Federal Columbia River Power System (FCRPS) projects addressed in this UPA to provide for multiple purposes, including hydropower generation, flood control, irrigation, navigation, fish, wildlife, water quality, municipal and industrial water, and recreation. BPA is responsible for marketing and transmission of power generated from these projects. The actions described in the UPA are discretionary actions that are consistent with providing for the authorized multiple project purposes.

Since the 2000 BiOp was issued, the region has gathered additional scientific information about the survival benefits affiliated with certain types of actions. For example, NOAA has identified factors that limit evolutionarily significant units (ESU) survival in the tributaries and the estuary. The 2000 BiOp and the associated Reasonable and Prudent Alternative (RPA) did not identify actions that were needed to avoid jeopardy for each of the ESUs. NOAA's updated analysis now includes ESU-specific survival needs. In consideration of these analyses, this UPA presents a customized approach to the life-stage needs of each ESU.

[1] See the Action Agencies' October 6, 2004 *Crosswalk of 2000 NOAA FCRPS BiOp RPA Actions and the 8/30/04 Draft UPA*, located at www.salmonrecovery.gov.

This UPA continues most of the uncompleted and on-going actions in the 2000 BiOp. It refines the actions of the RPA into a new set of federal actions based on adaptive management principles. As in the 2000 BiOp, this UPA includes processes to assess and report progress and implementation planning. This UPA was provided in draft for review by NOAA on August 30, 2004 and for public review on September 8, 2004. A subsequent draft was also provided to NOAA on October 26, 2004. This UPA has been refined in response to comments received on NOAA's draft biological opinion. It is also intended to be consistent with applicable federal and state laws including but not limited to the Federal Water Pollution Control Act (CWA), National Environmental Policy Act (NEPA), Oil Pollution Prevention Act of 1990, the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), agencies' authorizing legislation, and state water law.

This document includes the following sections and appendices:

Section 1 – Introduction and Overview: A general description of the purpose of this document, including summaries of the UPA and discretionary conservation actions.

Section 2 – Adaptive Management Framework: A description of the framework for adaptive management, including performance standards, implementation planning, and progress reporting.

Section 3 – UPA and Conservation Actions: A description of our general approach, the biological rationale for our strategies and substrategies, the specific actions to be taken for each ESU and our performance goals and discretionary conservation actions. The conservation actions would be taken beyond the UPA pursuant to the Northwest Power Act and other authorities, which, while not needed to avoid jeopardy under ESA, should provide additional benefits to advance the conservation and recovery of listed fish.

Section 4 – Research, Monitoring and Evaluation (RM&E): Describes studies of action effectiveness and critical uncertainties designed to assess compliance, quality control, and allow adaptive management.

The Survival "Gap"
Throughout this UPA, the Action Agencies refer to the "gap" or the survival gap. These terms are defined here to mean the estimated difference in survival between the 2000 BiOp hydrosystem operations and the NOAA Fisheries designated reference operation.

These gaps were initially presented in NOAA's draft BiOp and will be revised or updated in the Final BiOp.

Section 5 – Conclusion: Provides the Action Agencies' conclusion that the UPA is not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat.

A. Summary of the Updated Proposed Action

Over the years the Action Agencies have built up a comprehensive program of diverse actions to help improve the survival of salmon and steelhead. Since we began implementing the actions describe in the 2000 BiOp, we have expanded and further refined our conservation programs to focus on ESA-listed salmon and steelhead. The Action Agencies propose this UPA for the duration of the biological opinion issued at the end of this consultation. In the event of reinitiation of consultation, the Action Agencies will consider whether to continue maintain, fund, or otherwise retain jurisdiction or discretionary control over the actions described in this UPA. Following is a general summary of important actions included in the UPA.

Continue adult fish passage. The Action Agencies have already completed a number of reconfiguration projects at federal dams to improve fish passage and survival based on actions identified in the 2000

BiOp. As a result, the dams have met or exceeded the adult fish survival performance standards under the 2000 BiOp, and this performance will be maintained.

Improve juvenile fish passage. The UPA reflects updated performance standards for juvenile fish survival based on today's best estimates of what is possible with the dams in place. These performance standards are much higher than dam survivals twenty years ago, when survivals were more than 30% lower than they are today. The Action Agencies will continue to implement specific capital improvements, providing funding and implementation priority to dams with the lowest juvenile passage survival rates. In this UPA, the Action Agencies make new commitments to pursue removable spillway weirs (RSWs) or similar surface bypass devices where feasible. These configuration modifications, combined with operational spill levels based on biological performance, will result in improved juvenile survival at federal dams compared with existing conditions for all ESUs. For example, initial tests at Lower Granite dam show enhanced survival with lower spill levels and RSW passage.

Continue and enhance spill for juvenile fish passage: The UPA continues the basic spring and summer spill program from the 2000 BiOp. As before, changes in spill levels at individual dams can be adjusted based on site-specific performance evaluations. More spill volume does not necessarily mean better fish survival at every dam, and spill amounts in the UPA are driven by performance not volume. Installation of RSWs and other forms of surface bypass can act as spill enhancements, which can both improve survival and lower costs by passing fish with less water.

Continue reservoir operations and river flows to benefit migrating fish. The Action Agencies will continue to operate federal storage reservoirs so these reservoirs can supplement streamflows and provide spill at mainstem dams to benefit juvenile fish migration consistent with current implementation of the 2000 BiOp as modified through implementation plans. This proposed hydrosystem operation includes both discretionary and nondiscretionary actions.

Modify fish transportation to improve juvenile survival. The Action Agencies will continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental and McNary dams. Initiation of transport has been delayed until April 20th due to recent data indicating that transportation in the early part of April is not as beneficial. As a result, the UPA adds spill and reduces fish transportation between April 3 and 20. Although Snake River fall Chinook transportation is still provided in the summer based on the best current science, in 2007 or 2008, after installation of spillway weirs, we plan to study spill vs. transport survival for summer migrating fish. The transportation program will continue to be adaptively managed towards improving the survival of affected ESUs.

Additional Hydrosystem Actions to Consider

- *Spill management* for biological results is something we would like to explore collaboratively with states and tribes in the future. Can we better use spill to enhance biological benefits? How should biological criteria/performance be applied to the operation of RSWs?
- *Reduced summer spill* with offsets is *not* part of this UPA. However, the Corps or BPA may pursue this option in the future, if appropriate, through the exercise of the annual performance measure/adaptive management approach outline in Section II or through a future amendment to the UPA. Summer spill modifications will be considered only if they achieve equivalent or better biological performance for listed fish.
- *Mainstem Amendment actions* adopted by the Northwest Power and Conservation Planning Council (Council) have not been fully incorporated into this UPA. However, the Action Agencies remain committed to working with the Council, the states and tribes, and other regional interests to assess how the Mainstem Amendments might be reflected in our future hydrosystem operations, consistent with our ESA and Northwest Power Act responsibilities.

Expanded predator control to manage impacts to juvenile fish. The Action Agencies propose to expand efforts to reduce consumption of juvenile salmon by birds and other fish. Caspian tern management actions could be implemented as early as 2005 (pending completion of environmental review and approval), with resulting juvenile survival improvements as early as 2006. We will increase incentives above the base Northern Pikeminnow Management Program (NPMP) and deliver immediate juvenile survival improvements for listed ESUs. The Action Agencies will continue to develop our understanding of the effect of predation on migrating juvenile salmonids. This will enable us to enhance existing predator management programs as well as develop and implement additional predator management actions in order to reduce levels of predation on juvenile salmonids.

Improve tributary spawning and rearing habitat. As we have under the 2000 BiOp, Reclamation and BPA will continue to improve tributary fish habitat by **removing passage barriers** and performing other channel improvements to improve the access to and condition of spawning and rearing areas; **screening diversions** to prevent fish entrainment; **securing instream flows** to improve tributary migration and spawning and rearing flows, and to help maintain water quality; and **protecting and enhancing** the ecological functions of riparian areas to support stream bank and channel integrity, decrease water temperatures, and increase nutrient sources. Based on the NOAA's revised jeopardy analysis, we propose to implement tributary habitat actions and conservation measures for Snake River spring/summer chinook and steelhead, Upper Columbia River spring Chinook and steelhead, and mid-Columbia River steelhead. We provide specific commitments in the form of three- and six-year targets for each of those ESUs.

Improve estuary habitat. The Corps and BPA will continue to implement projects to protect and enhance habitat along and adjacent to the mainstem Columbia River below Bonneville Dam and tidal wetlands. However, as in the case of tributary habitat, we are adding a greater focus to these efforts, and propose to implement actions that NOAA agrees will provide survival improvements for listed ESUs.

Implement hatchery actions. BPA will continue to fund safety-net programs for the Snake River Sockeye, Snake River spring/summer Chinook, Mid-Columbia steelhead, Lower Columbia River steelhead, and Columbia River chum ESUs as long as NOAA Fisheries considers these programs to effectively contribute to reducing the risk of extinction. We will improve the adult trap at Lower Granite Dam to benefit the Snake River fall Chinook ESU and enhance sockeye smolt production in conjunction with the current safety-net program to benefit the Snake River sockeye ESU. BPA will also continue to fund the Safety Net Artificial Propagation Program (SNAPP) planning process identified in the 2000 FCRPS BiOp. If necessary, we will develop safety-net contingency plans for populations identified by SNAPP as being at high risk of extinction. If identified as necessary, effective, and feasible through the SNAPP process, we would intervene with artificial production for severely depressed and declining populations.

Pursue harvest opportunities. The Action Agencies will continue to pursue harvest improvement opportunities as discretionary conservation actions. We will pursue opportunities to reduce harvest impacts on listed species and assess and inventory additional terminal fishery locations above Bonneville Dam that provide potential for reducing ESA impacts from mainstem fisheries.

Continue to support regional RM&E. The Action Agencies will continue to invest in studies to help improve our understanding of how various actions affect fish survival and to fine-tune future actions and better measure their results. Many of the studies are on the cutting-edge of scientific inquiry and will require multiple years of investigation to provide results.

Follow through on actions taken under the 2000 FCRPS Biological Opinion. The Action Agencies have been implementing the 2000 BiOp for the past four years. Each year the Action Agencies have

submitted to NOAA Fisheries and made publicly available a comprehensive progress report on implementation progress and accomplishments. Many of the actions taken since 2000 continue to accrue biological benefits to ESA-listed species and must be considered in evaluating the survival benefits anticipated from the UPA. The annual progress reports and the comprehensive *2003 Check-In Report* detailing programmatic compliance with the 2000 BiOp are incorporated by reference in this UPA. Additional detail is also included in Appendix C.

B. Summary of Updated Proposed Actions by ESU

Our UPA includes specific commitments for ESUs affected by FCRPS operations. **Figure 1** generally represents the actions we propose and the level of improvements that we anticipate would occur for

ESU	NOAA draft BiOp Relative Survival Gap (%) 2004	Hydrosystem Improvements		Predator Control		Habitat Improvements		Hatcheries
		Config	*Operations*	Avian	Fish	Tributary	Estuary	
Snake River spring/summer Chinook	1.5	**L**	**VL**	**M**	**L**	**L**	**VL - L**	**L**
Snake River fall Chinook	12.7	**L**	**VL**	**M**	**L**	N/A	**M**	**M**
Snake River sockeye	N/A	N/A	**VL**	**M**	**L**	N/A	N/A	**M**
Snake River steelhead	0.2	**L**	**VL**	**M**	**L**	**VL - L**	**VL - L**	N/A
Upper Columbia River spring Chinook	6.6	**L**	**VL**	**M**	**L**	**M**	**VL - L**	N/A
Upper Columbia River steelhead	8.6	**L**	**VL**	**M**	**L**	**M**	**VL - L**	N/A
Mid-Columbia River steelhead	0.0 - 8.8	**L**	**VL**	**M**	**L**	**L**	**VL - L**	**L**
Lower Columbia River Chinook	0.4 - 1.2	**VL**	**VL**	**M**	**L**	N/A	**L - M**	N/A
Columbia River chum	0 -1.4	**VL**	**VL**	**VL**	**L**	N/A	**L - M**	**L**
Lower Columbia River steelhead	0 - 0.3	**VL**	**VL**	**M**	**L**	N/A	**L - M**	**L**
Lower Columbia River coho	0	**VL**	**VL**	**M**	**L**	N/A	**L - M**	N/A
Upper Willamette River Chinook	N/A	N/A	**VL**	**M**	**L**	N/A	N/A	N/A
Upper Willamette River steelhead	N/A	N/A	**VL**	**M**	**L**	N/A	N/A	N/A

Legend
Very low (VL): neutral or ancillary survival improvements
Low (L): < 2% survival improvements
Medium (M): = 2% - 24% survival improvements
High (H): = 25% - 100% survival improvements

specific ESUs as we implement those actions.

Figure 1 ESU improvements anticipated by Action Agencies from UPA implementation

C. Conservation Measures

Reclamation is proposing two conservation measures that were both initiated under the 2000 BiOp: (1) for Snake River spring/summer Chinook and Snake River steelhead to continue habitat improvement programs in the Upper Salmon, Lemhi, and Little Salmon subbasins and (2) for Mid-Columbia steelhead in the North Fork John Day, Middle Fork John Day, and Upper John Day subbasins. BPA is proposing a conservation measure to improve tributary habitat conditions in the Okanogan subbasin. As described on p. 4-19 of the *Endangered Species Consultation Handbook*, "conservation measures represent actions … to further the recovery of species under review. … The beneficial effects of the conservation measures are taken into consideration for both jeopardy and incidental take analyses." The scope of Reclamation's conservation measures is presented for the Snake River spring/summer Chinook, Snake River steelhead and Mid-Columbia steelhead ESUs. The scope of BPA's conservation measure is presented for upper Columbia River steelhead.

D. Additional Conservation Actions Contributing to Fish Recovery

In addition to actions specified in this UPA, each Action Agency implements a significant number of actions under their existing authorities that contribute to the conservation and future recovery of listed species. These actions are not part of the UPA and should not be considered in NOAA's jeopardy analysis. They are referenced herein merely to provide context for the actions proposed to avoid jeopardy and adverse modification of critical habitat to address comments regarding federal recovery expectations. Where specific conservation actions are known to complement actions proposed to avoid jeopardy, they are described in some detail in the pertinent section of the UPA.

BPA also implements an extensive Fish and Wildlife Program authorized by the Northwest Power Act's direction to protect mitigate and enhance fish and wildlife affected by the construction and operation of the FCRPS. This program is guided by the Council's Fish and Wildlife Program. As reflected in each implementation plan and progress report produced under the 2000 BiOp, many of the Fish and Wildlife Program actions benefit ESA listed salmon and steelhead while also encompassing the broader set of species affected by the FCRPS. Prior to implementation, BPA will ensure that any actions affecting ESA listed species receive appropriate section 7 ESA coverage.

E. Subbasin Planning and Assessment

Subbasin planning and assessment remains an important component of the Action Agencies' implementation strategy for actions taken to avoid jeopardy as well as for those taken to support recovery of ESA-listed species.

Beginning in 2002, BPA entered into contracts with the Council to develop subbasin plans for the entire Columbia River Basin. Under the contracts, state subbasin planning coordinators were designated in Idaho, Montana, Oregon and Washington. The contract also provides for a subbasin planning template approved by NOAA Fisheries, a regional coordination board, and subbasin work plans. Draft subbasin plans were submitted to the Council in May 2004 and are undergoing independent scientific review as well as NOAA, U.S. Fish and Wildlife Service, BPA, regional state and tribal fish and wildlife co-manager, and public review. Following necessary refinements to the draft subbasin plans, the Council anticipates adopting plans that meet the standards they have set for adequacy into the Fish and Wildlife Program.

The Action Agencies believe that the guidance given by NOAA on the limiting factors affecting ESUs that are the subject of the new BiOp are consistent with the subbasin assessments that are the foundation for subbasin plans as well as the NOAA analyses for recovery planning. The Action Agencies anticipate utilizing the adopted subbasin plans that form the basis for NOAA-approved local recovery plans in selecting specific actions to implement the UPA.

F. Coordination

The actions described in this document serve a number of purposes. They explicitly address the Action Agencies' implementation of their obligations for listed salmon and steelhead under the ESA. Agencies will also be implementing some of these actions pursuant to their obligations under the Northwest Power Act. Regional planning and coordination with the Council (including independent scientific review), tribes, state and federal fish and wildlife agencies, and other regional parties are an integral part of the implementation.

The Action Agencies will continue to coordinate FCRPS operations and facility improvements through the NOAA Fisheries Regional Forum. In 1995, NOAA Fisheries established the Regional Forum with a goal of ensuring the broadest possible technical and policy input in planning, funding, and implementing decisions regarding the operation and configuration of the FCRPS. The Regional Forum currently consists of an Implementation Team (IT) and three technical teams – the Technical Management Team (TMT), the System Configuration Team (SCT) and the Water Quality Team (WQT). The Regional Forum also has access to an Independent Scientific Advisory Board (ISAB) co-sponsored by NOAA Fisheries and the Council.

II. Adaptive Management Framework

The Action Agencies will implement this UPA based on performance, accountability for results, and adaptive management. We will use the best available scientific information to identify and carry out actions that are expected to provide immediate and long-term benefits to ESA-listed fish. We will use implementation planning and progress reporting to inform and signal appropriate adaptations or adjustments to our actions.

Our adaptive management framework includes the following:

- **Goals** that summarize what we want to accomplish to meet our ESA obligations. We will coordinate with the broader recovery efforts in the Columbia Basin.
- **Strategies** that explain the underlying biological rationale for our actions and performance measures.
- **Priorities and programmatic level performance targets** specify implementation actions for the next several years of implementation. We may modify and adjust these over time as needed to achieve overall performance standards and to provide for cost-effective implementation.
- **Biological Performance standards** that provide overall measures of success on a multi-year basis based on adult fish abundance and trends, and adult and juvenile fish survival through the hydrosystem. These may vary depending on environmental and water conditions, ocean survival conditions, harvest, and other factors outside the control of the FCRPS.

Essential to the success of an adaptive management approach is the ability to validate the effectiveness of actions taken and to modify actions based on new information. The Action Agencies are committed to this process and are undertaking a comprehensive monitoring program to determine the effectiveness of actions taken to avoid jeopardy to listed species. Data derived from this extensive monitoring and research program will be made publicly available in coordination with regional database efforts.

A. Planning and Reporting

1. Implementation Planning and Action Agency Roles and Responsibilities

The Action Agencies will prepare ***implementation plans*** to document our specific strategies, priorities, actions, measurable targets, and timetables. In these plans, the Action Agencies will identify ESU-specific targets and actions. We will address both the actions that are essential under this UPA and the conservation actions and measures that are not a requirement for the avoidance of jeopardy but which aid in the recovery of listed species. The Action Agencies will maintain a ***BiOp database*** to provide project and action level detail for planning and reporting purposes. This approach will be efficient and provide the most up-to-date information about the status of actions and projects being implemented.

Our implementation plans will identify responsibilities specific to the Action Agencies and will serve to coordinate our efforts with other appropriate regional processes. Those efforts would typically include coordination due to a statutory obligation for the Federal government (BPA/Council), voluntary coordination among Federal agencies (Federal Caucus), and coordination required by the 2000 BiOp, for Federal/non-Federal engagement (TMT, SCT, Pacific Northwest Aquatic Monitoring Program (PNAMP), etc.).

We have not spelled out the contents of our implementation plans in detail here, but please refer to our most recent *2004/2004-2008 Implementation Plan* as an example.

Following the release of the new BiOp, the Action Agencies intend to execute an inter-agency Memoranda of Understanding (MOU) defining implementation and funding roles and responsibilities for some joint implementation actions to increase certainty and clarity of implementation.

2. Progress Reporting

We will use the project level detail contained in the Action Agencies' BiOp database to track results and assess our progress in meeting programmatic level performance targets. We will track overall population performance through annual reports of adult abundance and trends in adult abundance for listed ESUs. The results of the progress reports will inform adjustments in future year plans through adaptive management.

The Action Agencies will prepare ***annual progress reports*** based on our implementation plans. The progress reports will document our ability to achieve ESU-specific performance targets established in established in this UPA and updated through our implementation plans. In several instances the UPA specifies anticipated dates for implementation of certain actions that are important steps toward achieving performance standards. The Action Agencies consider those dates to be benchmarks for implementation and will report on the status of achievement of these benchmarks in the annual progress report. If, for any reason, a benchmark is not met as expected, the Action Agencies will evaluate its effect on our ability to achieve the performance standard as expected and, if warranted, will identify an alternative to maintain our ability to meet the performance standard consistent with terms of the new BiOp.

3. Comprehensive Evaluations

The Action Agencies will prepare a ***comprehensive programmatic evaluation*** of progress after 2007 and 2010. These check-in reports will also serve as the annual progress report for the year in which we present them. This evaluation will primarily focus on the programmatic performance targets to determine whether our cumulative implemented actions remain consistent with the objectives in this UPA and the new BiOp. We will also evaluate how our cumulative performance is related to adult population trends and adult and juvenile fish survival through the hydrosystem. The Action Agencies will use these evaluations to adaptively manage and to ensure that the required level of performance is achieved. If we determine that course changes are necessary in order achieve expected performance, we will discuss those changes with NOAA Fisheries and the regional salmon managers prior to implementation.

Our *2003 Check-In Report* provides an example of the Action Agencies' approach to these cumulative reports. We will summarize our cumulative accomplishments, review survival and fish return status, propose corrective actions where we are off track, and address key variables, new research, and monitoring and evaluation results.

It is important to note that the Action Agencies have undertaken numerous mitigation actions since the 2000 BiOp was issued. To the extent these mitigation actions contribute to the survival or recovery of the listed species subject to this new BiOp, the Action Agencies expect to be credited with such benefits under the new BiOp. In that regard, we also fully expect that the actions undertaken pursuant to this UPA and new BiOp will continue to benefit listed fish for many years to come. When the Action Agencies reinitiate consultation on the operation of the FCRPS, we believe those mitigation actions, still subject to agency discretion, should continue to be counted as a part of our proposed ongoing FCRPS action, and be used to fill the survival "gap" (if such a gap still exists) to the degree those actions continue to benefit listed fish.

B. Performance Objectives and Standards

As in the 2000 BiOp, performance objectives and measures remain central to the UPA. For the near-term, the specific programmatic performance targets and priorities for each of our hydrosystem, habitat, hatchery, and predator control actions provide clear but flexible objectives for evaluating the success of our actions.

For conservation and recovery of listed fish in the long term, adult trends and adult and juvenile survivals through the hydrosystem establish useful reference points to determine if we are advancing in our conservation and recovery efforts. Examples of adult return and juvenile and adult hydrosystem survival targets were included in the 2000 BiOp, and have guided our efforts since then. Adult hydrosystem survival targets have been largely achieved, juvenile survival targets have shown progress, and adult returns have improved, in some cases dramatically. We will continue to report on these performance measures in our annual and cumulative progress reports. Because of these performance measures, we are prioritizing actions in this UPA for the ESUs most in need of survival improvements and the dams with the lowest fish survival for our proposal.

NOAA Fisheries' approach in the draft BiOp included the overall FCRPS performance standard, which is the estimated juvenile fish survival through the hydrosystem based on the NOAA designated reference operation. . This standard essentially measures *how close the hydrosystem is to the best operation of the dams for fish, without regard to other project purposes.* NOAA Fisheries developed the reference operation for the revised jeopardy analysis under the BiOp remand process. This reference operation describes the estimated survival *potential* of the hydrosystem if the system was not constrained by other operational requirements for which the dams were authorized, including flood control, irrigation, power generation, and navigation. The overall goal for our collective actions (i.e., hydrosystem operations, configurations, predator management, habitat improvements, and hatchery actions) is to meet that potential through filling the survival "gap" identified through NOAA Fisheries' jeopardy analysis. This would effectively provide "no impact" for the operation of the dams, except for impacts related to the existence of the concrete structures.

The Action Agencies will address the "gap" first by using hydrosystem operations, structural dam modifications, juvenile fish transportation, and predator management, prior to utilizing other offsetting actions. Because the Action Agencies operate the dams to meet multiple Congressionally authorized purposes, the Action Agencies may not address all of the impacts of discretionary operations through operations only. In addition to operational and structural changes at the dams, we will also pursue actions that have potential for survival benefits for targeted ESUs – including habitat, or hatchery actions, depending on the ESU. Actions will be commensurate with the size of any remaining part of the "gap" that was not being met through hydrosystem and predator control actions.

1. Progress Report Updates on Overall Adult Trends

An overarching performance objective, for the FCPRS as well as other actions in the Columbia Basin for the conservation and recovery of listed fish, is a stable and improving trend in the numbers of adult anadromous fish over multiple years. All of the listed ESUs are exhibiting higher adult returns today than they were when listed in the 1990s and at the time of the 2000 BiOp. Many factors contributed to these fish returns, including the benefits of conservation actions implemented under the 1995, 1998 and 2000 BiOps, the Council's Fish and Wildlife Program, the Corps' Columbia River Fish Mitigation (CRFM) program, and the efforts of the tribes, states, and individuals. In addition to improvements to fish passage at mainstem dams, to habitat in the estuary and tributary subbasins, and to hatchery and harvest practices, the current favorable ocean environment has also contributed to this success.

Overall population performance, as exhibited by adult abundance and trends, provides an important context for planning actions to address FCRPS performance under the BiOp and for broader conservation purposes. As noted in the Progress Reporting section, the Action Agencies will annually consider adult abundance and trends for each listed ESU to determine priorities and timing of actions to improve juvenile fish survival. This will include consideration of how much emphasis to place on hydrosystem and predation management actions compared to other non-hydrosystem actions for different ESU's. Some ESU's may require greater or more immediate attention, while those that are less at risk may be helped with less aggressive measures (at least in the near-term). This approach makes best use of limited available resources for those ESU's in greatest need.

2. Progress Report Updates on Adult and Juvenile Fish Survival Through the Hydrosystem

Another benchmark for our actions toward conservation and recovery of listed fish is *adult and juvenile survival through the hydrosystem*. The Action Agencies have more direct influence on this outcome than on broader, non-hydrosystem related goals. For adult fish, we have largely achieved or exceeded the performance standard identified in the 2000 BiOp (Ruff Memo 6/29/04 to Brian Brown). Because we do not expect the proposed operation will reduce adult passage survival, we will continue that operation and monitor adult passage. We will periodically assess adult survival through the hydrosystem to ensure that adult passage survival remains high. Consistent with our adaptive management approach, we will adjust our actions as warranted to ensure implementation of an effective and efficient program.

As noted previously, we have been advancing in achievement of juvenile fish survival standards in the 2000 BiOp. The total system juvenile survival performance standard is the most appropriate measure for ESUs that have a combined management strategy of both transportation and in-river migration. The survival of the transported fraction of the population reflects both direct effects and indirect effects ("D") associated with the transportation process. In-river survival is useful as a secondary standard, particularly when a higher proportion of fish are left to migrate in-river. In-river survival would be the preferred measurement of performance where transportation is not available or effective as a management tool.

We will continue to report on adult and juvenile hydrosystem survival in our annual and cumulative progress reports. We will be providing this reporting based on the best available information. It is neither reasonable nor practical to attempt field measurements of juvenile fish survival for each stock migrating each year (e.g. Bear Valley Creek spring/summer Chinook, Entiat spring Chinook, John Day spring Chinook, etc.). In some cases, PIT-tag sampling limitations make such measurements infeasible or very costly. In other cases, there could be high biological risk or detriment (i.e., adverse impacts to migrating fish) that could exceed the potential benefit of the information collected. In these cases, we may use surrogates as indicators for some ESUs. For example, estimated survival of a composite of Snake River stocks in the lower Columbia could serve as a surrogate to represent the survival of mid- and lower Columbia River stock survival through the same reach (e.g., McNary to Bonneville).

3. Hydrosystem Performance Measures for Comprehensive Evaluations and Modifications

The Action Agencies propose hydrosystem performance measures for evaluating improvements in fish survival from the actions in this UPA. In this section the Action Agencies describe the general content of our comprehensive evaluations of hydrosystem performance.

Juvenile Fish Survival

In the new BiOp, NOAA will estimate the expected juvenile fish survivals through the hydrosystem that are associated with the hydrosystem actions in this UPA. Of course, actual survival will vary with actual water runoff conditions; and the timing and effectiveness of configuration changes, etc. The Action Agencies propose to use these performance expectations as a basis for performance tracking, and will report juvenile survival as described below in the comprehensive evaluations that we will prepare in 2007 and 2010.

2007. For yearling chinook and steelhead, the Action Agencies 2007 comprehensive evaluation & progress report will identify system survival rates that were achieved in 2005, 2006 and 2007 based on empirically estimated in-river survival rates, coupled with updated model analyses that includes transport survival. These empirical based estimates will be compared to a perfomance standard represented by the mean and range of system survival estimates from the new BiOp assessment for a limited subset of comparable water years. Similarly for sub-yearling Chinook, the 2007 progress report will identify the system survival rates that were achieved in 2005 and 2006 based on empirically estimated in-river survival estimates coupled with updated model analyses of system survival. These survival estimates will be compared to a performance standard represented by the mean and range of system survival estimates from the new BiOp assessment for a limited subset of comparable water years. The Action Agencies assume that if significant new knowledge on juvenile survival rates is obtained from ongoing research, that NOAA may update the new BiOp modeling estimates for the proposed operation.

2010. The Action Agencies 2010 comprehensive evaluation and progress report will use the same approach as in 2007. The empirically based survival rates that were achieved in 2005-2009 for all ESUs will be compared to a performance standard represented by the mean and range of system survival estimates from the 2004 BiOp assessment for a limited subset of comparable water years. Additionally, the system survival rates achieved in 2010 for yearling Chinook and steelhead ESUs will be compared to the expected 2010 system survival rates estimated in the new BiOp (using a comparable water year estimate). The Action Agencies assume that if significant new knowledge on juvenile survival rates is obtained from ongoing research, that NOAA may update the new BiOp modeling estimates for the proposed operation.

Modifications to Proposed Operations. If in any year the Action Agencies propose to modify the hydrosystem operations described in this UPA, a prospective analysis approach will be used to determine whether performance expectations can still be achieved with the proposed change. If performance is projected to fall short, the Action Agencies may modify the proposed change, or propose additional actions to compensate for the projected shortfall. The prospective modeling analysis will evaluate whether the new hydrosystem operations, plus any new non-hydrosystem actions that qualify for crediting, will equal or exceed the levels of juvenile system survival that would otherwise occur if the hydrosystem operations in the UPA were carried out. The prospective survival estimate for the new operation would be compared to an estimate of the original proposed operation survival using the most current NOAA runoff forecasts available and current juvenile survival data. In the case of a proposal to change operations for multiple years, the Action Agencies will use a range of runoff and passage conditions for the prospective analysis. The Action Agencies' analysis would be completed at least four weeks before a new operation would be implemented.

Adult Survival

The Action Agencies' 2007 and 2010 comprehensive evaluations and progress reports will identify available empirical information on adult survival rates for each ESU over the 2005-2007 and 2005-2009 time periods, respectively. The mean and annual survival rates for available years will be compared to

the mean and range of estimates (for comparable water years) that were identified in the new BiOp and for which NOAA concluded were equal to reference condition survival levels. This comparison will check to see that the empirically-derived survival rates are continuing to equal or exceed the expected adult survival rates for the applicable subset of water years. As part of the 2007 and 2010 comprehensive reviews, the Action Agencies will also identify and consider any new scientific information on adult survival.

4. Predator Control Program Performance Measures

Management of piscivorous and avian predation of juvenile salmonids is an effective means of increasing juvenile fish survival (Beamesderfer et al. 1996, Roby et al. 1998, NOAA 2000, Good et al. 2004). The Action Agencies will pursue focused measures that reduce predation mortality in the near- and long-term.

For both piscivorous and avian predation, we can make quantifiable estimates of juvenile fish survival improvements. This provides a common currency relative to the broader hydrosystem or FCRPS performance standards. As described above, annual planning and post-season evaluation will take into account any improvements in predator management over the 2000 BiOp baseline condition (i.e., current survival benefits associated with ongoing predator control).

Performance metrics will include the change in annual predation rates and the resulting change in annual juvenile salmonid survival rates.

5. Habitat Performance Measures

The Action Agencies will provide increased certainty and specificity of habitat improvements through our adoption of programmatic habitat metrics. These metrics increase our accountability for specific targets and further define the expected level of effort needed for ESU-specific survival improvements. By setting clear, measurable targets for specific actions, the Action Agencies and NOAA Fisheries should be better able to judge the success of the habitat program to provide life-cycle improvements to each ESU.

Tributary Habitat Performance Measures

The Action Agencies have developed an initial set of performance measures for tributary habitat improvements that are expressed as goals for changes in physical habitat conditions for targeted ESUs. Actions may produce one or more types of habitat improvement. Performance metrics might include, for example, cubic feet per second of water leased or number of miles of spawning and rearing habitat access improved. As we learn more from monitoring programs, we anticipate that we will have a more sophisticated means to measure biological performance and the effectiveness of habitat actions. But it will be several years before we have reliable information from these efforts.

The Action Agencies have adopted physical performance measures to address the limiting factors identified by NOAA Fisheries in selected subbasins for certain stream-type ESUs and within the constraints of practical considerations and discretionary authorities. We express those performance measures as metrics goals for the four limiting factors of the tributary substrategies and have customized them for each ESU or major population group for an ESU, as appropriate. Basic metric goals are:

- **Streamflow:** cubic feet per second of water leased or purchased and/or conserved
- **Entrainment:** number of irrigation diversion screen problems resolved
- **Channel morphology:** miles of tributary access or complexity restored
- **Riparian condition:** miles of riparian habitat protected or enhanced

Estuary Habitat Performance Measures

The primary metrics that the Action Agencies propose to use initially in the estuary are the numbers of acres protected, restored, or enhanced. The estuary habitat initiatives are explained in more detail in the Action Agencies' restoration plan entitled *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary, Appendix A* (Johnson et al., 2003). The number of acres provides a surrogate measure for progress toward addressing the effects of the FCRPS or estuary habitat enhancement actions on juvenile salmonid survival until the science is developed to use biologically based metrics.

This measure may be modified as the RM&E program in the estuary provides a better understanding of the impacts of restoration work in the estuary. For example, actions outlined within the Action Agencies' *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary* further address performance indicators and monitored attributes that will assist us in monitoring habitat restoration actions. This monitoring will assist in evaluating potential benefits to salmonids (ocean and stream types) considering factors not presently being evaluated (i.e. species life history diversity). Proposed monitored performance attributes include:

- Species composition,
- Stock population age/size structure,
- Stock identity, and,
- Temporal presence (the time when juvenile fish are present).

6. Hatchery Performance Measures

The performance measures for the hatchery portion of this UPA are: 1) the continued operation of the existing safety-net program for the Snake River sockeye salmon ESU, the Snake River fall Chinook component of the Nez Perce Tribal Hatchery program, and the safety-net programs for populations in the Snake River spring/summer Chinook salmon, Mid-Columbia River steelhead, Lower Columbia River steelhead, and Columbia River chum salmon ESUs (as long as these programs are determined by NOAA to effectively contribute to reducing the extinction risk of the ESU or target population or contribute to abundance, diversity, spatial distribution, or productivity of the ESU); 2) production of an additional 150,000 Snake River sockeye salmon smolts annually beginning in 2008, assuming this action is approved through *US v. OR* and adequate broodstock is available for the smolt program; and 3) expand and operate the Lower Granite Dam adult trap to increase Snake River fall Chinook broodstock collection, support removal of out-of-basin fall Chinook strays, conduct research, and improve accuracy of monitoring of the ESU status, assuming the supported management actions are approved through *US v. OR*.

C. The Role of Cost Effectiveness

While comprehensive performance management is critical to successfully achieve ESA goals, long-term management should also be cost-effective. Clearly defined performance standards and biological objectives should be met through cost effective alternatives, so that fish receive the most benefits possible for the region's financial investment.

The Council's Mainstem Amendments recommend that the Action Agencies evaluate the effectiveness of summer spill and assess whether similar benefits can be provided at less cost. For example, turbine operations offer promise. There may be opportunities to reduce turbine operational costs associated with fish protective measures while providing similar or greater survival benefits than the current mode of operations. This is consistent with the Council's Mainstem Amendments, which request that the Action Agencies evaluate turbine operations to optimize survival cost effectively.

The Action Agencies will continue to use the adaptive management framework to achieve our stated performance objectives in a cost-effective manner. We may seek hydrosystem operational and configuration changes or propose alternative implementation options if they would achieve equal or better survival improvements at lower cost. We will continue to engage in regional discussions of any potential or proposed cost effectiveness initiatives.

III. Action Agencies' Approach and Updated Proposed Action

A. Action Area

The Action Agencies consider the action area under this UPA to include:

- The mainstem Columbia River, including and downstream of Libby and Hungry Horse dams and reservoirs; the Snake River below the confluence with the Salmon River; and the Clearwater River below Dworshak reservoir and dam, down to and including the Columbia River estuary and plume.
- The estuary and plume, which includes the area immediately off the mouth of the Columbia River influenced by freshwater discharge, up to the limit of tidal influence at Bonneville Dam (approximately river mile 146);
- The 4th field HUC subbasins that are the focus of our proposed tributary habitat actions (Methow, Wenatchee, and Entiat subbasins);
- Areas directly and indirectly affected by Reclamation's conservation measures in the Upper Salmon, Little Salmon, Lemhi, Upper John Day, North Fork John Day, and Middle Fork John Day subbasins and BPA's conservation measures in the Okanogan subbasin; and,
- Redfish, Alturas, and Pettit lakes and the tributaries that connect them to the Snake River, due to the activities associated with the safety-net hatchery programs for Snake River sockeye salmon.
- Lower South Fork Clearwater River and Lower Selway River downstream to the confluence with the North Fork Clearwater River, due to the activities associated with the Nez Perce Tribal Hatchery for Snake River fall Chinook salmon.
- All areas directly or indirectly affected by the 19 Reclamation projects.

B. General Approach

The Action Agencies have been implementing the RPA of the 2000 BiOp since December 2000. Under this UPA, we would implement the majority of measures in the 2000 RPA without modification and refine some of the more general offsite measures described in the 2000 RPA[2]. This is in response to NOAA's updated jeopardy analysis and Judge Redden's May 2003 order. These refinements are directed toward addressing the survival gaps identified by NOAA in the most biologically effective manner and to increase certainty and focus of implementation.

Consistent with the updated NOAA Fisheries' analysis identifying the FCRPS related survival gaps for individual ESUs, the Action Agencies propose to target the lifestage needs of each ESU.

For ***low*** survival gaps (less than or equal to 2%), we propose to achieve sufficient survival improvements through hydrosystem configuration and operations and/or predator control actions. For ***medium*** level survival gaps (between 2 and 24%), we propose to achieve additional survival improvements through targeted habitat and hatchery actions. These ***low*** and ***medium*** rankings and associated survival gaps are derived from NOAA Fisheries' guidance for habitat improvement (Kratz et al. 2004). This general prioritization and "stacking" of actions is conceptually displayed in **Figure 2**.

[2] For further information on the relation between the 1999 actions of the 2000 RPA and this UPA, please see the Action Agencies' *Crosswalk of 2000 NOAA FCRPS BiOp RPA Actions and the 8/30/04 Draft UPA* posted at www.salmonrecovery.gov.

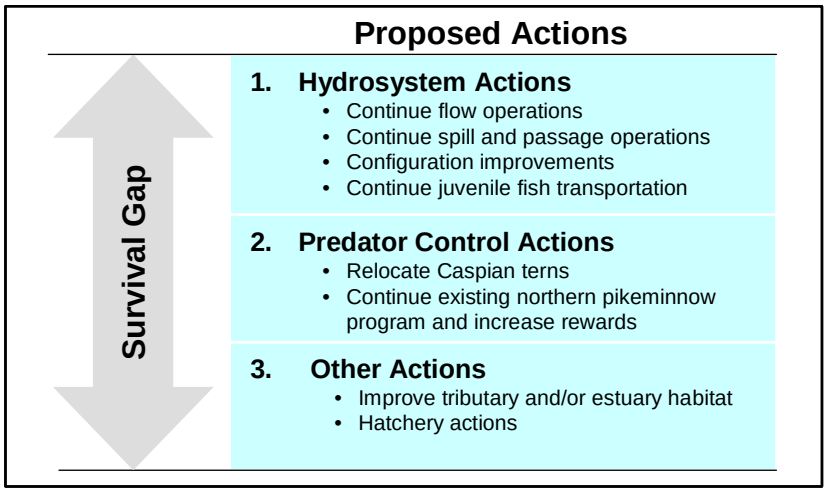

Figure 2 Action Agency general prioritization of actions to fill FCRPS survival gaps

C. Continuing or On-going Actions

While this UPA looks forward in time to describe our future actions, the Action Agencies have already implemented many actions under the 2000 BiOp. These actions have already begun to accrue survival benefits or are expected to soon begin to provide survival benefits for listed ESUs. The Action Agencies have documented these actions in the annual progress reports and the *2003 Check-in Report* prepared under the 2000 BiOp. Because these actions were implemented under the 2000 BiOp and we expect that they will be maintained to assure the continuation of benefits over time, the Action Agencies ask NOAA Fisheries to consider them in evaluating the biological benefits that are now accruing, or will soon begin to accrue for purposes of the new BiOp. The Action Agencies' progress reports are available at www.salmonrecovery.gov. Additional detail of tributary habitat actions implemented under the 2000 RPA, including metrics for each action, is included in Appendix C.

It is also clear that actions undertaken pursuant to this UPA will continue to benefit listed fish for many years to come, well beyond the term of this new BiOp. When the action agencies reinitiate consultation on the operation of the FCRPS, many of these actions will continue to be subject to agency discretion. If during the reconsultation, NOAA and the action agencies agree it is important to carry these actions forward, then such renewed commitments should be viewed as a part of the new proposed action. As such, these ongoing-actions should receive credit, and count to fill the survival "gap" (if such a gap still exists) in proportion to the degree they continue to provide benefits to listed fish.

D. Strategies and Substrategies

The Action Agencies will continue to use the strategies and substrategies devised to implement actions under the 2000 BiOp. Our published ESA implementation plans lay out these strategies and substrategies and their underlying biological rationale. They will continue to guide our implementation of this UPA and other conservation related actions. We have slightly modified some of the substrategies to align with the recent scientific information and the general approach described in this document and have added strategies and substrategies to address predator control actions.

It should be noted that these strategies and substrategies provide the context for implementation of the Action Agencies' ESA and recovery actions. They do not, however, specify the actions and performance

targets for individual ESUs and therefore should not be included in NOAA's jeopardy analysis. The Action Agencies' ESU-specific actions are described in more detail in Section III.E of this document.

These strategies and substrategies are summarized in this section.

1. Hydrosystem Strategies and Substrategies

The Action Agencies use three hydrosystem strategies and related substrategies.

We will continue operating the FCRPS to achieve the hydrosystem performance standards described in the 2000 BiOp. We will specifically operate individual dams as further detailed in the water management plans, implementation plans, the processes afforded through the Regional Forum, and project decision documents.

Reclamation is also consulting on the mainstem effects of the continued operation and maintenance of 19 of its projects in the Columbia River basin. (See Appendix B for details.)

Hydrosystem Strategy 1: Configure Dam Facilities to Improve Juvenile and Adult Fish Passage and Survival

The Action Agencies have given much attention over the last decade to improving juvenile and adult passage survival through the hydrosystem complex. We have given highest priority to developing and installing additional configuration improvements to increase passage survival rates at mainstem projects.

The Action Agencies will develop 1- and 5-year implementation plans that describe the system configuration priorities, capital investments, hydro system research and reliability improvements that are coordinated through SCT.

Hydrosystem Substrategy 1.1: Mainstem Juvenile Passage Improvements

Safe and efficient passage of juvenile fish through the hydrosystem is essential to assuring successful perpetuation of all species. The Action Agencies have already made substantial juvenile passage improvements at each FCRPS dam (e.g., surface bypass systems - RSW and corner collector, modifications to existing mechanical bypass systems, relocation of bypass system outfall pipes, minimum-gap turbine runners, extended–length turbine intake screens, and spillway deflectors to enable increased spill volumes). We have developed and installed an array of prototype juvenile passage enhancement devices at the eight mainstem dams. While these devices have been found to incrementally increase juvenile passage survival rates, each dam is unique and poses different juvenile passage challenges. To meet system juvenile fish survival standards, we consider the cumulative effect of these improvements.

Hydrosystem Substrategy 1.2: Mainstem Adult Passage Improvements

Safe and efficient passage of adult fish through the hydrosystem is essential to assuring successful perpetuation of all species. This substrategy will provide adult passage facilities that achieve the adult fish survival performance standards described earlier in Section II.B. Although the system adult passage survival standard was achieved in 2001 and 2002 and was likely met in 2003 (passage results are incomplete), steps are needed to assure that this performance continues. The adult measures will be directed at investigation and potential correction of conditions that may delay adult migration and/or that improve the passage facilities to assure their continued serviceability and reliability. Adult monitoring facilities (PIT-tag detection) are also needed at each project to facilitate monitoring and evaluation efforts.

Hydrosystem Substrategy 1.3: Measures That Address Temperature and Dissolved Gas

The Action Agencies, other federal agencies, states, and tribes have implemented many actions to address water quality in the mainstem Columbia and Snake rivers. Those actions have focused primarily on water temperature and total dissolved gas (TDG), which are influenced by the FCRPS. Under this substrategy, water quality attributes would be managed to provide optimal passage conditions for listed salmon and steelhead populations.

In 2003, we completed a *Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers* (WQP), as described in Appendix B of the 2000 BiOp and are implementing the measures outlined in that document. The Action Agencies have considered the respective ecological objectives of the ESA and the CWA. In many instances actions implemented for the conservation of ESA-listed species also move toward attainment of water quality standards (e.g. reducing total dissolved gas and temperature). The overlap of the statutory purposes of the ESA and the CWA are extensive, however, there remain additional actions that are appropriate in a water quality plan that are nonessential for the survival and recovery of the listed species. The WQP includes additional actions to improve mainstem water quality by reducing total dissolved gas and temperature that further CWA objectives and are appropriate as conservation measures. (*See* Appendix A for the current WQP)

Hydrosystem Substrategy 1.4: Project Configuration Research, Monitoring, and Evaluation (RM&E)

RM&E for configuration and operations and maintenance (O&M) activities provides:

- Information necessary to design, build, modify, and operate fish passage facilities;
- Baseline information on passage efficiencies and survival through past projects; and,
- Post-construction evaluation of new or modified passage facilities.

Data from RM&E efforts is also necessary for determining success in meeting the hydrosystem performance standards.

Hydrosystem Strategy 2: Manage Water to Improve Juvenile and Adult Fish Survival

The Action Agencies' goal is to implement water management measures to enhance juvenile and adult survival consistent with other project purposes and available water supply. These measures include system flow objectives for juvenile fish migration, reservoir operations to help meet needs of fish at or near the project, spill for juvenile fish passage, and others.

Each year, the Action Agencies manage a varying amount of natural flow that enters the FCRPS as runoff from precipitation and melting snow pack. Hydrosystem operators use this water to meet multiple purposes, including irrigation, flood control, power production, fish and wildlife, navigation, and recreation. As anticipated in the 2000 BiOp, operators may have to interrupt or adjust water management actions in response to unforeseeable power system, flood control, or other emergencies. They only undertake such emergency actions as a last resort and they only undertake actions needed to respond to the specific emergency condition. During winter power emergencies, for instance, hydrosystem operators may draft water from reservoirs that they otherwise would hold for spring and summer flow augmentation. Once the emergency is past, they replace flow augmentation as soon as, and to the maximum extent, possible. Similarly, during summer emergencies, the federal hydrosystem operators may draft storage reservoirs below biological opinion draft limits, or reduce bypass spill for fish. Federal operators will manage any power emergencies in accordance with the Regional Forum TMT emergency protocols.

Each fall the Action Agencies prepare an annual Water Management Plan (WMP) that describes proposed hydrosystem fish operations for the upcoming fall/winter, spring and summer passage seasons. The Action Agencies expect to implement most of the water-management measures for fish survival in the BiOps under most water conditions. However, until January of each year, when the National Weather Service and the Action Agencies issue their initial runoff forecasts, we have little information about the actual water supply conditions for the upcoming season. Thus, the Action Agencies prepare seasonal updates (fall/winter and spring/summer) to the WMP that reflect operational priorities based on actual and anticipated water conditions. Each year the TMT reviews and comments on the WMP and the updates. Additionally, the TMT is tasked with in-season management and may make recommendations for short-term adjustments to hydrosystem operations. Where inconsistencies exist between measures, the Action Agencies will resolve them using the priorities discussed in the following substrategy discussions.

The Action Agencies will continue to update and annually issue a 5-Year WMP. This plan is a long-range view of hydrosystem operations. It summarizes operations research and other regional initiatives that may lead to hydrosystem operations changes.

The implementation of water management measures is accomplished through in-season operations coordinated through the TMT. Operational substrategies for hydrosystem components are described below. (A project-by-project list is provided in **Table 2** of Section III-D, *ESU Specific Actions*.)

In response to the low-water year of 2001 BPA drafted a "Guide to Tools and Principles for a Dry Year Strategy". The draft strategy is largely resource focused and does not address an approach to fish operations in low water years. BPA is exploring options for operational flexibility in dry years and may propose a suite of dry year fish operations for consideration.

Hydrosystem Substrategy 2.1: Reservoir Operations to Improve Fish Survival

Reservoir operations necessary for improved fish survival and migration conditions through the FCRPS include flow augmentation, limited flow and pool level fluctuations, and cool water temperatures. The annual and 5-year WMPs are the work plans for this substrategy.

Hydrosystem Substrategy 2.2: System Flow Management to Improve Fish Survival

Coordinated system operations aimed at providing river flows facilitate spawning and redd protection as well as aid fish migration, minimize exposure to predation, and improve water quality. The FCRPS' ability to provide flows for these purposes is commensurate with the available natural water supply.

Hydrosystem Substrategy 2.3: Spill Operations for Project Passage

Spillways are generally among the safest juvenile fish passage routes past the mainstem projects. This includes both high survival past the dams as well as reduced migration delay in the forebays.

Hydrosystem Substrategy 2.4: Transmission Reinforcements in Support of Flexibility for River Operations

BPA will continue to work with NOAA Fisheries to identify and remove transmission system constraints to fish operations if appropriate.

Hydrosystem Substrategy 2.5: Operate to Achieve Maximum Fish Benefits in a Cost Effective Manner

Hydrosystem operations proposed in the 2000 BiOp were based on the best information then available.

Since then, federal agencies and others have completed extensive fish passage research. Where research showed we could increase juvenile and/or adult passage survival rates, we have altered BiOp operations accordingly. At times the new operations also reduced operational costs. For example, the Lower Granite RSW enabled improved juvenile spill passage survival rates, reduced total dissolved gas (TDG) levels, and used less water, which increased power generation and revenues.

We have also made operational improvements at Bonneville, The Dalles, John Day and Ice Harbor dams under the 2000 BiOp. The Action Agencies will continue to evaluate the fish passage and cost effectiveness of fish operations and expect to propose additional improvements and efficiencies to juvenile or adult passage operations as appropriate. For example, RSWs or RSW-like structures at the projects would achieve the dual purposes of protecting juvenile listed fish and conserving "lost" energy revenue (in the form of reduced spill operations), with benefits to listed fish continuing to accrue over the entire operational life of these structures, well beyond the ten-year span of the new BiOp.

Hydrosystem Strategy 3: Operate and Maintain Fish Passage Facilities to Improve Fish Survival

Many of the FCRPS projects incorporated anadromous fish passage facilities, such as fish ladders and bypasses and/or mitigation hatcheries, at the time they were built. Since then, the Action Agencies have updated the original facilities and installed new facilities, such as bypass systems, collection and transport facilities, PIT-tag detection systems, and TDG monitoring equipment.

The Corps' District Offices in Seattle, Walla Walla and Portland coordinate operations and maintenance (O&M) activities at the dams. Each dam has a staff to carry out day-to-day O&M requirements. The Corps will continue to develop 5-year O&M plans that describe routine and non-routine O&M projects planned at each of the dams. These plans are coordinated with the Fish Passage Operations and Maintenance Team (FPOM). The FPOM develops operational priorities and operating criteria that are summarized in the Fish Passage Plan. Project personnel and others involved with river operations and fish passage facilities implement this plan and update it annually (see http://www.nwd-wc.usace.army.mil/tmt/documents/fpp).

Hydrosystem Substrategy 3.1: Operation and Maintenance of FCRPS Fish Facilities

Safe and efficient fish passage depends on properly functioning facilities. Established O&M criteria assure continued proper operations.

Hydrosystem Substrategy 3.2: Non-Routine Maintenance of Fish Passage Facilities

Safe and efficient fish passage depends on properly functioning facilities. Established O&M criteria assure continued proper operations. As distinct from routine O&M activities, non-routine O&M activities include one-time or very extensive activities.

Hydrosystem Substrategy 3.3: Juvenile Fish Transport Actions to Improve Fish Survival

The juvenile fish transportation program typically improves juvenile fish survival through the FCRPS when managed in accordance with established operating criteria. Because of the results of recent research, the Action Agencies are still evaluating uncertainties concerning the amount and timing of transportation.

Hydrosystem Substrategy 3.4: Operations RM&E

Monitoring and evaluation of FCRPS fish facilities identified if facilities are operating as intended to improve their performance. Examples of O&M-related RM&E include evaluation of juvenile fish transportation and adult passage at dams.

2. Predator Control Strategies and Substrategies

Some birds and fish consume large numbers of juvenile salmonids and are a major cause of ESA-listed fish mortality (Beamesderfer et al. 1996, Roby et al. 1998, NOAA 2000, Good et al. 2004). The Action Agencies intend to pursue opportunities to increase juvenile fish survival through focused measures control specific predators. In addition, the Action Agencies believe that the effects of mammalian predation on adult fish should be addressed to determine if management actions are warranted.

Predation Strategy 1: Redistribute Avian Predators

Avian predators are one of the factors currently limiting salmonid recovery in the Columbia River Basin. Every year, bird species such as Caspian terns and double-crested cormorants, consume large numbers of migrating juvenile salmonids. Human activities in the Columbia River Basin, some of which are associated with the FCRPS, appear to be related to population increases of avian predators. Therefore, actions may be warranted to reduce avian consumption of juvenile salmon.

Predation Substrategy 1.1: Redistribute Caspian terns nesting on East Sand Island in the Columbia River estuary to habitats located outside of the Columbia River Basin.

For many of the listed species migrating through the Columbia River estuary, tern predation is considered one of the primary limiting factors affecting juvenile survival (Fresh et al. 2004). Since 1997, researchers have been studying the effect of piscivorous[3] waterbirds on juvenile salmonid survival in the Lower Columbia River. In 1998, scientists estimated that Caspian terns nesting on Rice Island consumed about 12.4 million juvenile salmonids, or approximately 13% of the estimated 97 million out-migrating smolts that reached the estuary during the 1998 migration year (Collis et al. 2003). This research prompted managers to relocate the tern colony to East Sand Island, located approximately 15 miles downstream and near the ocean, which resulted in a successful reduction in predation of juvenile salmonids by approximately 6-7 million fish annually. However, annual predation of juvenile salmonids by terns nesting on East Sand Island is still substantial; on average, terns consumed 5.9 million smolts annually from 2000 to 2003 (Collis et al. 2003).

Predation Substrategy 1.2: Perform analysis of the double-crested cormorant population in the Columbia River, and evaluate and implement alternatives to manage the cormorant population.

The double-crested cormorant colony on East Sand Island in the Columbia River estuary is the largest along the Pacific Coast (Collis et al. 2000). In 2003, approximately 10,646 breeding pairs were nesting on East Sand Island. Given the birds' feeding habits, it is much more difficult to determine the number of juvenile salmonids they consume. However, based on some preliminary bioenergetics modeling, it appears that cormorants nesting on East Sand Island are consuming equal if not slightly higher numbers of juvenile salmonids as Caspian terns (Roby, pers. comm.); researchers estimated that cormorants nesting on East Sand Island consumed 4.8 million juvenile salmonids in 2003.

[3] Piscivorous is defined as "habitually feeding on fish".

Cormorants in the mid-Columbia River have also been showing an increase in numbers. We do not currently have a reliable estimate of the cormorant population in the mid-Columbia River or its impact on salmonids, but the numbers have been increasing. Research of the mid-Columbia cormorant population may be warranted.

Predation Substrategy 1.3: Perform analysis of the Caspian tern population in the Mid-Columbia River, and evaluate and implement alternatives to manage the tern population.

The only known Caspian tern colony in the mid-Columbia River during 2003 was on Crescent Island, just below the confluence of the Snake and Columbia rivers. The tern colony on Crescent Island consists of 500 – 700 breeding pairs. However, the limited area of suitable tern nesting habitat on Crescent Island and the large colony of California gulls on the island suggest that there is little opportunity for expansion of the tern colony.

The colony of Caspian terns on Crescent Island could have a substantial impact on in-river juvenile salmonids, particularly the upper Columbia River steelhead ESU (Roby, pers. comm.). A 2003 study found their diet consisted of approximately 68% juvenile salmonids, similar to diets of Crescent Island terns during the 2000-2002 breeding seasons (Collis et al. 2003). In 2000 and 2001, terns on Crescent Island consumed an average of 575,000 juvenile salmonids annually.

Predation Strategy 2: Reduce Fish Predation

Management of piscivorous fish is an effective means of increasing juvenile fish survival (Beamesderfer et al. 1996, NOAA 2000). The Action Agencies intend to pursue opportunities in the near-term as well as longer-term to achieve increases in juvenile fish survival through focused measures that reduce the numbers of fish that consume ESA-listed fish.

Predation Sub-strategy 2.1: Expanded Northern Pikeminnow Management Program

The Northern Pikeminnow Management Program (NPMP) is a multi-year effort to reduce piscivorous predation on juvenile salmon primarily through public angler-driven system-wide removals of predator-sized northern pikeminnow (*Ptychocheilus oregonensis)*. BPA funds the NPMP.

Since program inception in 1990, the bounty on northern pikeminnow has motivated sports fishermen to remove over 2 million northern pikeminnow throughout the system. This has reduced mortality by an estimated 25% (Friesen and Ward 1999), equivalent to over 4 million juvenile fish not eaten by northern pikeminnow each year. Currently, the annual harvest rate ranges between approximately 8 and 16 percent of the qualifying northern pikeminnows. In 2001 and again in 2004, BPA increased the reward, which led to significant increases in both catch and exploitation. Preliminary estimates are in the range of 14-18%. (Tom Friesen, ODFW personal communication).

Predation Sub-strategy 2.2: Other Fish Predators

Smallmouth bass, Walleye and channel catfish are also significant predators of juvenile salmonids (Vigg et al. 1991, Zimmerman 1999). Results from NPMP full indexing in 2004 should update earlier estimates of predation by these non-indigenous species. That new information, combined with existing documentation on bass and walleye predation, should allow the region to begin to pursue options to manage these exotic species. It may be more appropriate to manage these predators on more of a site-specific basis rather than system-wide as in the case of the NPMP.

Predation Strategy 3: Address Fish Predation by Pinnipeds

Marine mammal predation has increased sharply in recent years at Bonneville Dam. Estimates of adult salmonid losses at Bonneville Dam tailrace alone are on the order of 1-2%, primarily of the population of adult migrating spring Chinook (source: Corps).

Lethal and non-lethal deterrence methods are available and utilized in the Northwest (Ballard Locks). Management actions to address marine mammal predation downstream of Bonneville Dam should be scoped and considered for implementation by the appropriate federal agencies.

3. Habitat Strategies and Substrategies

This UPA refocuses the 2000 RPA and specifically defines the goals of habitat improvements for each ESU. The types of actions formerly anticipated from RPA Actions 149 through 163 of the 2000 BiOp, as modified by the Action Agencies' implementation plans and by the *2003 Check-in Report,* were less specific than those included in this UPA. We now have greater certainty about the limiting factors associated with the spawning and rearing habitat of the stream type ESUs and the differential usage of the estuary by the stream type and ocean type ESUs. In concert with NOAA's revised analysis, this has allowed the Action Agencies to customize habitat improvements for each ESU.

The habitat portion of the UPA is directed toward those viable salmonid population (VSP) parameters and limiting factors pertinent to specific ESUs and their subsets of populations or major population groups. We note that the ESA standard is focused on the listed population or ESU as a whole. We address those factors pertinent to the life-stage needs of tributary and/or estuary spawning and rearing habitats that affect the ESUs and/or population groups.

The UPA describes habitat actions in terms of the two major habitat strategies, tributary and estuary, and related substrategies. For certain stream type ESUs, it focuses on actions that address limiting factors in specified subbasins. For ocean type ESUs in the estuary, it focuses on those habitat modifications that will address potential limiting factors. We note that not all of NOAA Fisheries' potential limiting factor issues are within the discretionary authorities of the Action Agencies. For example, where local and state governments make regulatory land use and water appropriations decisions that affect habitat conditions, the Action Agencies cannot address that potential limiting factor.

Available science cannot quantify the increased fish survival attributable to each habitat action for each ESU. We expect to learn from the effectiveness monitoring program described in Section IV of this document. As these data become available, we may seek to enhance the immediate effects of our actions through shifting the emphasis from one potential limiting factor to another or changing from an activity that addresses a certain factor to another that addresses the same factor. Consistent with our adaptive management framework, we will use our implementation plans to reflect any shifts and to refine the targets of our programs.

Finally, our proposed habitat actions account for the varying level of survival improvements that can be anticipated over time. Some types of actions to address certain potential limiting factors have nearly immediate life-stage survival improvements. As appropriate, the Action Agencies propose a mix of both near-term and long-term actions but emphasize those that yield near-term survival benefits. For example, reducing mortality related to entrainment immediately increases survival whereas riparian improvements take a longer time to show survival improvement. We identify the near-term and long-term actions related to the potential limiting factors in Section III.E of this document.

In addition to improving juvenile survival, our habitat improvement projects in the estuary will provide an opportunity for individuals of all ESUs to utilize different habitats on their migration to the ocean and help to maintain the other VSP criteria of diversity and spatial structure. While the direct benefits to the population levels cannot be quantified, we consider it important to the long-term health and viability of salmon and steelhead to maintain diversity in life history and distribution. Our rationale for habitat actions is included in Appendix D of this document.

Habitat Strategy 1: Tributary Habitat Protection and Improvement

NOAA has provided information developed by the Technical Recovery Teams (TRTs) and the Council's subbasin assessments and draft subbasin plans to describe the potential for habitat improvements for each population and major population group for each ESU. However, the science that would allow us to quantify and predict juvenile survival improvements from specific habitat projects or types of habitat projects is still in its infancy. Thus, NOAA Fisheries evaluated the potential for survival improvements from habitat actions in qualitative rankings of low, medium, and high potential. NOAA also identified for each ESU, population, and major population group, the important VSP parameter(s) to be addressed and the habitat limiting factors associated with the tributary spawning and rearing areas.

The Action Agencies propose to address limiting factors for these ESUs that spawn in the tributaries:

- Upper Columbia River spring chinook,
- Upper Columbia River steelhead.

The four limiting factors affiliated with spawning and rearing habitats that the Action Agencies will address for tributary habitat improvements are:

- streamflow,
- entrainment,
- channel morphology, and,
- riparian condition.

These limiting factors define the substrategies for tributary habitat improvements. For clarity, these substrategies have been renamed from our prior BiOp implementation plans to reflect the names of the limiting factors. A description of the general approach the Action Agencies used to guide development of the tributary habitat proposed action is presented in Appendix E of this document.

The Action Agencies considered NOAA Fisheries' primary limiting factors for ESUs in each subbasin, evaluated those limiting factors in consideration of the Action Agencies' respective authorities for implementation[4], and selected habitat improvement actions that consider both near-term and longer-term improvements.

In cases where BPA funds all or a large portion of the tributary habitat improvement project whose implementation is consistent with BPA's Habitat Improvement Program Biological Opinion issued by NOAA Fisheries in July 2003 (or subsequent revisions), BPA will assume the role of "lead agency" and, with cooperation from the cost-sharing agency, ensure compliance with that biological opinion and its terms and conditions.

[4] For example, a suggested habitat improvement potential is flood plain development restrictions. That type of action would require local zoning restrictions and is clearly beyond the authority of the Action Agencies. These and similar types of actions are not included in this Proposed Action.

Tributary Habitat Substrategy 1.1 Streamflow

The Action Agencies will continue to increase water quantity on non-Federal lands in the tributaries that provide important spawning and rearing habitat for the selected stream-type ESUs. Streamflow improvements have near-term survival impacts. We will address streamflow limiting factors through site-specific opportunities, which may include:

- Lease and acquire stream flows.
- Initiate and continue instream flow evaluation studies.
- Replace headgates.
- Increase streamflows.
- Continue implementing streamflow and instream water transaction programs.

This substrategy is consistent with the Pacific Coast Salmon Recovery Fund (PCSRF) *In-stream Flow Projects* metric category.

Tributary Habitat Substrategy 1.2 Entrainment

NOAA identified entrainment of adults and juveniles by water diversions as a potential limiting factor in some subbasins. Addressing entrainment has near-term effects on reducing mortality. The region has made significant progress to alleviate the historic entrainment problem by installing or retrofitting screens to current NOAA's specifications. Some work remains to be done in some subbasins, and the Action Agencies will address entrainment where it is needed.

This substrategy is consistent with the PCSRF *Fish Screening Projects* metric category.

Tributary Habitat Substrategy 1.3 Channel Morphology

The Action Agencies will continue to improve fish passage on non-Federal lands in selected subbasins by removing obstructions to spawning and rearing habitat including diversions, culverts, and other migration barriers. This substrategy also includes actions that would improve stream connectivity with floodplains and side channels. Most channel morphology activities have near-term survival improvement effects.

This substrategy is consistent with the PCSRF *Fish Passage Improvement Projects* and *Instream Structural Projects* metric categories.

Tributary Habitat Substrategy 1.4 Riparian Protection and Riparian Enhancement

This substrategy focuses on improvements to riparian areas by protecting and enhancing riparian habitat on non-Federal lands. Types of actions to address this substrategy may include acquisition of easements or other protective interests in land, riparian treatment and fencing, and streambank stabilization projects. Riparian protection and enhancement actions accrue benefits over a longer period of time and have long-term survival improvement effects.

This substrategy is consistent with the PCSRF *Land Acquisition/Lease/Easement Projects* and *Riparian Habitat Improvement Projects* metric categories.

Tributary Habitat Conservation Actions

As we did under the 2000 BiOp, the Action Agencies will continue to use their existing programs and other discretionary authorities to support additional habitat improvements initiatives and measures in the Columbia River Basin accessible to listed anadromous species. The Action Agencies will provide support for these programs that may be in areas outside the geographic boundaries of the listed ESUs or outside the action area of this implementation plan, but which also conserve or enhance the spawning and

rearing habitat of populations of the listed ESUs. Prior to implementation, the Action Agencies will ensure that such actions have undergone appropriate section 7 consultations. BPA will continue to implement a program that integrates its ESA obligations with the Council's Fish and Wildlife Program. This would include a wide range of projects that promote habitat conservation and improvements. Reclamation and the Corps will continue to use their discretionary authorities to provide technical assistance to others for stream habitat improvements.

Reclamation will use its current technical assistance program to provide habitat improvements to address certain limiting factors in the Lemhi, Upper Salmon, Little Salmon Rivers, North Fork John Day, Middle Fork John Day, and Upper Mainstem John Day subbasins in Idaho and Oregon as ***conservation measures***.

Habitat Strategy 2: Habitat Protection and Improvement in the Estuary

Scientists generally believe that estuaries provide a protected and food-rich environment for juvenile salmonid growth and allow the transition between the fresh and salt-water environments for both juveniles and adults. The 2000 FCRPS BiOp included RPA actions calling for habitat work and RM&E efforts in the estuary to help offset impacts of the FCRPS. The Action Agencies and others in the region developed a comprehensive estuary restoration program to inventory, protect and restore key habitats. The program includes a major monitoring, analysis and research program to evaluate progress toward rebuilding the productivity of the system over the long term. This program is outlined in more detail in the Action Agencies' restoration plan, entitled *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary, Appendix A* (Johnson et al., 2003). This restoration plan identifies five elements – protection, conservation, enhancement, restoration and creation – which are addressed in this strategy.

NOAA's final Technical Memorandum, *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of the Effects of Selected Factors on Population Viability*, dated June 2004, and the guidance document *Mitigating the Effects of FCRPS Operations*, dated July 1 2004 indicate that the potential benefits of estuary habitat improvements are likely to be greatest for ocean type salmonids such as Snake River fall Chinook, Lower Columbia River chum, Lower Columbia River Chinook, and Lower Columbia River steelhead. These documents indicate a *very low* to *low* potential to benefit the other listed ESUs (stream type) by improving habitat in the estuary. However, species life history diversity hypotheses set forth in *Salmon at River's End: The Role of the Estuary in the Decline and Recovery of Columbia River Salmon* and the June 2004 technical memorandum indicate that some stream type salmonids may also benefit from habitat improvements in the estuary. As addressed elsewhere in this document, there is also some potential to benefit these stream type ESUs through predation management actions.

The six estuary habitat restoration projects proposed by the Action Agencies are within the Action Agencies' authorities and are anticipated to address predation, and habitat to differing levels. These projects will provide some increase in juvenile salmonid shallow water habitat that would benefit all listed ESUs, with the greatest habitat benefit to those ESUs expressing ocean type life histories that use the estuarine environment for longer periods of time. Finally, as the habitat restoration projects listed are intended to expand and improve juvenile salmonid shallow water habitat, this increase and improvement in rearing habitat is believed to provide refuge for some of the ESUs, thereby increasing survival and decreasing predation. As with habitat enhancement, the predation decrease is expected to provide a larger benefit for ocean type salmonids using the lower river and estuary for longer periods of time.

As the estuary studies continue to improve our understanding, the Action Agencies will be better able to target the amount and types of habitat that would help avoid jeopardy and better quantify the biological

benefits of these actions. Ultimately, our goal is to implement actions that provide the greatest and most efficient biological benefit to listed ESUs.

Additional projects are expected to be identified based on research and regional coordination and developed following the Action Agencies Restoration Plan, providing greater benefits in the future.

Estuary Habitat Substrategy 2.1: Protect Estuary Habitat

This substrategy includes estuary projects that would secure a property interest through land acquisition, lease, or easement. Metrics tracked for these types of projects include:

- the number and location of acres protected,
- the term of protection, and,
- the riparian miles protected.

The Action Agencies are attempting to acquire ownership or development rights to intact patches of habitat or critical areas in need of further restoration treatments.

Habitat conservation is geared toward the goal of increasing the potential for natural processes to work for the benefit of multiple species and can be a critical component of a larger restoration plan, limiting harmful impacts of conventional management practices and complementing other measures to help boost the site's potential for self maintenance. Examples of habitat conservation incentives include financial support for the implementation of riparian setbacks, the addition of riparian buffer strips, integrated pest management, and off-stream livestock watering techniques. The Action Agencies' restoration plan includes additional discussion of protection and conservation strategies and applications.

This substrategy is consistent with the PCSRF *Land Acquisition/Lease/Easement Projects* metric category.

Estuary Habitat Substrategy 2.2: Estuarine Habitat Improvement

This substrategy includes a suite of habitat actions – estuary habitat enhancement, restoration, and creation– that are described in the Action Agencies restoration plan (Johnson et al, 2003). These actions will be tracked in the Federal Caucus' Habitat Team (FHT) and PCSRF metrics as estuarine improvement projects. The metrics include the location and number of acres protected, enhanced or restored, the number of acres opened or created, and the number of acres where invasive species control measures are applied.

Enhancement. Habitat enhancement entails the improvement of a targeted ecological attribute and/or process. Several groups are implementing enhancement projects to improve different elements of the ecosystem including: riparian plantings and fencing; tide gate or culvert replacement; invasive species removal; and stream bank stabilization.

Restoration. Like habitat enhancement projects, restoration projects can take place in a variety of ways. According to the working definition, restoration means the return to a previously existing ecological condition. This can involve more intense modification and manipulation of site conditions than enhancement. As a result, *restoration* projects typically require more careful planning, design, and maintenance than enhancement projects. For example, we can gain miles of habitat by reconnecting tidal channels that have been cut off by tidewaters, dike construction, and placement of fill material for land-use activities. Reconnecting these areas through the removal of tide gate structures, dike breaching, and or culvert installation into a roadbed, however, can increase the risk of flooding landowners that were previously protected by these structures. Therefore, reconnecting tidal channels may require a

combination of strategies, such as acquisition and enhancement. At sites where reconnection is not possible, self-regulating tide gates should be considered.

Creation. Habitat creation involves constructing or placing habitat features that did not exist previously, but which attempt to mimic conditions of an intact, functioning ecosystem. Tidal channel excavation is an example of a habitat creation strategy intended to replicate the natural structure and function of an intact channel in close proximity to the project site. Another is the placement of dredged material intended to create marsh or other habitat. Because of the uncertainty about the potential ecological gain from a habitat creation strategy, it needs to be accompanied by a strong effectiveness-monitoring component.

As the estuary studies continue to improve our understanding, the Action Agencies will target and implement actions that would help avoid jeopardy (establish amount and types of habitat) and better quantify the biological benefits of these actions. Our goal is to implement actions that provide the greatest biological benefit to listed ESUs.

4. Hatchery Strategies and Substrategies

As with the habitat actions, the scope and priority for hatchery actions depends upon the difference, or "gap", between survival achieved through the 2000 BiOp hydrosystem operations and the reference operation. We have revised our hatchery strategies to focus on the biological priorities indicated by the updated NOAA analyses under the BiOp remand.

Hatchery Strategy 1: Implement a Safety-net Program as an Interim Measure to Avoid Extinction

A number of listed salmon and steelhead populations in the Columbia Basin may be at particularly depressed levels, with some facing a high risk of extinction. A safety-net project designed to intervene with artificial production techniques may be appropriate to prevent extinction of these populations while the factors responsible for the population decline are addressed.

Hatchery Strategy 2: Reduce Potentially Harmful Effects of Artificial Production to Aid Recovery

Hatchery Substrategy 2.1: Develop Hatchery and Genetic Management Plans (HGMPs)

Hatchery operations and hatchery-origin fish may have negative impacts on listed stocks of salmon and steelhead. The HGMP development process will allow us to determine qualitatively whether a hatchery or facility can contribute to recovery of a listed species through the modification of existing practices or facilities.

Hatchery Substrategy 2.2: Reduce Negative Impacts of Artificial Propagation

Reducing negative impacts of artificial propagation may increase survival of listed populations.

5. Harvest Strategies and Substrategies

Harvest reform measures have the potential for immediate benefits to listed ESUs, including enabling continued tribal and non-tribal harvest of stronger stocks. The Action Agencies' harvest strategies seek to improve adult life-stage survival through measures that will directly or indirectly reduce the take of listed species in the near-term and will advance harvest reforms, for application over the longer term.

Harvest Strategy 1: Fishery Effort Reduction Programs

Harvest reductions produce immediate increases in spawning escapement, thereby reducing the near-term risks of extinction more quickly and certainly than other conservation actions.

Under this strategy, the Action Agencies would continue to pursue opportunities for reducing harvest impacts on listed species consistent with the 2000 BiOp related conservation recommendations. These opportunities may include agreements that reimburse commercial harvesters for reducing their catch or for not fishing – thus, creating increased abundance that can be passed through other fisheries to the spawning grounds.

Harvest Strategy 2: Potential Alternative/Terminal Fishing Locations

Fisheries can be located in areas that minimize the harvest of non-target stocks to the extent possible, subject to various constraints. Terminal fisheries can in some cases provide alternative harvest opportunities to mixed stock fisheries.

Under this strategy, the Action Agencies would address potential alternative/terminal fishing locations depending on interest from fisheries managers.

Harvest Strategy 3: Develop Fishing Techniques to Enable Fisheries to Target Non-listed Fish While Reducing Harvest-related Mortality on ESA-listed Species

The most likely and immediate source of relief from tight harvest restrictions lies in achieving greater catch selectivity, either through use of more selective fishing gear or by expanding fishing opportunities in known-stock, terminal areas (All-H Paper, Vol. 2, pg. 38, 39, 48). We can determine mortality rates on fish released from live capture gear and hold them within acceptable levels.

E. ESU Specific Actions

Based on the strategies and substrategies previously described, this section includes the Action Agencies' proposed actions to benefit specific ESUs. These actions would contribute to filling the ESU specific survival "gaps" identified in NOAA's revised jeopardy analysis. Also included in this section are the Action Agencies' conservation actions and measures that would benefit ESUs, but are not part of the UPA and should not be included in NOAA's jeopardy analysis.

The Action Agencies propose the actions in this UPA for the duration of the BiOp issued at the end of this consultation. In the event of reinitiation of consultation, the Action Agencies will consider whether to retain and continue protection and maintenance of actions that they are implementing or have implemented.

1. Proposed Actions That Would Benefit Multiple ESUs

The actions described in this section generally benefit all ESUs.

Figure 3 displays the Action Agencies array of actions that contribute to filling the survival "gaps" for most or all of the listed ESUs affected by the FCRPS.

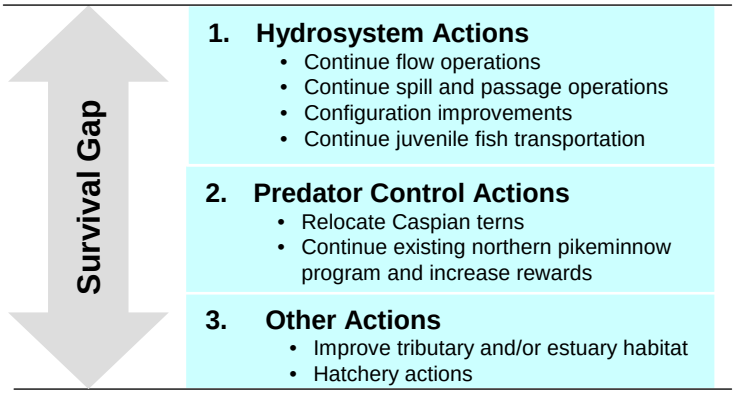

Figure 3 Proposed actions to benefit multiple ESA-listed ESUs

Hydrosystem Actions

The following major actions have varying potentials to affect listed ESUs in the Columbia River Basin. We note that the population effects on ESUs vary widely and may change due to different actions. We would expect the impact on specific stocks to vary inversely with the total distance traveled to that point and the potential for specific stocks to be transported. For example, a change in spill at Bonneville Dam has the potential to impact Snake River juvenile fall Chinook. However, because few fish are left inriver to migrate, the impact of the change is not the same as it might be for lower Columbia River coho.

Table 1 summarizes the specific ESUs benefited by the following groups of actions.

Table 1. ESUs Benefited by Proposed Hydrosystem Actions

	FLOW OPERATIONS	SPILL & PASSAGE - LOWER COLUMBIA	SPILL & PASSAGE - LOWER SNAKE	CONFIGURATION IMPROVEMENTS - LOWER COLUMBIA	CONFIGURATION IMPROVEMENTS- LOWER SNAKE	JUVENILE FISH TRANSPORTATION
Upper Columbia Spring Chinook	x	x		x		x
Upper Columbia Steelhead	x	x		x		x
Snake River Spring/Summer Chinook	x	x	x	x	x	x
Snake River steelhead	x	x	x	x	x	x
Snake River Sockeye	x	x	x	x	x	x
Snake River Fall Chinook	x	x	x	x	x	x
Mid-Columbia Steelhead	x	x		x		x
Lower Columbia Chinook	x	x		x		
Lower Columbia Steelhead	x	x		x		
Columbia River Chum	x	x		x		
Upper Willamette Chinook	x					
Upper Willamette Steelhead	x					
Lower Columbia Coho	x	x		x		

The dates provided below for the hydrosystem actions, including studies, development and implementation, are planning dates and may change based upon the results of on-going research and regional coordination. Any changes will be coordinated through the annual implementation planning process. Most of the actions described below will occur within the 2005-2010 period. The operations will continue, as described, through 2014 and the planned construction and evaluation of improved bypass systems such as removable spillway weirs (see RSW and BSG, below) will continue until 2014.

Flow Operations. Operations for the delivery of water through the FCRPS will benefit all of the listed ESUs.

Spill and Passage Operations in the Lower Columbia. Lower Columbia River spill and passage operations will benefit all fish originating upstream of Bonneville Dam and those fish that use the mainstem for spawning and rearing downstream of Bonneville Dam. Considering TDG, the spill operations may also include a minor impact on the Willamette stocks as well.

Spill and Passage Operations in the Lower Snake. Lower Snake River spill and passage operations will benefit all fish originating upstream of Ice Harbor dam and those fish that use the mainstem for migrating, spawning and rearing downstream of Ice Harbor. Considering TDG, the spill operations may also include a minor impact on the upper and mid-Columbia stocks as well.

Configuration Improvements. The Corps will complete the extended submerged intake screen systemwide letter report and implement recommended improvements, as coordinated with NOAA Fisheries. Configuration modifications of the lower Columbia River dams will benefit all fish originating upstream of Bonneville Dam. Because adult chum salmon migrated upstream of Bonneville in 2003, this stock was also included. Configuration modifications of the lower Snake River dams will benefit all fish originating upstream of Ice Harbor Dam.

The Corps will complete investigation of fish performance and engineering issues including improved porosity-control panel and panel connection design, debris handling, vertical barrier screen (VBS), gatewell cleaning and inspection measures for Bonneville, and John Day dams and implement them, as appropriate.

Juvenile Fish Transportation. The juvenile fish transportation operations will benefit all stocks of fish originating from upstream of Lower Monumental in the spring and from upstream of McNary Dam in the summer.

Mainstem Juvenile Passage Improvements. The Action Agencies will continue to evaluate and make capital improvements to improve fish passage survival rates as guided by the 2000 BiOp RPA actions. We will generally give schedule and funding priority to improvements at dams where the passage survival rates are lowest. To accomplish this, the Action Agencies will develop comprehensive passage improvement plans for each passage dam. These plans will guide future configuration investments and help hydrosystem operations meet the hydrosystem passage survival targets and standards included in the 2000 BiOp (see Tables 9.2-3, 9.7-5 and Table D4 of the 2000 BiOp).

Key Alternatives Under Development

Below we summarize major improvements at each dam that we are considering or anticipating as Key Alternatives Under Development. We are still developing passage plans and evaluating alternatives. Thus, at this point, we generally cannot specify the ultimate configuration (and related operational) recommendations at each project. We will compare biological effectiveness and costs to determine the optimum configuration and operation at each project that will contribute to achievement of performance requirements.

Bonneville Dam. We will continue to consider the 1st powerhouse alternatives to provide additional improvement to passage conditions. With continued 2nd powerhouse priority and current BiOp spill levels these could provide a modest survival improvement for spring/ summer chinook and steelhead migrants. These alternatives also have the potential to allow reduction of spill levels while maintaining current passage survival for all ESUs. For 2004 operations, the existing standard length screens were pulled and fish now pass through the turbines (with a priority for operating the new minimum gap runner (MGR) turbines) or the existing sluiceway. Upon completion of the adult fallback evaluation/analysis at Bonneville Dam, the Action Agencies will use the information to optimize passage conditions for both juvenile and adult fish to meet performance standards.

1st Powerhouse surface bypass (sluiceway improvements): The Corps began to evaluate sluiceway passage efficiency and survival in 2004. We are investigating improvements in the sluiceway as a lower cost surface bypass alternative to bypass system improvements and deep-slot surface bypass. At the time

of release of the Bonneville Decision Document, only a preliminary calculation of potential benefits for spring/ summer chinook based on assumptions was conducted. As reported in that document, a combination of survival and efficiency improvements in higher flow years could provide a 0.2% project survival improvement. As indicated, evaluations of the current sluiceway passage parameters are just getting underway and better survival and efficiency data is forthcoming. (2007)

1st Powerhouse FGE, bypass system improvements and outfall relocation: The Corps has been evaluating this alternative in parallel with surface bypass alternatives over several years. Designs for the bypass improvements and outfall relocations have been completed and could be implemented quite quickly. Prototype extended length screen tests have shown potential fish guidance efficiency (FGE) improvements from 39% existing to 72% for spring/summer chinook, 41% existing to 85% for steelhead, and 9% existing to 35% for fall chinook. As reported in the Bonneville Decision Document, when combined with an improvement in survival to 98% through this route from 90% for the first two ESUs, the alternative is estimated to have the potential to provide a project survival improvement of between 0.3% and 0.6% for spring/summer chinook, 0.4% and 0.7% for steelhead based on a weighted average flow year, with higher values in high and medium flow years. For fall chinook with a route specific survival improvement from 82% to 98%, project survival was estimated to improve 0.0% to 0.3% only in high flow years. We will also investigate and construct as warranted vertical barrier screen cleaning and gatewell debris removal facilities and real time gatewell flow mechanisms. (2010)

***2nd Powerhouse FGE and bypass improvements*:** This alternative has the potential to provide a small increment of survival benefit for all migrants. The Corps continued to test a prototype of the guidance modifications in 2004, which now is being tested with the new corner collector operational. The analysis presented in the Bonneville Decision Document reports a potential 0.1% to 0.3% project survival improvement for all ESUs, with FGE improvements from 48% existing to 60% for spring/summer chinook and steelhead and 28% existing to 40% for fall chinook. The effect of the new corner collector operation on guidance into the bypass system may be an important factor in determining the benefit of this alternative (2008).

The Corps and BPA will assess and implement where feasible, less-intrusive, PIT-tag interrogation methods at Bonneville dam. The Corps is also considering other passage improvements at Bonneville, including full flow PIT-tag detection capability, which is anticipated to help reduce stresses and thereby potentially benefiting juvenile passage issues such as "extra" mortality (2007). Concerns with orifice passage at the 2nd Powerhouse is also an issue that has been raised and we will investigate orifice passage improvements (2010).

The Dalles Dam. The Action Agencies, in coordination with the Regional Forum, are developing a planning document that will present a strategy for carrying out fish passage improvement actions at The Dalles Dam. This plan will consider the alternatives listed below, as well as some additional alternatives, such as turbine intake screens. In addition, the plan will look at all alternatives under a range of flows and project operating conditions.

***Additional spillway modifications*:** With the addition of the spillwall at The Dalles Dam in 2004, we anticipate that survival of juvenile salmonids passing the spillway could be as high as 98%. If spillway survival estimates from 2004 research indicate that spillway survival is less than 98%, we will likely pursue other spillway improvements to achieve the targeted 98% spillway survival. Current baseline passage efficiency for the spillway under 2000 BiOp spill is 86%, with a remaining 8% passing through turbines and 6% passing through the sluiceway during the spring. During summer with 2000 BiOp spill; passage estimates are 74% for the spillway, 19% for turbines and 7% for the sluiceway. Assuming a spillway survival rate of 98% with the passage distribution estimates listed above, overall project survival could increase by as much as 4% for both spring and summer migrants (2007).

***Forebay guidance device*:** If spillway modifications to improve spillway survival are unsuccessful, reducing spill below 2000 BiOp levels is an alternative that might help improve spillway egress and reduce injury, thereby improving spillway survival. One potential drawback to reducing spill at The Dalles is that a corresponding reduction in spillway passage would likely occur. One alternative that could help maintain spill passage, yet allow spill levels to be reduced is a forebay guidance device. A behavioral guidance structure (BGS) placed in the forebay at Lower Granite Dam demonstrated that approximately 80% of downstream migrants that may have otherwise passed through turbines or the juvenile bypass system were diverted by the BGS to either surface bypass collector or spillway routes. A similar structure placed in The Dalles forebay may be used to maintain or improve project survival under reduced spill scenarios. Outlined below are possible theoretical survival benefits that a forebay guidance structure may provide under existing or reduced spill scenarios (2007).

- *30% Spill Scenario with Forebay Guidance Device:* Assuming a spring fish passage efficiency (FPE) of 76% (spill passage = 61%, turbine passage = 24%, and sluice passage = 15%,) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) FPE during the spring with 30% spill and a forebay guidance device could be as high as 92.2%, resulting in an overall project survival increase of up to 2% for spring migrants. During the summer, assuming an FPE of 64%, (spill passage = 54%, turbine passage = 36%, and sluice passage = 10%,) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) summer FPE with 30% spill and a forebay guidance device could be as high as 90.8%, resulting in an overall project survival increase of up to 3% for summer migrants.

- *20% Spill Scenario with Forebay Guidance Device:* Assuming a spring FPE of 52.9% (spill passage = 24%, turbine passage = 47.1%, and sluice passage = 28.9 %, (assuming same sluice/turbine proportion as 30% spring spill)) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) spring FPE with 20% spill and a forebay guidance device could be as high as 84.8%, resulting in an overall project survival increase of up to 5% for spring migrants. During the summer, using an estimated FPE of 40.7% (spill passage = 24%, turbine passage = 59.3%, and sluice passage = 16.7 %, (assuming same sluice/turbine proportion as 30% summer spill)) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) summer FPE with 20% spill and a forebay guidance device could be as high as 84.8%, resulting in an overall project survival increase of up to 2% for summer migrants.

***Sluiceway guidance efficiency modifications*:** Increasing the passage efficiency of the sluiceway, either by modifying gate entrance configurations or increasing overall sluiceway capacity (or a combination of both), may also offer project survival benefits at The Dalles Dam. Using current spring passage estimates of 86% spill passage, 8% turbine passage, and 6% sluice passage, and route specific survival estimates of 94% spillway survival, 84% turbine survival, and 95% sluiceway survival, increasing sluiceway passage efficiency by 5% and decreasing turbine passage by 5%, could increase project survival by up to 1% under 2000 BiOp spill (2010).

***Sluiceway outfall relocation*:** Project survival could increase by as much as 1% assuming a sluiceway survival of 99% could be achieved by moving the sluiceway outfall downstream under 2000 BiOp spill and assuming spring passage estimates of 86% spill passage, 8% turbine passage, and 6% sluice passage (2010).

Turbine Survival Improvements: The Action Agencies will be evaluating turbine operation and geometry as a way to increase survival. The effort will employ a biological index test strategy (BIT) to examine both the internal turbine environment as well as the effects turbines have on tailrace egress. The

anticipated result of this work is at least a 1% increase in turbine survival for spring and summer juvenile salmonid migrants.

***Adult PIT Tag Detectors*:** Adult PIT tag detectors are being considered for The Dalles to facilitate evaluation of unaccounted losses in the lower river. (2014 as warranted)

John Day Dam. The Action Agencies, in coordination with the Regional Forum, are developing a planning document that will present a strategy for carrying out fish passage improvement actions at John Day Dam. Recent survival estimates of fish passing through turbine units and, under some operations, the juvenile bypass system suggests that there is good potential for additional survival improvements at this project. The Action Agencies have explored a number of alternatives to reduce the proportion of fish passing through turbine units, including extended-length turbine intake screens, surface flow bypass systems, and surface spill options. These alternatives, along with new alternatives to improve tailrace and turbine passage conditions will be analyzed in the context of the most recent passage research. In addition to these alternatives, provision of full-flow PIT tag monitoring capability, as discussed in the Bonneville section, is planned.

Adult PIT tag detectors: Adult PIT tag detectors are being considered for John Day to facilitate evaluation of unaccounted losses in the lower river. (2010)

Tailrace egress improvements: Survival and tailrace egress data from 2002 and 2003 showed that tailrace egress from the juvenile bypass system (JBS) to an exit station downstream took twice as long for yearling and subyearling chinook salmon under a 60% spill operation compared to egress under 30% spill. Many of the egress study fish tracked under the 60% spill condition moved into a large eddy that forms just downstream of the skeleton bays at the north end of the powerhouse. At the same time, survival estimates for fish passing the JBS, turbines, or powerhouse (JBS and turbines combined), were approximately 3% to 10% higher for yearling and subyearling Chinook passing under 30% spill than for those passing under 60% spill. It is likely that the higher survival estimates of fish passing during 30% spill was due to improved tailrace egress and therefore reduced exposure to predators.

Alternatives to improve tailrace egress could include a spillway divider wall (a wall dividing the powerhouse from the spillway), turbine operation improvements, relocation of the JBS outfall, additional turbines in the skeleton bays, surface bypass in the skeleton bays (discussed separately below) or a combination. Based on the egress and survival studies at John Day Dam, turbine survival estimates from other FCRPS dams, and the survival improvements achieved with the JBS outfall relocation at Bonneville Dam's Powerhouse II, yearling Chinook turbine and JBS survival is estimated to increase 3%. Subyearling Chinook survival is estimated to increase 5% for the JBS and 8% for turbines. The increase in overall dam survival rates with these improvements would be 1.3% for yearling Chinook and 2.7% for subyearling Chinook.

***Surface bypass skeleton bays/RSW/behavioral guidance device*:** The concept of these alternatives is to divert a proportion of turbine-bound fish to the spillway. In addition, the skeleton bay bypass alternative may improve tailrace egress by eliminating the eddy that currently forms below the skeleton bays. None of the structures have been prototype-tested at John Day Dam. It is assumed that none of these alternatives alter spillway survival from that of the baseline, but some combination will increase spill passage efficiency (SPE) and FPE. Using route-specific survival estimates collected under the 2000 BiOp spill operation for yearling Chinook (spill S = 97.1%, turbine S = 79.9%, JBS S = 96.5%) and a 24-hour spill operation for subyearling Chinook (spill S = 95%, turbine S = 72%, JBS S = 92%) and 2003 passage distribution estimates as the baseline, the survival increase for skeleton bay or RSW was estimated based on a range of SPE from 70% to 80%. Yearling Chinook dam survival increases range from 0.7% to 1.2% with implementation of RSW(s) or skeleton bay surface bypass. Subyearling Chinook dam survival

increases from 1.5 to 3.3% (2010).

***Extended length screens*:** Based on FGE estimates from 2002 fyke net studies and using route-specific survival estimates collected between 2000 and 2003 (same estimates as used above), extended length screens are estimated to increase dam survival by 0.7% for yearling Chinook and 2.6% for subyearling Chinook.

Turbine survival improvements: Recent study results have identified John Day turbines as having among the lowest juvenile fish passage survival rates in the FCRPS. The Action Agencies will be evaluating turbine operation and geometry as a way to increase survival. The effort will employ a biological index test strategy (BIT) to examine both the internal turbine environment as well as the effects turbines have on the overall tailrace (see tailrace improvements above). The anticipated result of this work is at least a 1% increase in turbine survival for spring and summer juvenile salmonid migrants.

McNary Dam.

***Powerhouse modernization*:** Evaluation of juvenile passage effects and opportunities for improvement will be a significant consideration in developing a long term plan to enhance power production at this project and improve direct and indirect turbine passage survival. Given a conservative estimate, direct turbine survival is anticipated to increase by 1 to 2%. The additional survival benefits anticipated with improvements to the tailrace hydraulic environment will not likely be achieved without a change in the current level of spill (both voluntary and involuntary) at McNary Dam (2010).

***RSW and BGS*:** The RSW already in operation at Lower Granite is estimated to have a passage effectiveness of 7:1 (6:1-8:1) and route specific survival estimate of 98 % (96 –100%). Two RSWs will be considered for this project to enhance spillway passage survival under reduced spill levels that result from powerhouse modernization, and/or to reduce costs of passage. At Lower Granite the RSW has been shown to pass similar numbers of juvenile spring migrants with less spill and thereby lower levels of gas entrainment than current 2000 BiOp (gas cap) spill and with reduced forebay delay. The application of two RSW at McNary spillway are anticipated to have passage effectiveness of 3.5:1, and route specific survival is estimated to remain 98% over a range of flows. Guided by results from tests at Lower Granite, a BGS may be considered in conjunction with RSW's to assess their potential contribution to effective fish passage and survival. Based on studies conducted at Lower Granite, the BGS efficiency is estimated to be 78.00% (60%-90%) for yearling Chinook and steelhead at McNary. No subyearling Chinook are spilled in the proposed summer operation at McNary.

***Juvenile fish facility improvements*:** Bypass improvements to the juvenile fish facility include relocation of the outfall pipe to improve egress conditions at the release site for juvenile salmon (2007). Combined survival improvements under the proposed operation for bypassed fish is expected to increase 2.5% for Snake and Columbia River Chinook and steelhead. Subyearling chinook are transported and are not bypassed to the tailrace. We will also investigate and construct as warranted vertical barrier screen cleaning and gatewell debris removal facilities and real time gatewell flow mechanisms. (2010)

***Improvements in spillway survival*:** Construction of a powerhouse divider wall was evaluated to provide a 0.5% total spillway survival benefit for yearling chinook and steelhead at McNary Dam due to increased egress conditions in the tailrace. (2010)

***Changes in project survival*:** Analysis of the proposed operation with all combined construction improvements at McNary Dam is estimated to increase project survival by 1.1% for yearling Chinook, 1.1% for steelhead, and 1.6 % for subyearling Chinook.

The relative benefits of in-river versus transport passage strategies will be a key consideration in recommendations to implement these improvements and their uses in future project operations. The Major System Improvements Analysis process will be the avenue for reaching recommendations for configuration and operations at this project.

Ice Harbor Dam. Spillway improvements tests in 2004 continue to evaluate spillway operations to assess causal mechanisms for injury and survival issues to assess what, if any, additional measures in addition to the RSW will be recommended. The RSW is under construction at this project and will be in operation in 2005. Tests will continue after installation to confirm any potential recommendations. After initial testing of the effectiveness of the RSW in 2005, and guided by results from tests at Lower Granite, evaluation of the benefit of installation of a BGS at this project will be conducted. BGS efficiency at Ice Harbor is estimated to be similar to the level of performance documented at Lower Granite, 78% (60%-80%).

***Spillway Improvements*:** Improvements for spillway survival under evaluation include adding divider walls with an assumed 0.5% increase in spillway survival (2008-2009 as warranted), and modification or relocation of spillway deflectors have potential to increase spill survival by 3% (2010 as warranted).

***Powerhouse Improvements*:** Items under evaluation include extended length screens which divert greater number of fish away from turbines and are assumed to increase current FGE values by 12% based on the change in FGE documented at Little Goose and Lower Granite after the implementation of extended screen for all species increasing yearling Chinook and Steelhead FGE to 82%, and subyearling Chinook 66%, respectively. The analysis for the reference alternative assumes an improvement of 1% increase in survival for a change in turbine operation based on biological testing, and a 2% improvement in total turbine passage (direct and indirect survival) with construction of a divider wall.

***Change in project survival*:** Analysis of the proposed operation with all combined construction improvements at Ice Harbor dam is estimated to increase project survival by 1.4% for both Snake River yearling Chinook and Snake River steelhead, and 0.9 % for Snake River subyearling Chinook.

Lower Monumental Dam.

***RSW and BGS*:** See the discussion under McNary, above, regarding potential RSW and BGS measures and project operations. RSW passage survival is estimated to be 98% (96-100%) and have passage effectiveness of 7:1 for all species. The BGS guidance efficiency at Lower Monumental is estimated to be similar to the level of performance documented at Lower Granite, 78% (60-80%) for Snake River yearling Chinook and steelhead. No Snake River subyearling Chinook are spilled under the proposed summer operation at Lower Monumental.

***Spillway improvements*:** Improvements for spillway survival under evaluation include adding divider walls to improve tailrace egress (2010 as warranted). This is assumed to provide a 0.5% increase in spill survival for yearling Chinook and steelhead. Other improvements to the spillway, including modification or relocation of spillway deflectors, have been estimated to provide a 1% survival benefit to yearling Chinook and steelhead passing through the spillway. Subyearling Chinook are not spilled in the summer under the proposed operation.

***Improvements to the juvenile fish facility*:** Because all fish entering the juvenile fish facility are transported under the proposed operation no fish are bypassed to the tailrace in spring or summer.

***Powerhouse improvements*:** Items under evaluation include extended length screens which divert greater number of fish away from turbines and are assumed to increase current FGE values by 12% based on the

FGE benefit documented at Little Goose and Lower Granite, resulting in an increase in FGE for Snake River yearling and subyearling Chinook to 61% (57-92%), and Snake River steelhead to 94% (70-100%), respectively. The analysis for the proposed alternative assumes an improvement of 1% increase in survival for biological index testing which may lead to operational changes on turbines, a 2% improvement in total turbine passage (direct and indirect survival).

***Changes in project survival*:** Analysis of the proposed operation with all combined construction improvements at Lower Monumental dam is estimated to increase project survival by 2% for Snake River yearling Chinook, 1.4% for Snake River steelhead, and 1% for Snake River subyearling Chinook.

Little Goose Dam.

***RSW and BGS*:** See the discussion under McNary, above, regarding potential RSW and BGS measures and project operations. Spillway passage survival would not be expected to change with construction of an RSW and passage effectiveness is estimated to be 7:1 for all species. The BGS guidance efficiency at Little Goose is estimated to be similar to the level of performance documented at Lower Granite, 78% (60-80%) for Snake River yearling Chinook and steelhead. No subyearling Chinook are spilled in the proposed summer operation at Little Goose.

***Spillway improvements*:** No new information exists since the spill survival estimates were developed for the 2000 BiOp. The current estimated spillway survival value for Little Goose is 100%; thus construction items associated with improving spillway survival not estimated to provide a benefit.

Improvements to the juvenile fish facility: Because all fish entering the juvenile fish facility are transported under the proposed operation no fish are bypassed to the tailrace in spring or summer.

***Powerhouse improvements*:** The analysis for the proposed alternative assumes an improvement of 1% increase in survival for all species as result of biological index testing which may lead to operational changes on turbines. A 2% improvement in total turbine passage (direct and indirect survival) for all species is estimated with the construction of a divider wall.

***Changes in project survival*:** Analysis of the proposed operation with all combined construction improvements at Little Goose dam is estimated to slightly increase project survival for Snake River yearling Chinook steelhead and increase project survival by 1% for Snake River subyearling Chinook due to the projected turbine improvements. RSW operation is project survival neutral in this analysis, however there is a lack of information on spill survival at Little Goose Dam. The current spill survival estimate is 100% (2000 BiOp, best professional judgment).

Lower Granite Dam.

***BGS*:** The BGS guidance efficiency at Lower Granite has been evaluated and estimated to have guidance efficiency of 78% (60-80%) for all species. Implementation of a BGS with the RSW at Lower Granite will divert 28% of the Snake River yearling chinook and 30 % of the Snake River steelhead from transport to passage through the RSW for an in river passage migration. No Snake River subyearling Chinook are spilled under the proposed summer operation at Lower Granite.

***Spillway improvements*:** Improvements for spillway survival under evaluation include modification or relocation of spillway deflectors with potential to increase spillway survival by 0.5% for yearling Chinook and steelhead (2010 as warranted).

***New juvenile fish facility*:** Because all fish entering the juvenile fish facility are transported under the

proposed operation no fish are bypassed to the tailrace in spring or summer. Transportation improvements are discussed below.

***Powerhouse improvements*:** The analysis for the proposed operation assumes a turbine survival improvement of 1% (direct and indirect) for all species if operations are changed in response to biological index testing.

***Change in project survival*:** Analysis of the proposed operation with all combined construction improvements at Lower Granite dam is estimated to increase project survival by 0.8% for Snake River yearling Chinook, 0.6% for Snake River steelhead, and 1.0% for Snake River subyearling Chinook.

Chief Joseph Dam Spillway Deflectors. Installation of spillway deflectors is underway with completion planned for 2007/2008. Spillway performance would be evaluated by 2009 and results included in the SYSTDG model by 2010.

Transportation. The Action Agencies propose to continue increased summer barging through August 15. Continued research and monitoring will provide information to develop a long-term transport program to benefit summer migrating species. We are planning research to examine the effect of transport on both ESA listed and non-listed juvenile fall Chinook. We will adaptively manage activities with consideration of in-season fish migration conditions and research results and, the transportation strategy that best contributes toward achievement of the total system survival performance standard.

***Modified initiation of transport*:** The Action Agencies will continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental and McNary dams. However, rather than beginning transport in accordance with the 2000 BiOp and the associated NOAA Fisheries Section 10 permit, we would initiate transport based on seasonal flows as follows:

In years when the seasonal average Snake River flow at Lower Granite is expected to be less than 70 kcfs, maximization of transportation will occur from the date the JBSs begin operation. Due to the mixed benefits of early season transport, however, collection for transport will not be initiated until April 20 in all years where average seasonal flows are expected to equal or exceed 70 kcfs. Prior to April 20, all collected fish will be bypassed back to the river. In those years where flows are anticipated to be between 70 and 85 kcfs, spill will be provided at the collector projects until April 20. Further investigations of spill patterns (e.g. large gate openings/bulk spill) that provide optimum spillway survival conditions in these lower flow conditions will be coordinated through the FFDRWG.

	< 70 kcfs	**70-85 kcfs**	**> 85 kcfs**
Transport	Maximize	Initiate Collection April 20	Initiate Collection April 20
Bypass	None	Bypass Through April 19	Bypass Through April 19
Spill	None	Spill Through April 20	Spill (Table 4)

Using the smolt index at Lower Granite as reported for 1994-2003 (Columbia River Dart), a change in the initiation of transport to begin collection on April 20 has the potential to affect on average 9.0% (range 1.2- 15.4%) of the Snake River yearling Chinook run (all stocks combined) and an average 4.6% (range 0.2-11.1%) of the juvenile steelhead run (all stocks combined). A potential change in SARs during this time period of possibly 50% (-40% to +400%) could be realized for spring/summer Chinook but little to no increase would be expected in steelhead survival (-46% to +35%). These estimates are based on weekly SAR data from a NOAA-Fisheries memo (from Paul Wagner to Jim Ruff June 18, 2004).

Anderson et al 2004 reported that the benefits to in river passage versus transport reversed at water temperatures at the Lower Granite Water Quality forebay of about 9°C. As a point of reference, the average daily water temperature met or exceeded 9˚C on April 20 in 7 of the 9 available data years between 1995 and 2004.
Improvements to increase adult salmon returns through the juvenile fish transportation process are being evaluated. These improvements include additional barges, a new juvenile fish facility at Lower Granite and improvements to the juvenile fish facilities at Little Goose, Lower Monumental and McNary Dams.

***Additional barges*:** Post release survival of juvenile fish transported to the estuary are anticipated to increase in direct response to the addition of barges because of the improve holding conditions provided by the reduction to holding densities and the ability to maintain mixed species separation. Additional barges are also anticipated to increase the flexibility of the operation process to allow for optimization of the barge release timing and location. This flexibility will allow releases to be designed to take advantage of outgoing tidal cycles and to avoid areas of heavy avian predation through nighttime releases and release locations that result in migration paths that avoid eddies near avian colonies. New barges are estimated to increase the "D" value for all transported species ("D" is estimated to increase by .05 [0-0.10] for yearling Chinook, and steelhead and .03 [0-.07] for subyearling Chinook).

***New and improved juvenile fish facilities*:** Improvements to the juvenile fish facilities at Lower Granite include a new unpressurized transport pipe, a new dewatering structure, the addition of species separation, increased raceways capacity and additional direct barge loading capabilities. The cumulative effects of these modifications are expected to reduce stress and injury caused by the collection and holding process. Reduction to chronic stress and suppressed immune functions will increase long-term survival probability. For Snake River yearling Chinook, steelhead and subyearling Chinook transported from Lower Granite, the change to differential delayed mortality is estimated to increase "D" by .025 (0-.05), .01 (0-0.02), and 1% (0-2%), respectively (2010).

Improvements to the juvenile fish facilities at Little Goose, Lower Monumental and McNary Dams vary among projects but are focused on improvements to species separation, reduced holding densities, improved barge loading and expanded direct loading capabilities. Survival improvements estimated for the fish transported from each of these projects are 1% (0-2%) yearling Chinook, 1% (0-2%) for steelhead and 0.75% (0-1.5%) subyearling Chinook.

***Total transport survival*:** The anticipated benefits of the proposed improvements to the transport program is expected to increase total transport survival including differential delayed mortality by 5.1% for yearling Chinook, 5.1% for steelhead, and 4.6% for fall chinook.

It should be noted that implementation of the maximum enhancements at all the projects directs 46.4% of the yearling chinook and 47.4% of the steelhead from transport to in river passage. This change is a direct result of an implementation of RSWs and BGSs at all the transport projects. As a consequence the total system survival *decreases* by 1.7% for yearling chinook and *decreases* by 2.6% for steelhead. Although transport survival increases with the planned transport improvements, the resulting survival of the fish redirect from transport to in river passage is insufficient to make up the difference in survival. Total system for subyearling chinook is estimated to *increases* by 3.2% if transport actions are implemented.

Spillway Tailrace Erosion. The Action Agencies are developing plans to evaluate and monitor tailrace erosion in response to voluntary spill for juvenile fish passage. The current operations are substantially different than the spillways were originally designed for. (2005)

Measures that Address Total Dissolved Gas (TDG) and Temperature. The Action Agencies will continue development and implementation of water quality improvement measures to enhance juvenile and adult fish survival and mainstem spawning habitat. This includes actions as identified in the comprehensive *Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers* that will make further progress towards meeting water quality standards for TDG and water temperature. Other measures would include continued water quality monitoring in the mainstem rivers, performing the necessary quality assurance and control to ensure accurate measurements and sharing this information on a real-time basis. Other measures would include performing and developing the necessary modeling efforts (including SYSTDG) in both the proposed action area and conjoining areas to make the best in-season management decisions for operating the river and implementing voluntary spill to improve fish passage and survival. The Action Agencies will continue to refine the SYSTDG model and its use as a river operations management tool. SYSTDG applications and results will be coordinated through the Water Quality Team, the TMT, Transboundary Gas Group and the Mid-Columbia Public Utility Districts.

***Total dissolved gas measures*:** The Action Agencies have worked with a Water Quality Team subcommittee on a systematic review of the forebay fixed monitoring sites (FMS). Changes at some sites have been implemented. Review and evaluation of forebay fixed monitoring stations at McNary Dam and the Snake River projects was initiated during the 2003 spill season and continued during the 2004 spill season. Alternative monitor locations were evaluated and compared to the existing FMS station. Findings and recommendations for more representative alternate forebay FMS locations will be presented to the WQT in October 2004, and recommendations that are adopted by the Action Agencies will be implemented.

The Corps will continue to monitor and prepare an annual report of the physical monitoring program for TDG, and will continue to coordinate the annual reporting of biological monitoring by the Fish Passage Center. The reports will be sent annually to the Oregon DEQ and Washington DOE. The program currently consists of forebay and tailwater monitoring stations, along with a few locations in free-flowing reaches. The use of back-up monitors and quality assurance/quality control (QA/QC) program have been implemented.

We have recently installed spillway flow deflectors to reduce total dissolved gas levels at most mainstem dams and plan to install end bay deflectors at Little Goose Dam. At various projects, we will consider spillwalls to reduce TDG supersaturation of powerhouse flows and to increase survival of juvenile migrants. Spillwalls may be necessary concurrent with spill reducing measures such as RSW's. RSWs, BGSs, or similar devices also can reduce gas entrainment through reduced spill while maintaining or improving juvenile passage survivals. We will continue research to determine water temperature effects on both juvenile and adult salmonids and implement solutions where appropriate.

The Corps and BPA will continue the evaluation of gas abatement options at Libby Dam. A comprehensive set of alternatives (including flow deflectors) for passing additional flow at Libby, and their respective TDG and temperature implications, are currently being evaluated. Installation of one or two additional units was examined and determined not to be a reasonable near term option. The Corps and BPA are currently consulting with the USFWS on the effects of Libby Dam operations on Kootenai River white sturgeon. Gas abatement options are being discussed in this consultation.

***Temperature measures*:** A temperature study that included the Columbia River upstream of McNary Dam, trash racks, gatewells, and draft tubes was completed in 2004. A computational fluid dynamics (CFD) model of the hydrodynamics and thermal characteristics of the project is currently under development and will be completed in 2005. Similarly, a report that examines the spatial and temporal characteristics of the 2004 temperature dataset, along with a comparison to historical information, will

also be completed in 2005. The model and this information will be used to investigate optimal powerhouse operations or structural modifications for minimizing thermal stress of juvenile salmon collected in the summer.

The Action Agencies have been working with an ongoing Water Quality Team subcommittee since 2001 to develop a plan to model water temperature effects of alternative Snake River operations. The 2001 and 2002 subcommittee work efforts determined the goals of water temperature modeling, investigated and evaluated multi-agency existing data, determined what questions can be answered without modeling, recommended and started additional water temperature and meteorological data collection, and recommended numerical models to be considered. The technical team recommended to the regional WQT that the CE-QUAL-W2 model be adopted for development in the river reaches of interest and identified a data collection strategy. The workgroup proposed to build the model in phases. The initial phase 1 includes the North Fork Clearwater at the mouth, Mainstem Clearwater at Orofino, Upstream Snake River at Anatone to the Downstream Snake River at Lower Granite Dam. Additional phases will include Dworshak Reservoir, and the Snake River up to Brownlee Dam, and down to the confluence with the Columbia River. Phase 1 is scheduled to be complete in 2004. Phases 2 and 3 are scheduled to be completed in 2005 and 2006 respectively.

The Action Agencies will continue to refine the water temperature model and its use as a river operations management tool. The model applications and results will be coordinated with the Water Quality Team and the TMT.

The Action Agencies are continuing to evaluate temperature effects on adult Snake River steelhead and fall chinook of drafting Dworshak Reservoir to 1520 feet elevation and extending the draft period into September. The field evaluations will continue through fall 2004 using temperature and depth-sensitive radio tags to evaluate adult salmon use of cooler waters during their migration upstream of Lower Granite by drafting Dworshak Reservoir. Model runs to evaluate the impacts of cool water releases from Dworshak on temperatures profiles to and through Lower Granite and data analysis will continue through 2005 for the final report in 2006.

Project Configuration RM&E. The Action Agencies will continue a wide range of hydrosystem RM&E studies to evaluate and improve juvenile and adult fish passage survival. This includes research on the effectiveness of spill passage operations, survival through various passage routes, structural improvements and pre- and post-construction evaluations to verify that proposed actions result in improved passage survival over the 2004 operation. Specific examples of ongoing activities are discussed below.

***Juvenile fish passage*:** Improved fish-tracking technologies and computational fluid dynamics (numerical modeling) will continue in association with RSW and BGS development. CFD models are being developed and/or verified for several projects in 2005. CFD models have been developed for Lower Granite and Ice Harbor, and are under development for McNary and Lower Monumental. Evaluations to correlate fish behavior and hydraulics are underway for Lower Granite and Ice Harbor.

Entry rates of fish approaching surface bypass/collector entrances were evaluated at the B2 corner collector, The Dalles sluiceway, and Lower Granite RSW in 2004. Studies to evaluate BGS performance to increase entry rates of the RSW at Lower Granite are planned for 2005. The results of these studies will be assessed and incorporated as new surface collection installations are developed.

High-flow outfall investigations were completed and the results were incorporated into the outfall design for the B2 corner collector. Future investigation will be focused on improved surface bypass, such as the RSW.

Studies investigating 24-hour spill at John Day Dam were completed in 2003, with a final report in 2004. Based on study results, spillway operations were modified to 12-hour spill in the spring and 24-hour spill in the summer, and will continue to be coordinated through the TMT.

The Corps' final report on investigating improved wet separator designs was completed in 2002. Based on regional review of these separator study findings, additional work was recommended to evaluate impacts of fish densities on separation efficiency before considering installation at Lower Granite, resulting in a new study being conducted in 2004. Wet separator designs will be considered at all collector projects, coordinated through the SCT, and implemented as warranted.

***Adult fish passage*:** Field evaluations of adult fish passage improvements including investigation of adult fish delay and fallback, including ladder pool junctions, at various projects were completed in December 2002 with final report in 2003. Design for changes occurred in 2004 for implementation in 2005 at Lower Granite, however, regional priorities at SCT placed this project below the funding level. A schedule for implementation at additional projects will be developed and prioritized through FFDRWG and presented to SCT.

The Corps will continue ongoing studies of adult pacific lamprey to inform salmonid passage issues.

Hydraulic evaluation reports of adult fishway main entrances concerning attraction conditions for various projects will be completed in 2005. Corrective actions will be coordinated through FPOM and implemented as warranted

When funding becomes available, the Corps plans to complete an engineering study to evaluate existing limitations to meeting fish passage plan operating criteria at the John Day Dam north shore ladder. The study will include a design report, which will evaluate alternatives and recommend corrective measures, as warranted.

***Turbine studies*:** The report on the 1st phase of the Turbine Survival Program has been completed. Scoping and initiation of the 2nd phase of the program began in 2004. Phase II will be a multi-year program to address a number of turbine passage issues. Biological index testing of families of units will be initiated, beginning at John Day Dam, with a planning date of 2006 with other projects to follow. Evaluation of draft tubes was initiated in 2002 at McNary as part of the turbine survival program. Tests of a painted turbine will continue at The Dalles in 2003. Consideration of further fish-friendlier technologies will be discussed in the region following results, and state-of-the-art turbine designs will be considered for implementation during current and future powerhouse rehabilitation programs (this does not include emergency repairs or maintenance actions).

Evaluation of adult passage and survival (including steelhead kelts) through turbines will be conducted to better understand the extent and impact of fallback through this route. This evaluation will be coordinated through SCT to help determine the regional priority. Radio tracking studies of adult salmonids have been conducted for several passage seasons. Information from these studies has enumerated the extent of fallback through various passage routes including turbines. Few radio tagged fish have been observed falling back through turbines. Final radio tracking reports will be completed in the 2005 and 2006. Pending results from the studies, the action agencies will collaborate within the regional forum to determine the need and feasibility of additional studies.

Tests for best operating conditions of minimum gap runners have been accomplished at Bonneville and McNary Dams. Schedules for additional efforts, including field tests, will be determined through

development of the Turbine Survival Program Phase II study plan in 2004 and implemented according to future funding priorities for the program.

Implementation Projections. With some notable exceptions, such as the McNary Modernization Project and certain transport studies carried out under O&M, the bulk of the actions or alternatives described in the previous paragraphs are accomplished with funds provided through annual Congressional appropriations for the Columbia River Fish Mitigation Project (CRFMP). The ultimate combination of configuration and operational alternatives remains to be determined through ongoing development of the alternatives, additional RM&E, life-cycle cost estimates and Regional prioritization considerations. Configuration actions include AWS. However, based on a preliminary analysis of potential configuration scenarios and assuming future funding levels would be similar to current levels it is anticipated that the above actions could be completed within the next 10 to 12 years. The survival improvement estimates above suggests that passage improvements at The Dalles, John Day and McNary dams combined with transport improvements would provide the most significant survival benefit under current BiOp operations. With continuing current funding levels, and based on preliminary cost data and prioritization of actions at those projects, it is estimated that improvements at these projects could be completed by 2010.

Configuration Changes. Several configuration changes that focus on improved surface bypass, including RSWs, are planned for design and construction based on the strong regional support for this passage route. Examples include planned installation of an RSW at Ice Harbor in 2005; potential installation at Lower Monumental and Little Goose in 2007 and 2008, or McNary in 2008 and 2009; and a behavioral guidance structure at The Dalles in 2007 to improve guidance through the forebay to the spillbays being used. Actual construction of these features and schedules will be dependent on results of on-going research, regional collaboration and prioritization, and future appropriations. While the order of construction and final configuration may vary, surface bypass improvements are expected to be in place at the eight lower mainstem dams in the next 10 years.

The following are some specific examples of additional configuration changes completed or contemplated at various projects.

- Primary bypass PIT detectors (less-intrusive) were installed at the McNary juvenile fish facility in 2003. Evaluation of primary bypass versus transport is being conducted in 2003-2009 at McNary. Design will begin in 2004 for installation of primary bypass PIT detectors at Ice Harbor (2005), Lower Monumental (2006), and John Day (2005) pending prioritization through SCT. The need for primary PIT tag detectors at Little Goose will be determined by 2006.
- All Corps Portland and Walla Walla District Columbia and Snake River turbine-to-draft tube sections are being inspected during scheduled turbine dewaterings. All obstructions are being identified with any unnecessary items being removed during each turbine units' 6-year overhaul.
- An investigation of additional emergency auxiliary water to The Dalles Dam north fishway was deferred in 2004 due to funding priorities coordinated through SCT. The Corps will investigate the addition of emergency auxiliary water for both fishways at The Dalles, as coordinated through the SCT process. The work will continue as funding priorities allow.
- The Corps has replaced and repaired major aging components of the Bonneville First Powerhouse Bradford Island and Cascade Island adult fishway auxiliary water system and submitted a final report. Engineering reports will be completed in early FY 2005, including identification of any additional major components needing rehabilitation. Implementation will be coordinated through SCT.

- Construction related to auxiliary water supply systems at Lower Granite and Ice Harbor were completed in 2003. Investigations on alternatives for Little Goose and Lower Monumental are continuing, as coordinated through SCT. The intent is to improve long-term reliability.

Reservoir Operations. The Action Agencies will annually implement several FCRPS project operations to benefit fish at or near a given project or its reservoir. These reservoir operations vary by project and include the following:

- minimum recommended project outflows for listed resident fish,
- limited outflow fluctuations to avoid stranding fish,
- lower Snake River reservoirs maintained at or above their minimum operating pool (MOP),
- John Day pool levels in the summer that would allow for irrigation pool, and
- flow augmentation draft and cool water releases to improve downstream water quality.

Table 2 summarizes high priority operations. However, these operations are coordinated through the TMT process and subject to annual adjustment. The Action Agencies will make real time hourly turbine and spill bay operation data available to NOAA Fisheries on a web site during the juvenile passage season. This information will be presented with the same lag time as total hourly generation data.

The Action Agencies will operate Dworshak to attempt to meet salmon flow and temperature objectives as well as state of Idaho TDG water quality standards. The Action Agencies will draft Dworshak to 1520 ft. in September. The extension of the draft limit into September reflects assumed requirements for 200 kaf to be held for release by the Nez Perce Tribe as defined by the final outcome of the Snake River Basin Adjudication process. If this assumption proves to be false, the Action Agencies will revisit this aspect of our UPA, and revise as necessary through the implementation planning process.

Table 2. Project Specific Operations included in the Proposed Action

FCRPS Project	Proposed Action Operation
Libby	• Use interim variable flow (VARQ) flood control criteria. • Variable December 31 flood control curve based on runoff forecast. • Operate to achieve 75% chance of reaching upper rule curve (URC) elevation by about April 10. • Refill by about June 30 each year. • Draft to meet salmon flow objectives during July-August w/draft limit of 2439 ft. by August 31 unless modified to meet the mainstem amendment operation. • Operate to provide tiered sturgeon volumes for spawning/recruitment • Operate to provide bull trout minimum flows • Provide even or gradually- declining flows during summer months (minimize double peak). • Negotiate with Canada annually to try to implement a storage exchange. • Limit spill to avoid exceeding Montana State TDG standards of 110%.
Hungry Horse	• Use interim VARQ flood control criteria. • Maintain minimum flows for bull trout with a sliding scale based on the forecast. • Minimum flows of 3200-3500 cfs at Columbia Falls and 400-900 cfs in the South Fork Flathead River. • Operate to achieve 75% chance of reaching URC elevation by about April 10. • Refill by about June 30 each year. • Draft to meet salmon flow objectives during July-August with a draft limit of 3540 ft. by August 31 unless modified to meet the mainstem amendment operation. • Provide even or gradually-declining flows during summer months (minimize double peak). • Limit spill to maximum of 15% to avoid exceeding Montana State TDG standards of 110%.
Albeni Falls	• Use standard flood control criteria. • Operate to provide kokanee spawning conditions (winter pool levels)

FCRPS Project	Proposed Action Operation
Grand Coulee	• Use standard flood control criteria including adjustments for flood control shifts from Dworshak. • Operate to achieve 85% chance of reaching URC elevation by about April 10. • Refill by about June 30 each year. • Draft to meet salmon flow objectives during July-August with variable draft limit of 1278-1280 ft. by August 31. • Reduce pumping into Banks Lake; and allow Banks Lake to operate up to 5 ft. from full pool during August to help meet salmon flow objectives.
Chief Joseph	• Until deflectors are operational, continue to implement the spill generation swap between Chief Joseph and Grand Coulee according to the guidelines established by the WQT to minimize TDG in the mid-Columbia.
Dworshak	• Use standard flood control criteria; shift system flood control to Grand Coulee in below average water years, if possible. • Provide minimum flows a with the objective of being within State of Idaho TDG water quality standards. • Refill by about June 30 each year. • Draft to meet salmon flow objectives with draft limit of 1520 ft. in September . • Regulate outflow temperatures to attempt to maintain water temperatures at Lower Granite tailwater at or below 68^{o} F. • Maximum project discharge for salmon flow augmentation to be within State of Idaho TDG water quality standards
Lower Granite to Ice Harbor	• Operate at minimum operating pool (MOP) elevation from April 3 until small numbers of juvenile migrants are present unless adjusted to meet authorized project purposes. For Lower Granite – operate at MOP until enough natural cooling has occurred in the Lower Granite forebay, generally after October 1. • Configure fish passage facilities and conduct fish passage operations to achieve the juvenile passage performance goals. • Spill in accordance with Table 4 of this document unless modified by implementation planning and adaptive management decisions. • Collect fish and transport at Lower Granite, Little Goose and Lower Monumental dams; provide fish spill in years when seasonal average flows are greater than 85,000 cfs during spring months.
McNary to Bonneville	• Operate John Day pool at the lowest elevation that continues to allow irrigation from April 10 through September 30. • Configure fish passage facilities and conduct fish passage operations to achieve the juvenile passage performance goals. • Spill in accordance with Table 4 of this document unless modified by implementation planning or adaptive management decisions. • Collect fish and transport during the summer at McNary unless modified through implementation planning or adaptive management decisions.

System Flow Management. Each year, the Action Agencies will provide coordinated water releases from the FCRPS storage projects for system purposes, to provide mainstem flow augmentation and improve system water quality.

The purpose of the flow objectives shown in Table 3 is to aid in achieving the hydrosystem performance standards by providing better instream flow to aid juvenile salmon and steelhead migration and enhance water quality. However, it is not possible to achieve the flow objectives in many water years because there is limited water and reservoir storage. The annual Water Management Plan strives to achieve the best possible mainstem passage conditions, recognizing the priorities established in this document and the need to balance the limited water and storage resources available in the region.

Table 3. Seasonal Flow Objectives and Planning Dates for the Mainstem Columbia and Snake Rivers

	Spring		Summer	
Location	**Dates**	**Objective**	**Dates**	**Objective**
Snake River at Lower Granite Dam	4/03 - 6/20	85 - 100[1]	6/21 - 8/31	50 - 55[1]
Columbia River at McNary Dam	4/10 - 6/30	220 - 260[1]	7/01 - 8/31	200
Columbia River at Priest Rapids Dam	4/10 - 6/30	135	N/A	N/A
Columbia River at Bonneville Dam	11/1 - emergence	125 – 160[2]	N/A	N/A

[1] Objective varies according to water volume forecasts.
[2] Objective varies based on actual and forecasted water conditions.

The Action Agencies will continue to use the following 2000 BiOp-based priorities for flow management:

- Operate reservoirs to attempt to meet flow objectives as described in the annual Water Management Plan.
- Operate storage projects to be at their flood control elevation on or about April 10 (the exact date to be determined during in season management) to increase flows for spring flow management.
- Refill the storage projects by approximately June 30 to provide summer flow augmentation.
- Provide fall and winter tailwater elevations/flows to support chum salmon spawning and incubation in the Ives Island area below Bonneville Dam and to provide access for chum spawning in Hamilton and Hardy creeks.
- Identify opportunities to shift system flood control from Brownlee and Dworshak reservoirs to Lake Roosevelt.
- Coordinate with Canada for storage that would support U.S. flow augmentation during the migration season.
- BPA and the Corps will continue to annually request and negotiate to seek to provide 1 MAF of Treaty storage from January through April 15, release the water during the juvenile fish migration season.
- BPA will continue to request, and negotiate with BC Hydro for storage of water in non-Treaty storage space during the spring for subsequent release in July and August for flow enhancement, as long as operations forecasts indicate that water stored in the spring can be released in July and August.

The Water Management Plans, prepared by the Action Agencies through the NOAA Fisheries Regional Forum, will continue to be the work plans for these actions.

Interruptions or adjustments in water management actions may occur due to unforeseeable power system, flood control, or other emergencies. Such emergency actions will be viewed by the action agencies as a last resort and will not be used in place of long-term investments necessary to allow full, uninterrupted implementation of the planned reservoir operations while maintaining other project purposes, such as an adequate and reliable power system.

During winter power system emergencies, water being held in reservoirs for spring and summer flow augmentation may be drafted. Once the emergency is resolved, any flow augmentation water that was used will be replaced as soon as possible, to the maximum extent. During summer emergencies, storage reservoirs may be drafted below biological opinion draft limits, or bypass spill for fish may be reduced.

Discussion of emergencies with effects of exceptional magnitude or duration will include involvement of regional executives.

Regarding future system operations, a reconnaissance level study of modifying current system flood control operations to benefit the Columbia River ecosystem, including salmon. is being conducted in 2004 and will be coordinated with NOAA and the Region.

Spill Operations. The Action Agencies will continue to consider the following to establish spill priorities.

- ***Spread the Risk –*** Under average or above-average spring runoff conditions, spill at both transport and non-transport projects will "spread the risk" between transportation and in-river migration. Under low-flow conditions and during the summer outmigration, spill will only occur at non-transport projects to enable maximum transportation.
- ***Dissolved gas management –*** We will provide specific spill levels for juvenile fish passage at each project, not to exceed established TDG levels (either the 110 percent TDG standard, or as modified by state water quality waivers, up to 120 percent TDG). Additionally, we will manage spill on a system basis according to a priority list. In high runoff conditions, this distributes spill across the region and prevents dissolved gas supersaturation "hotspots."
- ***Adult salmon fallback and delay –*** We will limit spill for juvenile fish passage to reduce adult fish fallback and delay.
- ***Passage survival research –*** We will continue spill-related research in order to evaluate juvenile passage survival, spill effectiveness in relation to spill levels and duration, effect of spill on juvenile fish retention in forebays and tailraces, tailrace egress, and effect of spill on adult fallback. The results of this research will inform future spill management decisions in the context of achieving biological performance standards and optimizing the biological benefits of current spill volumes at individual dams. In some cases, we may modify normal spill operations to support such research. For instance, we may, as currently planned in the regional forum, evaluate the biological performance of the 12-hour spill volumes now provided at McNary and Little Goose reshaped and allocated over 24hours. To the extent that greater spill duration and/or volumes are required for the purposes of spill evaluation at some projects, efforts will be made to minimize or offset additional effects to the hydropower system.

The Action Agencies will provide spill and operations of passage facilities at certain FCRPS projects, depending on runoff conditions, to provide better project passage for juvenile fish while avoiding high TDG supersaturation levels or adult fallback problems.

The Action Agencies will provide spill as identified in Table 4 to improve juvenile fish passage while avoiding high TDG supersaturation levels or adult fallback problems. Spill may be modified through the implementation planning process and adaptive management decisions. Future Water Management Plans will contain the annual work plans for these operations and spill programs will be coordinated through the TMT. The Action Agencies will continue to evaluate and optimize spill passage survival to meet the hydrosystem performance standards identified in the 2000 BiOp.

Table 4. Spill at run-of river projects to aid out-migration of juvenile anadromous fish.

Project	Planning Dates	Time	Spring Spill	Summer Spill	Amount	Minimum Generation Requirements kcfs
Lower Granite	April 3– June 20	1800-0600	Yes	No	120/115 gas cap	11.5[a]
Little Goose	April 3– June 20	1800-0600	Yes	No	120/115 gas cap	11.5[a]
Lower Monumental	April 3– June 20	24 hours a day	Yes	No	45% or 50% of outflow	11.5[a]
Ice Harbor	April 3– August 31	24 hours a day	Yes	Yes	120/115 gas cap 1800-0500 45 Kcfs 0500-1800	7.5 – 9.5[a]
McNary	April 10– June 30[b]	1800-0600	Yes	No	120/115 gas cap	50
John Day	April 10– August 31	1800-0600 1900-0600 May 15– July 20 June 21 24 hours a day	Yes	Yes	60% of outflow until June 20 Min spill 30% Starting June 21 30% of outflow	50
The Dalles	April 10– August 31	24 hours a day	Yes	Yes	40% of outflow	50
Bonneville	April 10– August 31	24 hours a day	Yes	Yes	120/115 gas cap nighttime 75 kcfs daytime [c] 50 min flow	30

a – Minimum generation requirements at the Lower Snake River Projects may not be needed all the time.
b – Collection of subyearling fall chinook for transportation at McNary Dam shall not be initiated until in-river migratory conditions are deteriorating (i.e., no longer spring-like).[5] In general, the switch from spring to summer operation will occur on or about June 20. Spring-like is defined as favorable flow and water temperature conditions; i.e., river flows are at or above the spring flow target (220 to 260 kcfs) at McNary Dam, and ambient water temperatures are below 62°F (17°C). Actual dates shall be set by TMT coordination.
c – Day and nighttime vary during the spill season and are set in the Fish Passage Plan.
Note: Spill for juvenile fish passage may be reduced or turned off for short periods of time because of navigation problems at the projects or to allow for juvenile fish barges to dock and undock. Also research at projects that spill may change the details of spill at the project.

The Action Agencies will continue to provide attraction spill for winter steelhead at Bonneville Dam during the winter months. The details of this action will be coordinated through the Fish Passage Operations and Maintenance Coordination Team (FPOM) and the Fish Passage Plan (FPP), including any need for related studies.

Juvenile Fish Transportation Operations. The Corps will continue to collect and transport juvenile salmonids at the three lower Snake River hydropower projects with collector facilities (Lower Granite, Little Goose, and Lower Monumental) and at McNary Dam in accordance with the Juvenile Fish Transportation Plan described in the annual Fish Passage Plan. In years when the seasonal average Snake River flow at Lower Granite is expected to be less than 70 kcfs, maximization of transportation will occur from the date the juvenile bypass systems begin operation. Collection for transport will be initiated April

[5] NMFS BiOp at Section 9.6.1.3.4 Page 9-77, Action 43

20 in all years where average seasonal flows are expected to equal or exceed 70 kcfs. Prior to April 20, all collected fish will be bypassed back to the river.

Fish Bypass Facilities Operations. The Corps will operate adult and juvenile fish bypass facilities in accordance with the annual FPP. The FPP is developed by the Corps in coordination with the region's fisheries agencies, Indian tribes, BPA, and other participants through the FPOM. The FPP describes year-round project operations necessary to protect and enhance anadromous and resident fish species listed as endangered or threatened under the ESA.

As part of the FPP, the Corps will continue to operate all turbine units at FCRPS dams for optimum fish passage survival. Index Tests have been conducted at all the Corps' Portland District Columbia River projects and will be completed at all Corps' Walla Walla District projects by the end of 2006. Turbine efficiency tables for optimum fish survival will be included in the annual Fish Passage Plan after coordination with FPOM. Further details will be provided in the annual Water Management Plan and Fish Passage Plan.

Transmission Reinforcements. The Action Agencies will continue to evaluate transmission system capabilities and transmission constraints on fish operations. If new transmission constraints to fish operations are identified, the Action Agencies will coordinate transmission system improvements with NOAA.

Operation and Maintenance of FCRPS Fish Facilities. The Action Agencies will continue to follow the criteria included in the Corps' FPP as annually updated through the FPOM team We will coordinate with NOAA Fisheries to reconcile comments on the annual Draft FPP concerning ways to reduce take as part of this process prior to the fish passage season or during the fish passage season. Routine operations and maintenance activities planned at each of the FCRPS dams include operating and maintaining fish passage facilities, debris control, O&M of mitigation fish hatcheries, and avian predation abatement. FPOM will consider early detection indicators to address debris build up at dams before it creates unsafe conditions for juvenile fish in the turbine gatewells.

Avian deterrent actions are being implemented. For example, two net frames at the Bonneville powerhouses were removed. Research on alternative predation deterrent methods will be investigated in 2005. This program will continue to be coordinated with FPOM and included in the annual FPP.

The Corps continues to maintain auxiliary water-supply systems and determines which spare parts for all adult fishways need to be available for each project. Funding for additional spare parts or high cost items will be prioritized for future implementation by FPOM.

Non-Routine Maintenance of Fish Passage Facilities. The Action Agencies will continue the following non-routine O&M activities at each of the mainstem FCRPS dams with fish passage facilities:

- Acquire necessary fish facility spare parts to minimize facility outages due to equipment failures.
- Review rehabilitation needs of adult fish counting systems at each project and develop appropriate work plans.
- Provide real-time data on turbine and spillway settings to NOAA Fisheries.
- Implement preventative maintenance programs to ensure the long-term reliability of fish passage facilities.
- Continue to identify and remove obstructions in turbine units that may injure fish.

Juvenile Fish Transportation Operations RM&E. The Action Agencies will continue to conduct RM&E to provide information on juvenile fish transportation and delayed mortality.

The Action Agencies propose to continue increased summer barging through August 15. Continued research and monitoring will provide information to develop a long-term transport program to benefit summer migrating species. We are planning research to examine the effect of transport on both ESA listed and non-listed juvenile fall Chinook. Activities will be adaptively managed with consideration of in-season fish migration conditions and research results and, the transportation strategy that best contributes toward achievement of the total system survival performance standard.

Predator Control Actions

Caspian Tern redistribution. The Action Agencies intend to carry out Caspian tern management actions to effect redistribution of terns from the Columbia River estuary in order to reduce predation of juvenile salmonids. These actions will be done in a manner consistent with the alternative selected in a Record of Decision (ROD) by the Corps and USFWS after completion of the joint Corps/USFWS/NOAA Environmental Impact Statement (EIS) on Caspian tern management (it has not been determined if the Corps and USFWS will be signing separate RODs or a joint ROD). In the Draft EIS, the Corps, USFWS, and NOAA propose Alternative C as the preferred alternative.

The preferred alternative relies on habitat management and social attraction at alternate nesting locations to reduce the tern colony in the Columbia River estuary. In conjunction with this increase of suitable habitat outside of the Columbia River Basin, the Corps would reduce the available habitat at East Sand Island from 6 acres to 1 to 1-1/2 acres. This proposed habitat acreage on East Sand Island (1 to 1-1/2 acres) was selected to reduce tern predation in the estuary on juvenile salmonids to a level that would increase salmonid population growth rates (lambda) (Good et al. 2004) while maintaining a viable tern population in the estuary. Under the scenario laid forth in the preferred alternative, the Caspian tern colony in the Columbia River estuary would be reduced from an average population of 9,085 nesting pairs (2000 – 2003) to 2,500 – 3,125 nesting pairs – paring predation by approximately 4 million juvenile salmonids annually. This estimate is based on an average annual per capita consumption rate of 327 juvenile salmonids per tern (Collis et al. 2003) and the assumption that there is a linear relationship between the number of terns nesting on East Sand Island and the number of juvenile salmonids consumed, which was supported in Good et al. 2004. Achieving the reduced population objective established by the currently identified preferred alternative reduces future annual consumption to an estimated 1.63 – 2.03 millions smolts from an annual average of 5.9 million.

The Draft EIS presents two action alternatives in addition to the preferred alternative. As shown by the Draft EIS, selection of either of these additional alternatives would provide equal or greater benefit to juvenile salmonids. If, after issuance of the Final EIS, the no action alternative (current management program) is selected, then the Action Agencies will consider appropriate adjustments to implementation of the new FCRPS BiOp through the implementation planning process or possibly through reinitiation of formal consultation.

The Caspian Tern Final EIS is expected to be completed in February 2005 and RODs issued by relevant agencies in March 2005. An implementation plan for the selected alternative will be completed subsequent to the RODs and by spring 2005. Implementation of the presently preferred alternative in the current DEIS that involved redistribution of the estuary tern colony could begin in FY05 and could begin producing results in FY06. The Action Agencies and the USFWS will prepare and coordinate an implementation plan with relevant entities. Although the final decision-making analyzed in the DEIS will not be completed prior to issuance of the FCRPS biological opinion, due November 30, 2004, the Action Agencies are including this tern reduction program in their UPA for the purposes of the ESA evaluation

of the UPA's effects pursuant to Section 7(a)(2) only and it is not meant to pre-judge the decision currently undergoing NEPA analysis. The status of implementation will be included in the annual Progress Reports.

The selection of the preferred alternative is contingent on the completion of the final EIS and the issuance of the ROD. If selected, the Action Agencies could begin implementation of this management measure in FY 2005. Our three-year goal is to develop 4 acres of out-of-Columbia River Basin tern habitat, which would enable the Corps to reduce the available habitat on East Sand Island by approximately 2 acres. By the end of year six, the Action Agencies plan to have completed the implementation of the management action (approximately 8 acres of offsite habitat created and 1- to1-1/2 acres of suitable nesting habitat remaining on East Sand Island). Our performance metric will be annual Caspian tern predation rates on juvenile salmonids and the resulting juvenile salmonid survival rates. In addition to these management goals, we will continue and expand our research efforts.

Since 1997, BPA and the Corps have funded research in the Columbia River estuary to assess the impacts of avian predators on the survival of juvenile salmonids. Through this program and data from recovered PIT-tags, researchers have collected baseline information on the annual colony size and level of reproductive success of Caspian terns nesting on East Sand Island as well as baseline information on diet composition and annual consumption of juvenile salmonids and other prey species. As the Action Agencies implement the proposed Caspian tern management action, the aforementioned RM&E program will continue in order to determine the effects of tern redistribution on colony size, annual level of reproductive success, and annual consumption levels of juvenile salmonids by Caspian terns remaining on East Sand Island. This will enable the action agencies to validate the assumption that there is a linear relationship between the number of terns nesting on East Sand Island and the number of juveniles salmonids consumed. In addition, the action agencies will continue and expand research efforts to determine whether or not other avian predators nesting on East Sand Island are compensating for the decrease in juvenile salmonid consumption by the redistribution of Caspian terns. Both gulls and cormorants nest on East Sand Island; however, past research indicates that the level of gull predation on juvenile salmonids is minimal. Therefore, research will continue to focus on the double-crested cormorant colony on East Sand Island. Annual colony size, reproductive success, diet composition, and consumption levels will continue to be monitored to determine the effect of cormorant predation on juvenile salmonids.

Species/ESUs Affected: The Caspian tern nesting period extends from early April through the end of July. Reducing tern predation rates has the potential to benefit the majority of the listed and non-listed yearling salmonids as well as some subyearling salmonids that migrate through the Columbia River estuary during the Caspian tern-nesting period. This would include the following ESUs:

- Snake River spring/summer Chinook Salmon,
- Snake River fall Chinook salmon,
- Upper Columbia River spring Chinook salmon,
- Upper Willamette Chinook salmon,
- Lower Columbia River Chinook salmon,
- Snake River steelhead,
- Upper Columbia River steelhead,
- Mid-Columbia River steelhead,
- Upper Willamette steelhead,
- Lower Columbia River steelhead,
- Snake River sockeye salmon, and
- Lower Columbia River coho salmon.

Caspian terns nesting in the estuary have little to no effect on Columbia River chum salmon (D. Roby, personal comm.).

Biological Benefit: Given current research limitations, it is difficult to determine the ESU-specific benefits that would result from this action. In general, the redistribution of the majority of the tern colony would result in an approximately 67% reduction in predation rates and an estimated 4% increase in juvenile salmonid survival. Steelhead and coho salmon are most heavily affected by Caspian tern predation (Collis et al. 2003, Ryan et al. 2003, Roby et al. 2003) and are, therefore, most likely to benefit from the redistribution. Good et al. (2004) determined that the reduction in the East Sand Island tern colony to 2,500 – 3,125 pairs would result in a 1% or greater increase in population growth rate for Snake River and upper, middle, and lower Columbia River steelhead ESUs. Therefore, we would rank this action as having ***medium*** potential to mitigate for hydropower effects. We have initiated and will continue research to better determine species/ESU-specific effects of tern predation in the estuary and the UPA.

Double-crested Cormorant analysis. Management efforts directed toward double-crested cormorants nesting in the Columbia River estuary can achieve additional gains, perhaps comparable to those associated with Caspian tern management. Intensive research efforts in 2005 could lead to an EIS, developed in conjunction with USFWS. Research into cormorant predation on juvenile salmonids, management measures to disperse the population, and an in-depth analysis of the regional double crested cormorant population (range, population dynamics, status) will support completion of the environmental review requirements to implement future management actions in 2008 – 2009, with implementation of management measures beginning in 2010.

Species/ESUs Affected: The double-crested cormorant nesting period begins in late April and continues to the end of August. Reductions in cormorant predation rates have the potential to benefit the majority of the listed and non-listed yearling salmonids as well as some subyearling salmonids that migrate through the Columbia River estuary during that time. This would include the following ESUs:

- Snake River spring/summer Chinook salmon,
- Snake River fall Chinook salmon,
- Upper Columbia River spring Chinook salmon,
- Upper Willamette Chinook salmon,
- Lower Columbia River Chinook salmon,
- Snake River steelhead,
- Upper Columbia River steelhead,
- Mid-Columbia River steelhead,
- Upper Willamette steelhead,
- Lower Columbia River steelhead,
- Snake River sockeye salmon, and,
- Lower Columbia River coho salmon.

Double-crested cormorants nesting in the estuary have little to no effect on Columbia River chum salmon (D. Roby, personal comm.).

There are a small number of resident double-crested cormorants (less than 1000 on East Sand Island) in the Columbia River estuary, but given their low numbers, researchers do not believe that they have a significant impact on juvenile salmonids outside of the breeding period (K. Fisher, personal comm.).

Biological Benefit: Until we select a management alternative, it is difficult to determine the potential benefit. However, in the next 3 years we will continue research efforts to better understand cormorant

predation on juvenile salmonids and initiate studies investigating the regional double-crested cormorant population and potential management measures to disperse that population. By the end of 2010, we plan to have completed the environmental documentation associated with potential cormorant management measures. Once management actions are implemented, our performance metric will be annual double-crested cormorant predation rates on juvenile salmonids and the resulting juvenile salmonid survival rates.

Caspian tern analysis. We will continue our ongoing research to determine the impact of Caspian tern predation on salmonids at Crescent Island, including better estimates of the species/ESU-specific impacts of tern predation. These efforts are aimed at developing a better estimate of predation rates. We estimate that two additional years of basic research, adjusting PIT-tag recovery rates for off-colony deposition, will be required. This research will enable NOAA Fisheries to establish whether management of the Caspian tern colony on Crescent Island is warranted. If it is, management alternatives and their implementation will be determined in conjunction with the USFWS, which is responsible for the management of Crescent Island.

Species/ESUs Affected: The Caspian tern nesting period begins in early April and continues to the end of July. Reductions in tern predation rates have the potential to benefit the majority of the listed and non-listed yearling salmonids as well as and some subyearling salmonids that migrate near Crescent Island during that time. This would include the following ESUs:

- Snake river spring/summer Chinook salmon,
- Snake River fall Chinook salmon,
- Upper Columbia River spring Chinook salmon,
- Snake River steelhead,
- Upper Columbia River steelhead,
- Mid-Columbia River steelhead, and,
- Snake River sockeye salmon.

Radio-tagged terns have been located foraging in the Columbia River both upstream and downstream from Crescent Island, in the Snake River from the confluence with the Columbia to Ice Harbor Dam, in the Walla Walla River, and in the Burbank Slough (Collis et al. 2003).

Biological Benefit: Until it is determined that management is warranted and a management alternative is selected, it is difficult to determine the potential benefit of this action. However, if management is deemed necessary, our three-year goal is to have begun the environmental review associated with potential management alternatives and to have begun implementation of a tern management plan on Crescent Island. Our performance metric will be annual Caspian tern predation rates on juvenile salmonids and the resulting juvenile salmonid survival rates. By the end of 2010, we plan to have completed the implementation of the management plan.

Expanded Northern Pikeminnow Management. The Action Agencies propose to reduce the number of larger, predatory pikeminnow throughout the mainstem Columbia and Snake rivers to increase survival of outmigrating juvenile salmon and steelhead. There is a positive relationship between numbers of pikeminnow removed and reduced juvenile fish mortality; similarly, there is a direct relationship among rewards, angler participation, and catch of pikeminnow. Since northern pikeminnow removals began in 1990, evaluation of the implementation of various removal fisheries within the NPMP has resulted in the estimate of a 25% reduction in juvenile salmonid losses due to pikeminnow predation (Friesen and Ward 1999). This results in the annual additional survival of approximately 4 million smolts due to the Action Agencies commitment toward this program. Average exploitation rates (the percentage of the targeted size fish annually removed) in the NPMP, notwithstanding the NPMP heavy-up in 2001/2004, have averaged approximately 12% for the last 6 years. If exploitation rates can be sustained through incentive

measures and other site-specific activities, then after a ramp-up period, it should be feasible to model estimates of the increased exploitation rate's effect on reduction in predator mortality. This increase above the baseline, once estimated and quantified, would be above and beyond the base implementation since issuance of the 2000 BiOp. Therefore, the marginal benefit of any increase in exploitation rate resulting from increases in program incentives should be separate and above base-period benefits.

The scope of the UPA includes continuation of the base NPMP with the addition of a general increase in the reward structure in the Sport-Reward Fishery similar to that of 2001 and 2004 to provide system-wide enhancement and benefit to all ESUs. In addition, through other enhancements in the reward structure, we will achieve increased emphasis in the Sport Reward Fishery in Little Goose and Lower Granite reservoirs to benefit listed Snake River Chinook. Specific improvements include:

- A general increase in the reward structure for the Sport-Reward component of the NPMP
- Increased number of tagged fish to enhance the estimation and evaluation of the NPMP
- Reservoir specific enhancement measures to address "hot spots' of salmonid predation which could include contracting for site-specific removals within project boat restricted zones (BRZ).

Species/ESUs Affected: The benefits of pikeminnow removals benefit all listed and non-listed yearling and sub-yearling salmonids that use the mainstem Columbia and Snake Rivers as outmigration corridors. The benefit is largest for subyearling migrants.

Biological Benefit: The northern pikeminnow alone is responsible for the loss of approximately 8% of the juvenile salmonid migrants in the FCRPS (2000 BiOp at page 9-106). We estimate that the cumulative effects of the NPMP have reduced pikeminnow predation on juvenile salmonids by 24%, or approximately a 2% absolute reduction in the 8% estimate. A 3-5% absolute increase in the exploitation rate could be expected to reduce system mortality by approximately an additional 0.3% (Paulsen memo to BPA 10/20/04). This has a **low** potential to fill the FCRPS survival "gap". The NPMP heavy-up for 2004 marks the first season that we have incorporated the action into longer-term implementation. After 3-4 continuous seasons with significantly higher exploitation rates relative to the baseline, the benefit associated with additional removals should be discernable and quantifiable.

Other Fish Predation. The Action Agencies propose the addition of focused pikeminnow removals at Bonneville, The Dalles and John Day dams/ forebay and tailrace boat restricted zones. Based upon results of 2004 full evaluation of the NPMP, we could use these specific removals within project/reservoir boat restricted zones to test removals of other non-indigenous predators – specifically smallmouth bass (*Micropoterus dolomieu)*. If tests are successful in 2005, then the Action Agencies will seek to scope possible continuation and/or expansion of test removals into a management action.

Some of these species already support recreational fisheries. So, if we do seek to expand the current NPMP to include other program components targeting non-indigenous predators, we will coordinate and seek acceptance both with the management agencies responsible for these species of fish and the general public.

Biological Benefit: It is likely that development and implementation of non-indigenous predator management would not result in biological benefit measured on a system-wide scale. Therefore, the performance metric used to measure benefit would be specific to the local removals. Site-specific removals could have positive effect on reservoir mortality and/or passage survival, proportional to the relative density of the stock within a particular reach. For instance, smallmouth bass management in Lower Granite reservoir will have a disproportionate benefit for Snake River subyearling Chinook pool mortality but no benefit for sockeye.

Our three-year goal is to have completed the required environmental documentation associated with potential management alternatives by the end of 2007, and to have begun implementation of a smallmouth bass management plan by 2008. By the end of 2010, we plan to have completed the implementation of the management plan. We will need to develop measurement and crediting mechanisms associated with site-specific removals of non-indigenous predators during the three-year performance metric goal period.

Estuary Habitat Actions

All ESUs pass through the estuary and utilize it to some extent. Therefore, the estuary habitat actions are listed here as benefiting all ESUs rather than listed by ESU.

Given the potential limiting factors and NOAA Fisheries' updated jeopardy analysis, the Action Agencies propose to focus the estuary program to improve survival of Snake River fall Chinook juveniles. While the Action Agencies' estuary habitat program will focus on Snake River fall Chinook, there will be benefits to the other ESUs, with the greatest benefits for ocean type. ESUs expressing primarily ocean-type life histories are chum salmon, Lower Columbia River steelhead, Lower Columbia River chinook, and Lower Columbia River coho (proposed for listing). The estuary habitat actions will also benefit ESUs expressing primarily stream-type life histories by providing opportunities to maintain or increase diversity and spatial structure/distribution.

As noted in *Habitat Improvements as Offsite Mitigation for FCRPS Operations: A Qualitative Assessment* (Kratz et al. 2004), the greatest opportunity to affect ocean type ESUs is by restoring lost shallow water, low velocity, and vegetated habitat (e.g. emergent marsh). Therefore, the Action Agencies estuary program will focus on habitat restoration for the ocean type ESUs. Subsequent discussion with NOAA indicates the greatest potential to benefit Snake River fall Chinook may lie in improving side channel and off-channel habitat in the upper fresh water portion of the estuary, (river mile 46 to river mile 146). The proposed Crims Island and Sandy River projects occur in this area. Action effectiveness monitoring associated with the estuary projects will help to improve our understanding of the value of these habitats to this and other ESUs and could lead us to an increased emphasis on habitat work in the upper estuary.

Based on NOAA's June 2004 final Technical Memorandum, *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of the Effects of Selected Factors on Population Viability*, the major estuarine-related factors that potentially limit salmonid population viability include ocean conditions and climate change (which control other factors), water flow, access to and quality of habitats, sediment, salinity, temperature, toxics, predators (e.g. terns, cormorants, northern pikeminnow), and hatchery and harvest practices. Although it would be useful to evaluate the role of each of these factors, analyses in the final Technical Memorandum were limited to a subset of these nine potential limiting factors, using the following criteria: (1) a significant change in the ESU was evident, (2) the factor could potentially affect population viability, and (3) there were quantitative data available that could be used to analyze the effect of the factor within the time that had been allotted.

Based on these criteria, NOAA Fisheries focused on water flow, availability of salmon habitats, toxics, and predation (primarily Caspian terns) in the estuary portion of the analysis. Of these potential limiting factors, predation is addressed separately. The Action Agencies have no regulatory authority over toxics and have limited ability to address this factor under existing authorities and programs. Although the Actions Agencies do not have specific authorities to reduce toxins, the restoration projects could enhance water quality locally.

Under the 2000 BiOp, the Corps and BPA prepared an estuary action plan (entitled *Action Plan to Implement the Federal Columbia River Power System Biological Opinion in the Columbia River Estuary*)

and an estuary restoration approach (entitled *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary)*. The Action Agencies will continue to implement actions based on these plans directed at providing biological benefit to ESA-listed fish. The Action Agencies will document changes to the estuary program through our annual progress reports . These updates will include status of the actions being taken, the acres of shallow water habitat restored, new information related to the overall effect of the proposed action on shallow water habitat as well as new information (empirical studies) contributing to an understanding of the value of shallow water habitat as a component of critical habitat.

Based on the NOAA Fisheries Final Technical Memorandum, *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of the Effects of Selected Factors on Population Viability*, our immediate focus will be to protect, restore and enhance shallow water and wetland habitats in the six proposed projects, as these were given the highest priority by NOAA Fisheries. The types of activities proposed under this action are outlined in the Action Agencies' restoration plan.- *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary.* The restoration plan identifies five strategies for the implementation of scientifically sound habitat projects to address the potential limiting factors identified for the estuary. As noted earlier, the science that would allow quantification of survival improvements as a result of habitat projects is not fully developed; particular uncertainty exists for the estuary.

Estuary Protection/Improvement. The Action Agencies have identified and are currently implementing or pursuing the six key habitat restoration projects listed below. Additional projects will be identified based on research and regional coordination and developed following the Action Agencies' restoration plan.

Crims Island – Protected 473 acres and will restore 208 acres of intertidal marsh and riparian forest. The project area offers a number of opportunities for tidal channel; marsh and riparian habitat restoration that would benefit federally listed salmonids, Columbian white-tailed deer and several species of waterfowl, among other species. Restoration of sub-tidal channels and intertidal marsh habitat would be the principal action to benefit salmon. Sub-tidal channel and intertidal marsh habitat restoration would require excavation of sediments to attain the proper elevations. Excavated material would be disposed of on adjacent lands currently used for grazing. Riparian forest habitat would be developed on the disposal sites and other areas of pasture, and would provide habitat for Columbia white-tailed deer and an additional source of detritus for aquatic invertebrates as well as cover and eventual large woody debris recruitment. Neotropical migratory birds would also benefit from riparian habitat restoration. Section 7 consultation with NOAA Fisheries has been completed. Additional information on the project can be found in BPA project proposal # 200300800 and the Integrated Feasibility Report and Environmental Assessment for the project. *Scheduled completion: 2006*

Sandy River – The project is located at the confluence of the Sandy and Columbia rivers just north of I-84, and east of the Troutdale airport. The project is within the Columbia River Gorge National Scenic Area in Multnomah County, Oregon. This project is part of a long-term effort to restore 1,500 acres of the Sandy River delta. The Action Agencies would restore 90 acres of native hardwood riparian forest and 20 acres of a seasonally wet slough in the Sandy River Delta to complete a 250-acre block of regionally scarce floodplain habitat. Section 7 consultation with NOAA Fisheries has been completed for portions of this work. Additional information on the project can be found in BPA project proposal # 199902500. *Scheduled completion: 2007.*

Germany Creek – Germany Creek is a tributary to the Columbia River at river mile 56. Columbia Land Trust and project partners propose to permanently protect 155 acres of critical riparian and floodplain habitat along the lower one mile of Germany Creek in Cowlitz County Washington. Additionally, there is

an important and unique opportunity to rehabilitate approximately 250 feet of an old creek channel to provide chum salmon spawning habitat, restore/enhance approximately 2.5 acres of off-channel rearing habitat for a variety of salmonid populations, and manage the riparian habitat to enhance its value for salmon as well as watershed function. The project would also implement riparian habitat enhancement measures throughout the site to improve/protect fish habitat and watershed function. Enhancement measures may include establishing conifers within the riparian corridor, controlling non-native vegetation, and fencing. Section 7 consultation with NOAA will occur in 2005, potentially using the HIP BiOp. Additional information on the project can be found in BPA project proposal # 200301100. *Scheduled completion: 2006*

Fort Columbia Wetland – The project site is located in the southwest corner of the Chinook River watershed (Pacific County, WA) between the town of Chinook and Fort Columbia State Park. It is situated at approximately river mile 6 of the Columbia River. Historically, a distributary of the mainstem Chinook River entered Baker Bay approximately 4 miles south of the river's mouth. The construction of a causeway and installation of a 24-inch concrete culvert perched above the mean high water mark under Highway 101 effectively disconnected the river and associated floodplain from the Columbia River estuary.

Our overall goal for this project is to restore approximately 96 acres of tidal wetland habitats in the Chinook River watershed and reestablish the ecological benefits these habitats provided for endemic fish and wildlife species. The project would re-establish the connection between the distributary of the Chinook River and its associated wetlands and floodplain with the greater Columbia River estuary. The project would also provide full opportunity for fish and wildlife to access restored habitats. Section 7 consultation with NOAA will occur in 2005, potentially using the HIP BIOp. Additional information on the project can be found in BPA project proposal # 200301100. *Scheduled completion: 2007*

Grays River Project – Grays Bay is located between river mile 19 and 23 along the Columbia River in Wahkiakum County, Washington. The project area encompasses the watersheds of three tributaries that empty into Grays Bay: Deep River (river miles 1-2), the Crooked River (river mile 0.5) and the Grays River (including Seal Slough, river miles 1-4). This project is part of a regional effort to restore the health of the Columbia River estuary and recover declining populations of salmon and steelhead. Columbia Land Trust and its conservation partners, including resource agencies and other non-profit conservation groups, have developed a Grays Bay area conservation strategy to protect and restore over 1,200 acres of critical habitat.

The Grays Bay conservation effort is currently underway. Over 600 acres have been secured for conservation, with negotiation on an additional 280 progressing well. The conservation strategy for this project calls for restoring a large portion of the important habitat lands: 116 acres have been restored with a remaining 500 currently in the design process. This project represents the single largest conservation/restoration effort in the Grays Bay watershed, and one of the largest and most important efforts in the Columbia River estuary.

Restoration strategies include removing tidegates, breaching dikes, restoring historic channel contours and revegetation to spruce swamp and other native plant communities. Overall, this project would accomplish the following:

- Permanently protect 880 acres of habitat lands, including spruce swamp forested wetlands, inter-tidal floodplain channels and emergent scrub-shrub wetlands;
- Restore floodplain connectivity to 500 acres of tidal backwater, riparian and wetland forested habitat;
- Restore over 300 acres of potential salmonid rearing habitat;

- Enhance approximately 3.0 miles of riparian shoreline; and,
- Protect three bald eagle nests and over 100 acres of potential marbled murrelet nesting habitat.

Section 7 consultation with NOAA will occur in 2005, potentially using the HIP BiOp. Additional information on the project can be found in BPA project proposal # 200301100. *Scheduled completion: 2007*

Chinook River Restoration – Approximately 800 acres will be restored and enhanced. This project would improve and/or enlarge the existing tidegate on the Chinook River to improve tidal flow, circulation and flushing in the Chinook River. These actions would improve fisheries access and egress for the Chinook River. Habitat restoration will also occur upstream. Information on the project can be found in BPA project proposal # 200301100. *Scheduled completion: 2010*

Estuary RM&E. The final draft of the Action Agencies' *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary* (Plan) was produced in July 2004. The Plan identifies the Columbia River estuary as a key element of the basin-wide research, monitoring, and evaluation effort developed for the 2000 BiOp for the operation of the FCRPS.

There is considerable uncertainty over the use of the estuary and plume by juvenile salmon and steelhead. The Action Agencies on-going RM&E program and monitoring of habitat projects will help to determine the use and benefits to different ESUs. It will still be difficult to quantify benefits given the difficulties in tracking juveniles throughout the estuary and distinguishing estuary effects by ESU or populations.

To develop the potential to improve ESA-listed salmon populations, the Corps and BPA will continue the program to protect and enhance tidal wetlands and other key estuary habitats. Because much is unknown at this time about salmonid use of the estuary and Columbia River, the approach includes concurrent research, planning and restoration activities. This approach will allow important on-the-ground recovery efforts to assist in salmonid recovery to proceed while research and planning efforts occur to better inform future actions.

Examples of RM&E that will help in this adaptive process are the absolute growth and variability of juvenile salmon in the estuary to allow definition of carrying capacity limitations at present, or restored population levels. Precise estimates of growth are needed from juvenile salmon of different life-history types corresponding to a range of residence times in the estuary.

The Action Agencies have identified several critical uncertainties in the estuary that will be pursued through the continuation of the Estuary RM&E Program:

- Determine the significance of the lower river and estuary, including the plume, to listed salmonid Evolutionarily Significant Units;
- Determine the highest priority habitat types for restoration in the lower Columbia River and estuary; and,
- Develop a method to assess whether the offsite mitigation program involving habitat restoration in the estuary is working.

The first two uncertainties are being addressed in part through the existing research program. The Cumulative Effects Program presently funded through the Corps' CRFM Project will address the third uncertainty. Additionally, hypotheses outlined in the *Salmon at River's End* report (species life history diversity, connectivity, etc.) need to be thoroughly tested and empirical data developed to ensure sound science is directing the restoration program.

Additionally, the Action Agencies RM&E Program has recommended several status and action effectiveness monitoring actions that should be undertaken in the Columbia River Estuary. In developing the RM&E program, the Action Agencies are including recommendations that other regional entities have the responsibility to implement. The intent of this strategy was to develop an RM&E program that was robust and comprehensive, understanding that the program would have to be linked to and coordinated with other agencies such as the EPA and state regulatory agencies as well as NOAA Fisheries.

The Action Agencies have identified the following status and action effectiveness actions in the Estuary RM&E program:

Status Monitoring:

- Describe the present status of the estuary ecosystem in terms of habitat conditions, habitat connectivity, and fauna relative to pre-European settlement conditions.
- Monitor the spatial distribution, life history diversity, and growth of juvenile salmon in the estuary.
- Estimate the survival rates of juvenile salmon of listed ESUs through the tidal-freshwater reach (river miles 46-146), the estuarine reach (river miles 0-46), and the plume.
- Determine the water quality in estuary salmon spawning and rearing habitat relative to state and federal water quality standards and salmon survival needs.
- Describe trends in the physical condition of estuary salmon spawning and rearing habitat in terms of substrate type, accretion rates, reduction/oxygenation potential, groundwater level, large woody debris, water velocity and water surface elevation compared to present conditions.
- Determine the status and trends of abundance, species composition, and distribution of invasive species in the estuary such as purple loosestrife, shad, and New Zealand mud snails.
- Provide biennial summaries of the status and trends of hydrographic and oceanic conditions affecting salmon survival within the estuary and salmon population size.

Action Effectiveness Monitoring:

- Implementation Monitoring. Determine if restoration projects in the estuary, as implemented, meet the project-specific performance goals.
- Effectiveness Monitoring. Determine whether individual restoration projects in the estuary are effectively changing relevant structural or functional parameters relative to reference and/or control sites.
- Validation Monitoring. a) Determine the extent to which habitat restoration projects in the estuary, collectively, are affecting targeted ecosystem processes that support listed salmon. b) Determine the cumulative effect of estuary habitat restoration on salmon population viability.

The first status monitoring recommendation is being addressed by the Habitat Mapping Project that was funded and completed in partnership with the Lower Columbia Estuary Partnership (LCREP), as well as the Bottom, et al study. The third is addressed by the survival study that was initiated in 2001. The fourth and fifth are addressed by the studies funded through LCREP by the Action Agencies. The effectiveness monitoring is being addressed by both project specific monitoring and the cumulative effects study.

The following studies are currently funded under the Action Agencies RM&E program for the estuary:

- McComas et al. 2001-2003: *A study to estimate salmonid survival through the Columbia River estuary using acoustic tag* (Corps).
- Bottom et al. 2001-2003, Estuarine habitat and juvenile salmon – current and historic linkages in the lower Columbia River and estuary" (Corps).
- Bottom et al. 2003, Historic habitat opportunities and food web linkages of juvenile salmon in the Columbia River Estuary: implications for managing flows and restoration" (BPA 200301100).

- Welch et al. 1998-2003, Canada Department of Fisheries and Ocean, *Ocean survival of juvenile salmonids in the Columbia River plume.* (BPA 200311400).
- Thom et al. 2003-2005 Evaluating the Cumulative Ecosystem response to Restoration Projects in the Columbia River Estuary (COE)
- Casillas et al. 1998-2003, *Survival and growth of juvenile salmonids in the Columbia River plume* (BPA 199801400)
- LCREP, Lower *Columbia River/Estuary Ecosystem Monitoring* (BPA 200300700).
- Sea Resources Inc., *Effectiveness Monitoring Chinook River Estuary Restoration* (BPA 200300600)
- BPA, Estuary RME Pilot Project , (BPA 200500100)
- Canada Department of Fisheries & Oceans, *Canada-USA Shelf Salmon Survival Study* (BPA 200300900)
- Muir et al. 2001-2005, Evaluation of the relationship among time of ocean entry, physical, and biological characteristics of the estuary and plume (COE).

There are several available ecosystem models for the Lower Columbia River and estuary. The Action Agencies have and continue to provide support to both the conceptual and numeric models that will contribute to understanding the physical processes that control or contribute to potential limiting factors for juvenile salmonids. The Action Agencies have funded the refinement of the conceptual model for the estuary. This model is complete and is currently undergoing review by the Action Agencies, the model will be provided to NOAA by December 2004.

The Action Agencies also continue to fund refinements to the numeric models covering circulation and water properties predictions and sediment dynamics. The Action Agencies are providing funding to refine the CORIE/ELCIRC model under the RM&E studies, specifically the Bottom et al. work. The Action Agencies will continue to fund incremental improvements to numeric models; however, the focus will be on funding RM&E actions that contribute to the understanding and knowledge base required to link biological response to physical parameters. This strategy will be revisited as our understanding of juvenile salmon use of the estuary grows.

Research in Oregon's coastal Salmon River is in progress by the U. S. Forest Service and Oregon Department of Fish and Wildlife. It is known that some salmonids use estuarine marsh channels as nursery habitats. Removal of tide gates and dikes has been a primary focus of recovery efforts in the Salmon River estuary because such "passive" restoration methods offer the most cost-effective means for returning significant quantities of wetland habitat to estuaries. Ongoing research in the Salmon River estuary is providing information about the responses of estuarine-rearing salmonids and prey resources to wetland restoration. Work such as this will help to inform our continuing efforts in the Columbia River estuary.

As the estuary studies continue to improve our understanding, the Action Agencies will be better able to target and implement actions that would continue to improve the status of all listed salmonids (establish amount and types of habitat) and further reduce the uncertainty of the biological benefits of these actions. Ultimately, the goal is to implement actions that provide the greatest biological benefit to listed ESUs.

After three years of implementing the estuary program, the Action Agencies will reevaluate the results and revise the actions as appropriate. To complete this evaluation the Action Agencies will work with NOAA Fisheries to compare project specific information to the impacts identified by NOAA (range of 50-700 acres reduction of shallow water habitat during the summer flow period). The Action Agencies will quantify the amount of shallow water habitat restored with the actions identified in the UPA to ensure that the total acres of shallow water habitat contained within these projects are within the range of the

effect of summer discharge in the Lower Columbia River. The Action Agencies will use all information obtained through the estuary program to inform this evaluation in coordination with NOAA Fisheries. Should the Action Agencies 3-year check-in demonstrate the proposed restoration actions do not provide the expected benefits the Action Agencies will work with the appropriate organizations in the Lower Columbia River to identify appropriate additional restoration projects.

Biological Benefits of the Proposed Estuary Actions: Because the estuary habitat projects in this UPA focus on the NOAA Fisheries identified limiting factors for the estuary, the Action Agencies believe that they will provide ***low*** to ***medium*** level of improvements for different ocean-type ESUs and a ***very low to low*** improvement for different stream-type ESUs.

Hatchery Actions

Safety-Net Artificial Propagation Program (SNAPP). BPA will continue to fund the SNAPP planning process identified in the 2000 BiOp, and, if necessary, develop safety-net artificial propagation contingency plans for populations identified by Step 1 of SNAPP (extinction risk analysis) to be at high risk of extinction. SNAPP is targeted on populations of the Snake River steelhead and spring/summer chinook salmon ESUs. If a new safety-net program is identified as necessary, effective, and feasible through the SNAPP process, and if NOAA Fisheries considers the new program as effective and essential to reducing extinction risk, we would intervene with artificial production for severely depressed and declining populations.

Reduce Negative Impacts of Artificial Propagation. The Action Agencies are developing HGMPs development process to identify hatchery reform actions that would reduce the negative impacts of hatchery operation on listed stocks. Phase I HGMPs were completed in July 2003. The Action Agencies completed draft Phase II HGMPs in March 2004 and most Phase III HGMPs were completed by late summer 2004. Due to legal issues, the Phase III HGMPs for hatchery programs in Washington State may not be completed until early 2005. As the Phase III HGMPs are completed, they are submitted to NOAA Fisheries for review and approval.

Biological Benefit of the Proposed Hatchery Actions: Because SNAPP planning has not identified populations requiring either a safety-net contingency plan or new safety-net program, and the hatchery reforms are not yet identified or prioritized for implementation, there are currently no actions that can be credited to fill any survival gaps. However, any new safety-net programs or priority hatchery reforms they would be expected to fill survival gaps if implemented in the future and those improvements would be reflected accordingly in our progress reports and implementation plans.

2. Snake River Spring/Summer Chinook

Survival improvements for this ESU will be gained through the actions shown in **Figure 4**. The hydrosystem, predator control, and estuary habitat actions are described in Section III.E.1, *Proposed Actions That Would Benefit Multiple ESUs*.

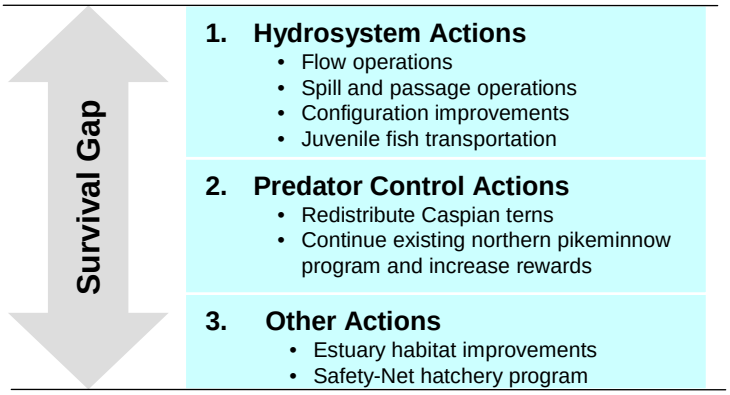

Figure 4 Updated Proposed Actions to benefit Snake River spring/summer Chinook

Tributary Habitat Conservation Measure

Reclamation is proposing, as a conservation measure, to continue a tributary habitat technical assistance program which was instituted under the 2000 BiOp (RPA Action 149) in three subbasins of the Salmon River drainage in Idaho. This conservation measure is intended to meet a greater increment of overall survival for Snake River spring/summer chinook during their spawning and rearing life stages than is required to avoid jeopardy to the species; consequently, it is formulated to partially meet recovery standards for this ESU as defined by the regulatory guidance in the Endangered Species Consultation Handbook (USFWS and NOAA Fisheries, p. 4-19). Absent this conservation measure, Reclamation would be required to withdraw from its current participation in tributary habitat improvements in the Lemhi, Upper Salmon, and Little Salmon Rivers basins due to a lack of funding authority. It is important to note that this is a Bureau of Reclamation conservation measure and does not imply or expect any level of participation by the other Action Agencies.

For Snake River spring/summer Chinook, NOAA Fisheries' concluded that there is a medium level of "intrinsic potential" to improve spawning and rearing habitat in the three subbasins included in this conservation measure. Reclamation considered the primary limiting factors identified by NOAA Fisheries for each subbasin and evaluated formulating a habitat improvement program that attempted to address those limiting factors considering the limitation of Reclamation authorities. Reclamation does not have, and does not anticipate having construction authority to address riparian habitat protection or enhancement actions. Reclamation can provide technical assistance to solve engineering issues affiliated with channel morphology but currently does not have authority to fund the construction of such projects. Authority to fund construction of instream projects has been introduced in the Congress. Reclamation can consider leasing or acquiring instream flows in compliance with state water law. In consideration of these authority limitations, this conservation measure is formulated to allow Reclamation to continue its current technical assistance program in the three selected subbasins, but cannot promise that authority to go beyond that program is forthcoming with any certainty.

Considerable investigations have been performed to identify the habitat limiting factors in the Little Salmon, Lemhi, and Upper Salmon Rivers basins and to assess the opportunities for improvement. We will not reiterate those findings here. However, in developing this conservation measure, Reclamation

considered NOAA Fisheries' recent analysis of potential habitat improvement measures and practical constraints in all three subbasins. In addition, opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the recently drafted Council subbasin plans, and consulting other state and local documents. Those habitat limiting factors, opportunity analyses, and Reclamation's discretionary authority were considered in developing a tributary habitat conservation measure which focuses on three of the limiting factors: entrainment, channel morphology, and streamflow. We also considered on-going programs by other entities and formulated a conservation measure that does not duplicate those other effects.

Reclamations' conservation measure for improving Snake River spring/summer Chinook juvenile survival production in the Lemhi, Upper Salmon, and Little Salmon subbasins is shown by metrics measurement and goals. Goals are established for 3 years after adoption of NOAA's new BiOp.

Table 5. Conservation Measure, Snake River Spring/Summer Chinook Salmon,

Limiting Factor	Metric Measurement	3-Year Metric Goal
Entrainment	a. Number of screens addressed[6]	10
Instream flow projects[7]	a. Cubic feet per second (cfs) of water protected for instream flows	20
Channel Morphology[8]	a. Miles of access restored	54
	b. Miles of complexity restored	0.25

Tributary Habitat Actions Implemented under the 2000 RPA

The Action Agencies' *2003 Progress Report* identified near- and long-term improvement actions that they had implemented under the 2000 RPA. A number of those actions were implemented in the Salmon subbasin and will continue to accrue survival benefits for Snake River spring/summer Chinook under the remanded BiOp. The Action Agencies expect that these actions will be maintained if needed to assure the continuation of benefits over time.

Table 6 lists the number of actions implemented by the Action Agencies in the Salmon subbasin that were reported in the *2003 Progress Report*. Information on additional actions implemented in FY 2004 have not yet been collected, but will be subsequently identified in the Action Agencies' 2004 Progress Report. Because the Action Agencies only began to collect consistent tributary habitat action metrics in FY 2003, this is a very conservative estimate of actions implemented under the 2000 RPA.

Additional detail, including metrics for each action, are available in Appendix C.

Table 6 Tributary Habitat Actions Implemented under the 2000 RPA – Salmon Subbasin

Near-Term Survival Improvement Actions	Implemented

[6] Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

[7] Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual "wet water" instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

[8] Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

Near-Term Survival Improvement Actions	Implemented
Barrier removal (RPA action 149)	10
Screen diversions (RPA action 149)	5
Lease or purchase in-stream flows (RPA actions 149 & 151)	9
Long-Term Survival Improvement Actions	
Protection or enhancement of riparian habitat (conservation easements, leases, land acquisitions, and establish riparian buffers)	6

Biological benefits: The Action Agencies believe that a ***low*** level of near- and long-term improvements benefiting Snake River spring/summer chinook will occur from these tributary habitat actions implemented under the 2000 RPA.

Hatchery Actions

Safety-Net Programs: BPA will continue to fund safety-net programs for this ESU, including the captive broodstock programs for the Tucannon River and Grande Ronde River (Upper Grande Ronde, Catherine Creek, and Lostine River populations), the captive rearing program for the Salmon River (Lemhi River, East Fork Salmon River, and West Fork Yankee Fork populations), and the Johnson Creek supplementation program, as long as NOAA Fisheries determines these programs to be an essential and effective contribution to reducing the risk of extinction for this ESU. The Action Agencies believe that these actions contribute a ***low*** level of benefits for this ESU.

Northeast Oregon Hatchery Planning: BPA will continue to fund the planning process for the Northeast Oregon Hatchery production program, which may have ***low*** benefits for this ESU when implemented.

3. Snake River Fall Chinook

Survival improvements for this ESU will be gained through the actions displayed in **Figure 5**. The hydrosystem, predator control, and estuary habitat improvement actions are described in Section III.E.1, *Updated Proposed Actions that Benefit Multiple ESUs.*

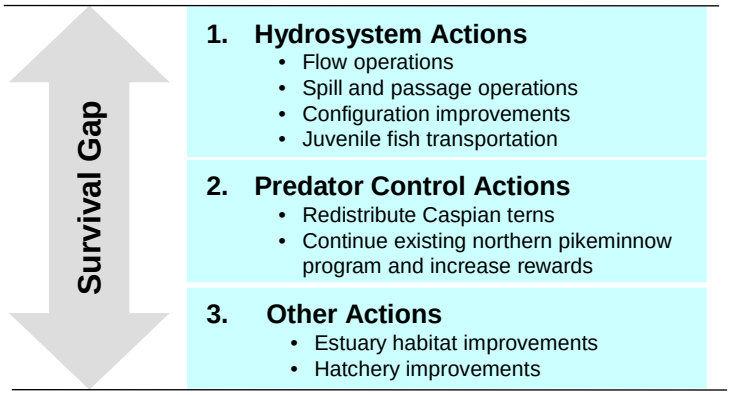

Figure 5 Updated Proposed Actions to benefit Snake River fall Chinook

Estuary Habitat Actions

The estuary habitat actions described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs* include shallow water habitat, freshwater marsh, and restored access to floodplains and side channel areas. These projects will help offset historical habitat losses and primarily benefit Snake River fall Chinook, and other ocean-type ESUs. Recent information provided verbally from NOAA Fisheries indicates the greatest potential to benefit Snake River fall Chinook may lie in improving side channel and off-channel habitat in the upper estuary, upstream of Portland. The Sandy River project occurs in this area. We will improve our understanding of the value of these habitats to this and other ESUs through action effectiveness monitoring associated with these projects. This improved understanding could lead us to an increased emphasis on habitat work in the upper estuary.

Biological benefits: The Action Agencies expect that Snake River fall Chinook will gain a ***medium*** level of benefit from implementation of our proposed estuary habitat actions.

Hatchery Actions

Lower Granite Dam Adult Trap Improvements: The Action Agencies propose to update adult salmon and steelhead collection facilities at Lower Granite Dam. This facility was designed and constructed (more than 25 years ago) during a period when anadromous fish adult returns were at very low numbers. Fall Chinook salmon returns, for example, were 16,000+ (6,600 natural origin fish) in 2002 compared to only 1,000 in 1975. The adult trapping and holding facilities would be modified to allow trapping and handling of up to approximately 6,000 adult fall Chinook salmon annually. Anticipated modifications include increased working space, an additional anesthetic tank, improved water supply, and increased number of adult holding tanks.

This proposed action is expected to: 1. Reduce risks to the ESU by improving hatchery practices (i.e., being able to collect and use natural-origin fish for broodstock will improve the integration between natural-origin and hatchery-origin fall Chinook salmon). 2. Jumpstart production in underutilized areas of

the Clearwater Basin by using natural-origin fish collected at the trap. 3. Reduce risks to the ESU from atypical straying of hatchery-origin fish from areas outside the Snake River Basin (i.e., increased trapping capability can allow the removal of unusual numbers of stray fish). 4. Improve data collection and understanding of ESU status (e.g., improved run-reconstruction). In order for the first three of these benefits to be fully realized, a number of production-related fishery management actions must be approved by the *US v Oregon* parties. The Action Agencies expect NOAA Fisheries to support these management actions in the *US v Oregon* process and that the actions will be approved.

The Action Agencies will fund their appropriate share of operation and maintenance costs associated with the fall Chinook trapping program, with cost sharing by other agencies as appropriate. NOAA Fisheries has proposed funding $100,000 of the estimated $250,000 annual O&M cost. The Action Agencies intend to: 1) operate LGR adult trap in 2005 and 2006 at current trapping capacity to support broodstock collection, remove out-of-basin strays, conduct research, and monitor status of the ESU; 2) complete the adult trap improvements in 2006; and 3) begin operating the improved trap in support of the actions listed above in 2007.

Nez Perce Tribal Hatchery fall Chinook component: BPA will continue to fund the Snake River fall Chinook component of the Nez Perce Tribal Hatchery program as long as NOAA Fisheries considers it to be contributing benefits to the ESU.

Biological benefits: The Action Agencies expect the adult trap improvements and the actions supported by the operation of the trap will contribute a ***medium*** level of benefits for Snake River fall Chinook.

4. Upper Columbia River Spring Chinook

Survival improvements for this ESU will be gained through the actions shown in Figure 6. The hydrosystem, predator control, and estuary habitat improvement actions are described in Section III.E.1, *Updated Proposed Actions that Benefit Multiple ESUs.*

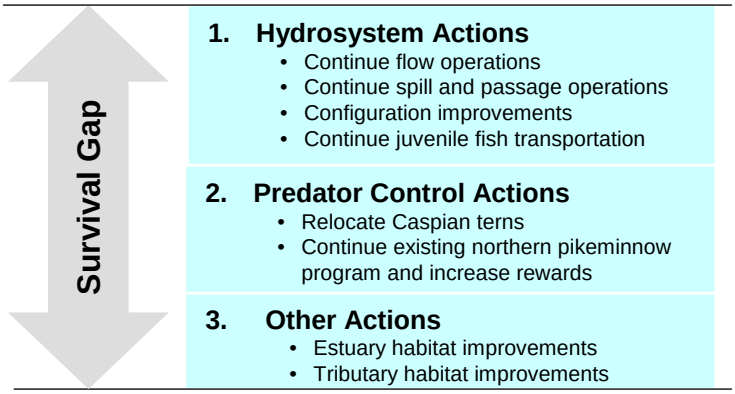

Figure 6 Updated Proposed Actions to benefit Upper Columbia River spring Chinook

Tributary Habitat Actions

The updated NOAA Fisheries analyses found that a qualitative estimate of "medium" (from 2 to 24 percent) improvements are needed for Upper Columbia River spring Chinook. The Action Agencies consider the survival change needed for Upper Columbia Spring Chinook to be in the lower range of medium. To fill that gap, the BPA and Reclamation propose a tributary habitat program to improve overall survival for the ESU during its spawning and rearing life stages.

NOAA Fisheries evaluated the likelihood of improving species survival through habitat improvements through an analytical approach that included the four VSP criteria of:

- abundance,
- productivity,
- diversity, and
- distribution.

NOAA performed a qualitative evaluation of trends in population status and associated tributary habitat condition and considered the potential to address identified habitat limitations sufficiently to elicit a response in population status. Qualitative rankings of high, medium, or low were assigned to population and habitat parameters based on the magnitude of the observed or potential change.

For Upper Columbia spring Chinook, NOAA concluded that there is a *medium potential* to improve spawning and rearing habitat in the three subbasins of this UPA. A summary of NOAA's analysis of the potential to increase populations, identification of anthropogenic limiting factors, identification of the ecological improvement potential, and adjusted improvement potential based on practical constraints is summarized in Table 7.

Table 7. NOAA Summary of Upper Columbia Spring Chinook (Yearlings)

Population	Index of Potential to Increase Population[9]	Primary Anthropogenic Limiting Factors [10]	Ecological Intrinsic Potential[11]	Intrinsic Potential Summary (practical constraints)[12]
Wenatchee	Very High	Medium—Channel morphology, flood plain connectivity, flows	Medium	Medium
Entiat	Very High	High—Channel morphology	Medium	Medium
Methow	Very High	Medium—Flows, entrainment, channel morphology, water temperatures	Medium	Medium

Upper Columbia spring Chinook spawn and rear in a limited number of tributaries to the upper Columbia River below Chief Joseph Dam. These tributaries rise along the eastern slope of the Cascade Range and include populations of the ESU in the Wenatchee, Entiat, and Methow. Actions to improve spawning and rearing habitat in all three of these tributaries (or subbasins) are included in this UPA.

Considerable investigations have been performed to identify the habitat limiting factors in the Wenatchee, Entiat, and Methow subbasins and to assess the opportunities for improvement. We do not reiterate those findings here. However, NOAA's recent analysis of potential habitat improvement measures and practical constraints in all three subbasins (Kratz et al. 2004) was considered in developing this UPA. In addition, we verified opportunities by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the Council's drafted subbasin plans, and consulting other state and local documents. (See Appendix E).

Wenatchee Subbasin. NOAA Fisheries' analysis showed that channel morphology, including flood plain connectivity and flows are the primary anthropogenic limiting factors in the Wenatchee subbasin. We include a significant increase of habitat condition associated with channel morphology. However, the flow improvement potential identified by NOAA Fisheries focuses on large streamflow increases in the lower Wenatchee River. Although low flows in this area limit some of the habitat potential, they do not form a migration barrier to other areas of the subbasin. Based upon practical constraints, there is little likelihood that flows could be significantly enhanced in that reach. Most upstream areas appear to have sufficient fish flows; but additional flow needs, if any, need to be confirmed by IFIM studies. Those studies are currently ongoing. Also, to provide greater assurance that the appropriate level of survival improvements accrue in the Wenatchee subbasin, BPA and Reclamation propose a habitat improvement action to address two additional limiting factors,1) entrainment, and 2) riparian enhancement and protection. NOAA did not identify these primary anthropogenic limiting factors, but the Action Agencies believe they would yield survival improvements. Based on the Action Agencies' analysis, the total proposed habitat improvements in the Wenatchee subbasin would meet the level of intrinsic potential needed to improve habitat conditions and juvenile survival.

Entiat Subbasin. NOAA identified channel morphology to be a primary anthropogenic limiting factor in the Entiat subbasin and considered the lower, channelized, section of the Entiat River to be of particular importance. Therefore, the UPA includes several morphology projects in the lower reach of the river including some opportunities to improve stream complexity and channel connectivity. We also anticipate

[9] Based upon an analysis of base period (historic) average annual redd counts and recent average annual redd counts.
[10] Anthropogenic limiting factors include instream flows, channel morphology (barriers, connectivity, condition of bed, sedimentation, etc.), entrainment (lack of fish screens), riparian condition, water quality including water temperature, etc.
[11] Ecological Improvement Potential is the anticipated qualitative response to improve population status by addressing limiting factors that resulted from anthropogenic management actions.
[12] An adjustment of the Ecological Improvement Potential based upon practical constraints which may limit the ability to address limiting factors including legal, social, political, or economic constraints.

that other channel morphology improvement projects will be implemented in other reaches of the subbasin.

Methow Subbasin. NOAA identified the primary anthropogenic limiting factors in the Methow as flows, entrainment, channel morphology, and water temperatures. The UPA considers those habitat limiting factors and NOAA's opportunity analyses to identify tributary habitat improvements for the Methow subbasin. Virtually all diversions in the Methow basin have been screened; consequently, our UPA focuses on implementing channel morphology projects. We also propose to implement some limited streamflow improvements and riparian protection and enhancement opportunities actions.

Summary—Upper Columbia Spring Chinook UPA

To confirm that the survival improvement goals are achieved, the Action Agencies will implement a habitat effectiveness monitoring program in the Methow subbasin. The program will inform the Action Agencies and NOAA about the survival effects of habitat improvement projects for this ESU. As our knowledge and understanding increases, we may modify the habitat goals associated with each limiting factor if a different mix of limiting factor goals would improve results.

Specific performance metrics and associated targets for improving Upper Columbia spring Chinook juvenile survival production in the Wenatchee, Entiat, and Methow subbasins is shown in Table 8. Metrics measurements and goals are established for 3 years after this UPA is adopted and cumulative goals for 6 years after adoption.

Table 8. UPA, Upper Columbia Spring Chinook, Wenatchee, Entiat, and Methow Subbasin

Limiting Factor	Metric Measurement	Metric Goal in three years	Cumulative Metric Goal in six years
Entrainment[13]	a. Number of screens addressed	5	10
Instream flow projects[14]	a. Cubic Feet per Second (cfs) of water protected for instream flows	12 cfs	40 cfs
Channel Morphology[15]	a. Miles of access restored b. Miles complexity restored	60 miles 5 miles	105 miles 10 miles
Riparian Protection/Enhancement[16]	a. Number of miles protected b. Number of miles enhanced.	4 miles 6 miles	12 miles 12 miles

Biological benefits: The Action Agencies proposed tributary habitat actions in the Wenatchee, Entiat, and Methow subbasins will provide a ***medium*** level of improvements for Upper Columbia River spring Chinook and are expected to exceed NOAA's identified survival gap for this ESU.

[13] Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

[14] Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual "wet water" instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

[15] Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

[16] Riparian protection projects include acquisition of riparian easements or purchases. Riparian enhancement projects include streambank stabilization and riparian treatments such as fencing or reconstruction.

Tributary Habitat Actions Implemented under the 2000 RPA

The Action Agencies' *2003 Progress Report* identified near- and long-term improvement actions that they had implemented under the 2000 RPA. A few of those actions were implemented in the Wenatchee, Entiat, and Methow subbasins and will continue to accrue survival benefits for upper Columbia River spring Chinook under the remanded BiOp. The Action Agencies expect that these actions will be maintained if needed to assure the continuations of benefits over time.

Table 9 lists the number of actions implemented by the Action Agencies in the Wenatchee, Entiat, and Methow subbasins that were reported in the *2003 Progress Report*. Information on additional actions implemented in FY 2004 have not yet been collected, but will be subsequently identified in the Action Agencies' 2004 Progress Report. Because the Action Agencies only began to collect consistent tributary habitat action metrics in FY 2003, this is a very conservative estimate of actions implemented under the 2000 RPA.

Additional detail, including metrics for each action, are available in Appendix C.

Table 9 Tributary Habitat Actions Implemented under the 2000 RPA – Wenatchee, Entiat, and Methow Subbasins

Near-Term Survival Improvement Actions	Implemented
Barrier removal (RPA action 149)	1
Lease or purchase in-stream flows (RPA actions 149 & 151)	2

Biological benefits: The Action Agencies believe that a ***very low*** level of near-term improvements will occur from these actions implemented under the 2000 RPA.

5. Upper Willamette River Chinook

This ESU does not have a survival gap associated with the FCRPS. However, survival improvements for this ESU will be gained through the actions listed in **Figure 7** and described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs*.

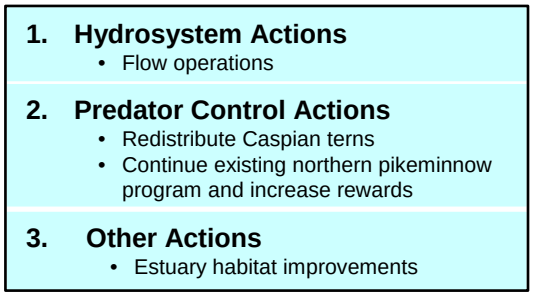

Figure 7 Updated Proposed Actions to benefit Upper Willamette River Chinook

6. Lower Columbia River Chinook

Survival improvements for this ESU will be gained through the actions listed in **Figure 8** and described in Section III.E.1, *Updated Proposed Actions that Benefit Multiple ESUs.*

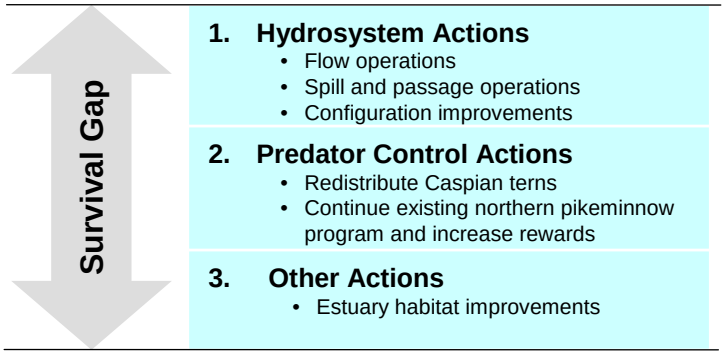

Figure 8 Updated Proposed Actions to benefit Lower Columbia River Chinook

7. Snake River Steelhead

Survival improvements for this ESU will be gained through the actions listed in **Figure 9**. The hydrosystem, predator control, and estuary habitat improvement actions are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs.*

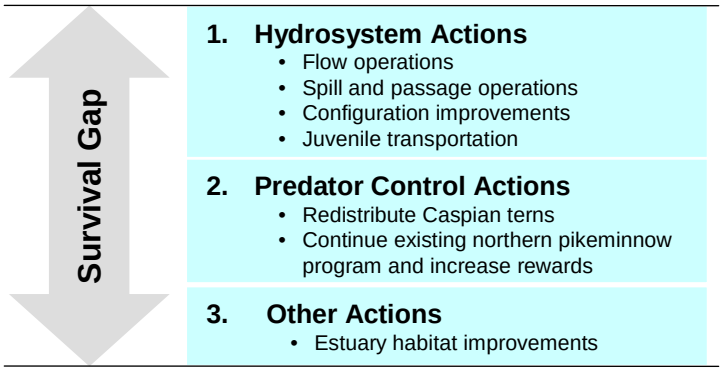

Figure 9 Updated Proposed Actions to benefit Snake River steelhead

Tributary Habitat Conservation Measure

Reclamation is proposing, as a conservation measure, to continue a tributary habitat technical assistance program which was instituted under the 2000 BiOp (RPA Action 149) in the Lemhi, Upper Salmon, and Little Salmon subbasins of the Salmon River drainage as described earlier for the Snake River spring/summer chinook ESU. It is important to note that this is a Reclamation conservation measure and does not imply or expect any level of participation by the other Action Agencies.

Snake River steelhead spawn and rear in the same major tributaries as spring/summer chinook plus steelhead utilize the Clearwater River basin and some Hells Canyon tributaries. NOAA Fisheries identified 25 populations in 6 major population groups for this ESU. As with spring/summer chinook, this conservation measure was not formulated to address all the major population groups but does include technical assistance for habitat improvements in subbasins that contain two of those major population groups.

For Snake River steelhead, NOAA Fisheries determined that the Lemhi and Upper Salmon River subbasins were considered to have a medium level of habitat improvement potential based upon practical constraints whereas the Little Salmon River was considered to have a very low habitat improvement potential. Reclamation considered the primary limiting factors identified by NOAA Fisheries for each subbasin and evaluated formulating a habitat improvement program which attempted to address those limiting factors considering the limitation of Reclamation authorities as described earlier for the Snake River spring/summer Chinook ESU.

Considerable investigations have been performed to identify the habitat limiting factors in the Little Salmon, Lemhi, and Upper Salmon Rivers basins and to assess the opportunities for improvement. We will not reiterate those findings here. However, in developing this conservation measure, Reclamation considered NOAA's recent analysis of potential habitat improvement measures and practical constraints in all three subbasins. In addition, opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the Council's draft subbasin plans, and consulting other state and local documents. Those habitat limiting factors, opportunity analyses, and Reclamation's discretionary authority were considered in developing a tributary

habitat conservation measure which focuses on three of the limiting factors: entrainment, channel morphology, and streamflow. We also considered on-going programs by other entities and formulated a conservation measure that does not duplicate those other efforts.

Most of the potential projects with willing non-Federal participants that were identified would benefit both Snake River spring/summer Chinook salmon and Snake River steelhead. Although steelhead tend to utilize habitat higher in the river systems than chinook, much of those high spawning and rearing streams are located on lands administered by the U.S. Forest Service which is formulating its own programs to improve habitat. To avoid duplication of effort, Reclamation is focusing on habitat improvement programs for the three selected limiting factors which are lower in the subbasin systems and which will improve survival for both ESUs. Therefore, the conservation measure metrics goals are identical for both species.

The conservation measure for improving Snake River steelhead juvenile survival production in the Lemhi, Upper Salmon, and Little Salmon subbasins is shown in Table 10 by metrics measurement and goals. Goals are established for three years after adoption of this revised Biological Opinion.

Table 10. Conservation Measures, Snake River Steelhead

Limiting Factor	Metric Measurement	3-Year Metric Goal
Entrainment	a. Number of screens addressed[17]	10
Instream flow projects[18]	a. Cubic feet per second (cfs) of water protected for instream flows	20
Channel Morphology[19]	a. Miles of access restored b. Miles of complexity restored	54 0.25

Tributary Habitat Actions Implemented under the 2000 RPA

The Action Agencies' *2003 Progress Report* identified near- and long-term improvement actions implemented under the 2000 RPA. A few of those actions were implemented in the Salmon subbasin and will continue to accrue survival benefits for Snake River steelhead under the remanded BiOp. The Action Agencies expect that these actions will be maintained if needed to ensure the continuation of benefits over time.

Table 11 lists the number of actions implemented by the Action Agencies in the Salmon subbasin that were reported in the *2003 Progress Report*. Information on additional actions implemented in FY 2004 have not yet been collected, but will be subsequently identified in the Action Agencies' 2004 Progress

[17] Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

[18] Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual "wet water" instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

[19] Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

Report. Because the Action Agencies only began to collect consistent tributary habitat action metrics in FY 2003, this is a very conservative estimate of actions implemented under the 2000 RPA.

Additional detail, including metrics for each action, is available in Appendix C.

Table 11 Tributary Habitat Actions Implemented under the 2000 RPA – Salmon Subbasin

Near-Term Survival Improvement Actions	Implemented
Barrier removal (RPA action 149)	10
Lease or purchase in-stream flows (RPA actions 149 & 151)	9
Long-Term Survival Improvement Actions	
Protection or enhancement of riparian habitat (conservation easements, leases, land acquisitions, and establish riparian buffers)	6

Biological benefits: The Action Agencies believe that ***very low*** to ***low*** near- and long-term improvements will occur from these actions implemented under the 2000 RPA.

8. Upper Columbia River Steelhead

Survival improvements for this ESU will be gained through the actions listed in Figure 10. The hydrosystem, predator control, and estuary habitat improvement actions that described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs.*

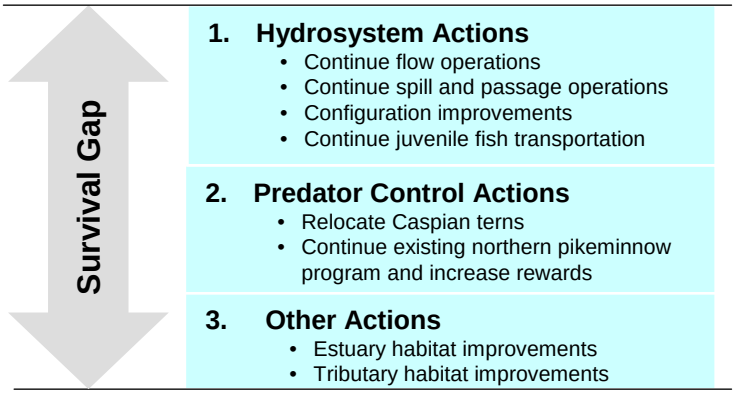

Figure 10 Updated Proposed Actions to benefit Upper Columbia River steelhead

Tributary Habitat Actions

According to NOAA Fisheries, a qualitative estimate of "medium" improvements are needed for Upper Columbia River steelhead. The Action Agencies consider this 3.8 percent gap to be in the lower range of "medium".

Upper Columbia steelhead spawn and rear in a limited number of tributaries to the upper Columbia River below Chief Joseph Dam. These tributaries rise along the eastern slope of the Cascade Range and include populations of the ESU in the Wenatchee, Entiat, Methow, and the Okanogan subbasins. Actions to improve spawning and rearing habitat in the Wenatchee, Entiat, and Methow subbasins are included in this UPA, and the Okanogan subbasin as a conservation measure.

Passage at Salmon Lake Dam and a potential pump exchange project for flow augmentation were identified as the major habitat improvement project in the Okanogan subbasin. However, there is low certainty that the Action Agencies could obtain measurable results from these projects during the term of this BiOp and considerable funding would need to be secured and, therefore, the level of certainty that habitat improvements could be made is not high enough to include these potential projects in this UPA.

For Upper Columbia steelhead, NOAA Fisheries concluded that there is a medium level of intrinsic potential to improve spawning and rearing habitat in the Wenatchee and Methow Rivers subbasins and a low to medium level of intrinsic potential in the Entiat. A summary of NOAA's analysis of the potential to increase populations, identification of anthropogenic limiting factors, identification of the ecological improvement potential, and adjusted improvement potential based on practical constraints is summarized in Table 12.

Table 12. Upper Columbia River Steelhead (Yearlings)

Population	Range of System Survival	Index of Potential to Increase Population[20]	Primary Anthropogenic Limiting Factors [21]	Ecological Intrinsic Potential[22]	Intrinsic Potential Summary (practical constraints)[23]
Wenatchee		Medium to High	Medium-High—Barriers, channel morphology including flood plain connectivity, flows	Medium	Medium
Entiat		Low to Medium	Medium—Channel morphology, flows	Medium	Low to Medium
Methow		High	Medium—Irrigation, sedimentation, barriers, large woody debris, riparian vegetation, and flows	Medium	Medium

In developing this UPA, the Action Agencies considered NOAA's recent analysis of potential habitat improvement measures and practical constraints in the Wenatchee, Entiat, and Methow subbasins. Opportunities were also verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the Council's draft subbasin plans, and consulting other state and local documents. (See Appendix E).

The limiting factors identified for Upper Columbia steelhead in each of the subbasins are similar to those identified for the Upper Columbia spring Chinook. BPA and Reclamation considered those similarities and selected an identical suite of habitat improvements for both ESUs in each subbasin. We will not reiterate these analyses here but refer the reader to the discussion of each subbasin's conditions under the

[20] Based upon an analysis of base period (historic) average annual redd counts and recent average annual redd counts.

[21] Anthropogenic limiting factors include instream flows, channel morphology (barriers, connectivity, condition of bed, sedimentation, etc.), entrainment (lack of fish screens), riparian condition, water quality including water temperature, etc.

[22] Ecological Improvement Potential is the anticipated qualitative response to improve population status by addressing limiting factors that resulted from anthropogenic management actions.

[23] An adjustment of the Ecological Improvement Potential based upon practical constraints which may limit the ability to address limiting factors including legal, social, political, or economic constraints.

section on Upper Columbia spring Chinook. Although steelhead tend to utilize habitat higher in the river systems than chinook, much of those high spawning and rearing streams are located on lands administered by the U.S. Forest Service, which is formulating its own programs to improve habitat. To avoid duplication of effort, BPA and Reclamation are focusing on habitat improvement programs for the four selected limiting factors that are lower in the subbasin systems and will improve survival for both ESUs. Therefore, our metrics goals are identical for both ESUs.

To confirm that the survival improvement goals are being achieved, BPA and Reclamation are implementing an effectiveness monitoring program in the Methow subbasin. The effectiveness monitoring findings will inform the Action Agencies and NOAA about the expected survival effects of the habitat improvement projects for this ESU. In future years, the Action Agencies will consider modifying the emphasis of the habitat goals associated with each limiting factor if we find that a better mix of limiting factor goals would yield better results.

The UPA for improving Upper Columbia River steelhead juvenile survival production in the Wenatchee, Entiat, and Methow subbasins is shown in Table 13 by metrics measurement and goals. We have established goals for three years after adoption of this UPA and cumulative goals for six years after adoption.

Table 13. UPA, Upper Columbia Steelhead, Wenatchee, Entiat, and Methow Subbasins

Limiting Factor	Metric Measurement	Metric Goal in three years	Cumulative Metric Goal in six years
Entrainment[24]	a. Number of screens addressed	5	10
Instream flow projects[25]	a. Cubic Feet per Second (cfs) of water protected for instream flows	12 cfs	40 cfs
Channel Morphology[26]	a. Miles of access restored b. Miles complexity restored	60 miles 5 miles	105 miles 10 miles
Riparian Protection/Enhancement[27]	a. Number of miles protected b. Number of miles enhanced.	4 miles 6 miles	12 miles 12 miles

Biological benefits: The Action Agencies anticipate a ***medium*** level of near- and long-term improvements for Upper Columbia River steelhead would occur from these proposed tributary actions.

[24] Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

[25] Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual "wet water" instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

[26] Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

[27] Riparian protection projects include acquisition of riparian easements or purchases. Riparian enhancement projects include streambank stabilization and riparian treatments such as fencing or reconstruction.

Tributary Habitat Conservation Measure- Okanogan Subbasin

As a conservation measure, BPA proposes to implement actions to improve tributary habitat conditions for upper Columbia steelhead in the Okanogan subbasin. This conservation measure is intended to meet a greater increment of overall survival for Upper Columbia Steelhead during their spawning and rearing life stages than is required to avoid jeopardy to the species; consequently, it is formulated to partially meet recovery standards for this ESU as defined by the regulatory guidance in the Endangered Species Consultation Handbook (USFWS and NOAA Fisheries, p. 4-19). Absent this conservation measure, BPA may still fund habitat actions under the broader Fish and Wildlife Program. It is important to note that this is a BPA conservation measure and does not imply or expect any level of participation by the other Action Agencies.

NOAA Fisheries evaluated the likelihood of improving species survival through habitat improvements through an analytical approach that considered the four VSP criteria of abundance, productivity, diversity and distribution. NOAA performed a qualitative evaluation of trends in population status and associated tributary habitat condition and considered the potential to address identified habitat limitations sufficiently to elicit a response in population status. Qualitative rankings of high, medium, or low were assigned to population and habitat parameters based on the magnitude of the observed or potential change.

For Upper Columbia River Steelhead, NOAA concluded that there is a high level of "intrinsic potential" to improve spawning and rearing habitat in Okanogan is possible when practical constraints are not considered. BPA considered the primary limiting factors identified by NOAA Fisheries for the subbasin that include temperature, barriers, flow, and sediment. Since Reclamation does not have authority to fund habitat actions in the Okanogan, BPA evaluated potential options for improving habitat in the subbasin. BPA proposes to implement some habitat activities to address limiting factors, such as enhancing riparian habitat and improving flows through instream water transactions. BPA may pursue these habitat actions in the Okanogan subbasin through the Council's Fish and Wildlife Program.

Tributary Habitat Actions Implemented under the 2000 RPA

The Action Agencies' *2003 Progress Report* identified near- and long-term improvement actions implemented under the 2000 RPA. A few of those actions were implemented in the Wenatchee, Entiat, Methow, and Okanogan subbasins and will continue to accrue survival benefits for upper Columbia River steelhead under the remanded BiOp. The Action Agencies expect that these actions will be maintained if needed to ensure the continuation of benefits over time.

Table 14 lists the number of actions implemented by the Action Agencies in the Wenatchee, Entiat, Methow, and Okanogan subbasins that were reported in the *2003 Progress Report*. Information on additional actions implemented in FY 2004 have not yet been collected, but will be subsequently identified in the Action Agencies' 2004 Progress Report. Because the Action Agencies only began to collect consistent tributary habitat action metrics in FY 2003, this is a very conservative estimate of actions implemented under the 2000 RPA.

Additional detail, including metrics for each action, are available in Appendix C.

Table 14 Tributary Habitat Actions Implemented under the 2000 RPA – Wenatchee, Entiat, Methow, and Okanogan Subbasins

Near-Term Survival Improvement Actions	Implemented
Barrier removal (RPA action 149)	2

Near-Term Survival Improvement Actions	Implemented
Lease or purchase in-stream flows (RPA actions 149 & 151)	2
Long-Term Survival Improvement Actions	
Protection or enhancement of riparian habitat (conservation easements, leases, land acquisitions, and establish riparian buffers)	1 (Okanogan subbasin)

Biological benefits: The Action Agencies believe that ***very low*** near- and long-term survival improvements could be expected to occur from these actions implemented under the 2000 RPA.

9. Mid-Columbia River Steelhead

Survival improvements for this ESU will be gained through the actions shown in **Figure 11**. The hydrosystem, predator control, and estuary habitat improvement actions that are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs*.

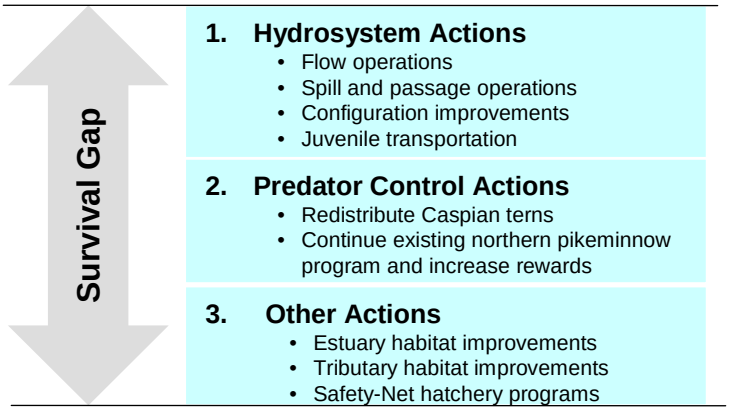

Figure 11 Updated Proposed Actions to benefit Mid-Columbia River steelhead

Hatchery Actions

Safety-Net Program: BPA will continue to fund the Mid-Columbia River steelhead safety-net program associated with the Umatilla Hatchery and the Yakima River steelhead kelt reconditioning program as long as NOAA Fisheries determines these programs to be an essential and effective contribution to reducing the risk of extinction for this ESU.

Biological benefits: The Action Agencies believe that the safety-net program provides a ***low*** level of survival improvement for Mid-Columbia River steelhead because it is effective at reducing the short-term risk of extinction.

Tributary Habitat Conservation Measure

Reclamation is proposing, as a conservation measure, to continue a tributary habitat technical assistance program which was instituted under the 2000 BiOp (RPA Action 149) in three tributaries of the John Day subbasin. This conservation measure is intended to meet a greater increment of overall survival for Mid-Columbia steelhead during their spawning and rearing life stages than is required to avoid jeopardy to the species; consequently, it is formulated to partially meet recovery standards for this ESU as defined by the regulatory guidance in the Endangered Species Consultation Handbook (USFWS and NOAA Fisheries, p. 4-19). Absent this conservation measure, Reclamation would be required to withdraw from its current participation in tributary habitat improvements in the Upper John Day, Middle Fork John Day, and North Fork John Day due to a lack of funding authority. It is important to note that this is a Reclamation conservation measure and does not imply or expect any level of participation by the other Action Agencies.

NOAA Fisheries evaluated the likelihood of improving species survival through habitat improvements through an analytical approach that considered the four VSP criteria of abundance, productivity, diversity and distribution. NOAA performed a qualitative evaluation of trends in population status and associated tributary habitat condition and considered the potential to address identified habitat limitations sufficiently to elicit a response in population status. Qualitative rankings of high, medium, or low were

assigned to population and habitat parameters based on the magnitude of the observed or potential change.

For the populations of Mid-Columbia steelhead, NOAA concluded that there is a high level of "intrinsic potential" to improve spawning and rearing habitat in the three subbasins of this conservation measure. Reclamation considered the primary limiting factors identified by NOAA Fisheries for each subbasin and evaluated formulating a habitat improvement program that attempted to address those limiting factors considering the limitation of Reclamation authorities. Reclamation does not have, and does not anticipate having, authority to address riparian habitat protection or enhancement actions. Reclamation can provide technical assistance to solve engineering issues affiliated with channel morphology but currently does not have authority to fund the construction of such projects. Authority to fund construction of instream projects has been introduced in the Congress. Reclamation can consider leasing or acquiring instream flows in compliance with state water law. In consideration of these authority limitations, this conservation measure is formulated to allow Reclamation to continue its current technical assistance program in the three selected subbasins, but cannot promise that authority to go beyond that program is forthcoming with any certainty.

Considerable investigations have been performed to identify the habitat limiting factors in the three John Day River tributaries included in this conservation measures and to assess the opportunities for improvement. We will not reiterate those findings here. However, in developing this conservation measure, Reclamation considered NOAA's recent analysis of potential habitat improvement measures and practical constraints in all three tributaries. In addition, opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the Council's draft subbasin plans, and consulting other state and local documents. Those habitat limiting factors, opportunity analyses, and Reclamation's discretionary authority were considered in developing a tributary habitat conservation measure which focuses on three of the limiting factors: entrainment, channel morphology, and streamflow. We also considered on-going programs by other entities and formulated a conservation measure that does not duplicate those other efforts.

The conservation measure for improving Mid-Columbia steelhead juvenile survival production in the North Fork John Day, Middle Fork John Day, and Upper John Day subbasins is shown in Table 15 by metrics measurement and goals. Goals are established for three years after adoption of NOAA's new BiOp.

Table 15. Conservation Measure, Mid-Columbia Steelhead

Limiting Factor	Metric Measurement	3-Year Metric Goal
Entrainment	a. Number of screens addressed[28]	30
Instream flow projects[29]	a. Cubic feet per second (cfs) of water protected for instream flows	7 cfs
Channel Morphology[30]	a. Miles of access restored	24 miles

[28] Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

[29] Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual "wet water" instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

Limiting Factor	Metric Measurement	3-Year Metric Goal
	b. Miles of complexity restored	3 miles

Biological benefit: The Action Agencies anticipate that ***low*** near- and long-term improvements to benefit Mid-Columbia River steelhead will occur as a result of these actions implemented under the 2000 RPA.

Tributary Habitat Actions Implemented under the 2000 RPA

The Action Agencies' *2003 Progress Report* identified near- and long-term improvement actions that they had implemented under the 2000 RPA. A few of those actions were implemented in the John Day subbasin and will continue to accrue survival benefits for mid-Columbia River steelhead under the remanded BiOp.

Table 16 lists the number of actions implemented by the Action Agencies in the John Day subbasin that were reported in the *2003 Progress Report*. Information on additional actions implemented in FY 2004 have not yet been collected, but will be subsequently identified in the Action Agencies' 2004 Progress Report. Because the Action Agencies only began to collect consistent tributary habitat action metrics in FY 2003, this is a very conservative estimate of actions implemented under the 2000 RPA.

Additional detail, including metrics for each action, is available in Appendix C.

Table 16 Tributary Habitat Actions Implemented under the 2000 RPA – John Day Subbasin

Near-Term Survival Improvement Actions	Implemented
Barrier removal (RPA action 149)	4
Lease or purchase in-stream flows (RPA actions 149 & 151)	17
Long-Term Survival Improvement Actions	
Protection or enhancement of riparian habitat (conservation easements, leases, land acquisitions, and establish riparian buffers)	70

Biological benefits: The Action Agencies believe that ***very low*** to ***low*** near- and long-term survival improvements could be expected to occur from these actions implemented under the 2000 RPA.

[30] Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

10. Upper Willamette River Steelhead

This ESU is not jeopardized by the FCRPS. However, survival improvements for this ESU will be gained through actions shown in Figure 12. The hydrosystem, predator control and estuary habitat improvement actions are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs*.

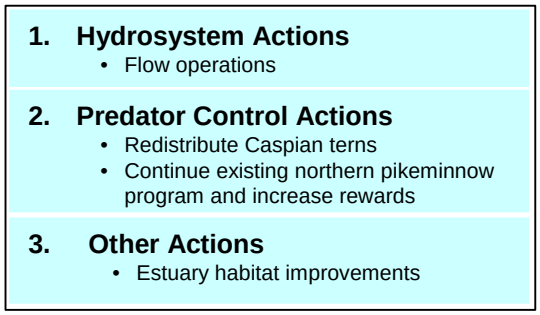

Figure 12 Updated Proposed Actions that would benefit Upper Willamette River steelhead

11. Lower Columbia River Steelhead

Survival improvements for this ESU will be gained through the actions listed in Figure 13. The hydrosystem, predator control, and estuary habitat improvement actions are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs.*

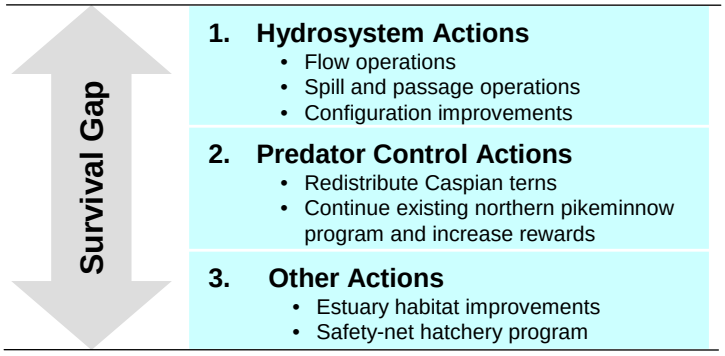

Figure 13 Updated Proposed Actions to benefit Lower Columbia River steelhead

Hatchery Actions

Safety-Net Program. BPA will continue to fund the Lower Columbia River steelhead safety-net program associated with the Hood River Production Program (Parkdale/Oak Spring hatcheries) as long as NOAA Fisheries determines it to be an essential and effective contribution to reducing the risk of extinction for this ESU.

Biological benefits: The Action Agencies believe that the safety-net program provides a ***low*** level of improvement for Lower Columbia River steelhead because it is effective at reducing the short-term risk of extinction.

12. Columbia River Chum

Survival improvements for this ESU will be gained through the actions listed in **Figure 14**. These actions are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs*. Caspian terns nesting in the estuary have little to no effect on Columbia River chum.

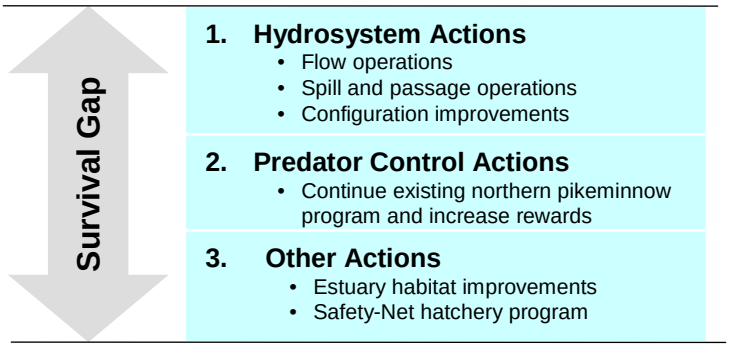

Figure 14 Updated Proposed Actions to benefit Columbia River chum

Hatchery Actions

Safety-Net Program: BPA will continue to fund the program to re-introduce Columbia River chum salmon into Duncan Creek as long as NOAA Fisheries determines it to be an essential and effective contribution to reducing the risk of extinction for this ESU.

Biological benefits: The Action Agencies believe that this hatchery action would provide a ***low*** level of improvement for Columbia River chum.

13. Snake River Sockeye

Survival improvements for this ESU will be gained through the actions listed in Figure 15. The hydrosystem, predator control, and estuary habitat improvement actions are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs.*

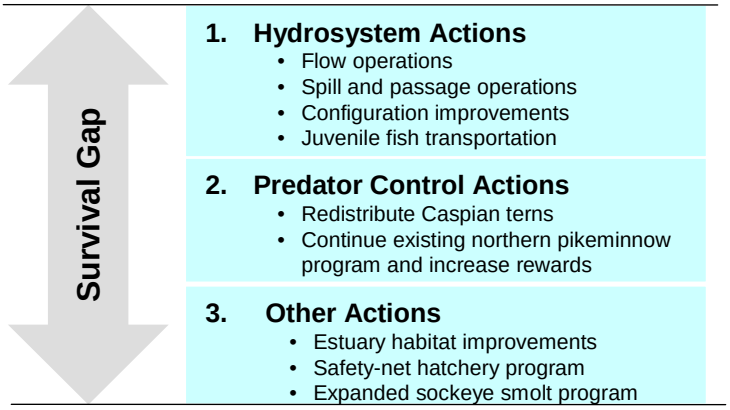

Figure 15 Updated Proposed Actions to benefit Snake River sockeye

Hatchery Actions

Safety-Net Program. The Action Agencies believe that the past and continuing operation of the Snake River Sockeye Safety Net Program is essential to preventing extinction of this ESU. BPA will continue to fund this program with the following projects as long as NOAA Fisheries determines it to be an effective and essential contribution to reducing the risk of extinction for this ESU:

- Redfish Lake Sockeye Captive Broodstock Program (two projects)
- Genetic Analysis of *Oncorhynchus nerka*
- Sockeye Salmon Habitat and Limnological Research

Expanded Sockeye Smolt Program. The Action Agencies propose to construct and fund operation of new hatchery facilities to produce smolts that support Snake River sockeye salmon survival and recovery. New facilities would be located in Oregon at Oxbow Hatchery near Bonneville Dam. This site would be capable of producing up to 150,000 smolts annually for release into Idaho's Sawtooth Valley sockeye salmon production areas (Redfish, Pettit, and Alturas lakes). This annual level of smolt production will depend on adequate number of broodstock for the smolt program. The overall objective is to seed/jumpstart the production areas with adults returning from smolt releases. The Action Agencies expect NOAA Fisheries to support these management actions in the *US v Oregon* process and that the actions will be approved.

The Snake River Sockeye Safety Net Program has likely prevented the extinction of this ESU. Still, except in 2000, sockeye returns to the Sawtooth Valley lakes have not exceeded 26 fish. This captive broodstock program has temporarily saved Snake River sockeye salmon and now additional hatchery actions are needed to jumpstart the ESU. Sawtooth Valley production areas need to be more fully seeded and only a larger-scale smolt program has the potential to accomplish this. Smolt releases produced the one substantial adult sockeye return in 2000 (257 fish).

The Action Agencies intend to complete the improvements to the Oxbow Hatchery by 2006 to allow for this additional smolt production starting with brood year 2006. The Action Agencies anticipate that these additional smolts will be available for release in 2008.

Biological benefit: The Action Agencies anticipate that these hatchery actions will provide a ***medium*** level of near- and long-term improvements for Snake River sockeye.

14. Lower Columbia River Coho

The Lower Columbia River coho is proposed for listing under the ESA. Survival improvements for this ESU will be gained through the actions listed in Figure 16. The hydrosystem, predator control, and estuary habitat actions are described in Section III.E.1 *Updated Proposed Actions that Benefit Multiple ESUs*.

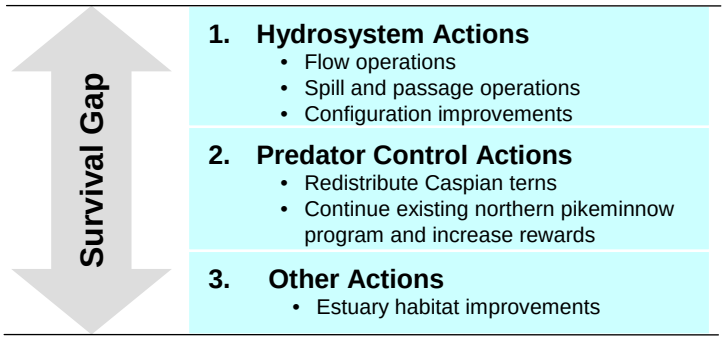

Figure 16 Updated Proposed Actions to benefit Lower Columbia River coho

IV. Research, Monitoring, and Evaluation (RM&E)

The Action Agencies will focus their RM&E efforts on assessing and maximizing performance of our proposed hydrosystem and non-hydrosystem actions. In addition to our proposed RM&E actions, and as part of our contribution to regional recovery efforts, we will continue to participate in the development, coordination, and implementation of a comprehensive RM&E program that is integrated with the council's Fish and Wildlife Program, the Corps' AFEP program, Reclamation's appropriated technical assistance activities, and RM&E activities of other Federal Caucus agencies. This RM&E program will be coordinated with regional federal, state, and tribal entities and results, as available, will be included in the annual progress reports.

Our proposed RM&E actions under the BiOp remand are integrated with conservation actions within our overall strategy descriptions and rationales. For clarity, specific actions are separated out under the headings of "Updated Proposed Actions" and "Conservation Actions."

RM&E Strategy 1: Status Monitoring

Rationale for BiOp and Recovery Measures: Regional monitoring of status information such as adult and juvenile fish abundance, distribution, and survival, or environmental conditions that have been identified as key measures of fish performance, is needed for an effective performance based approach. Under this strategy, the Action Agencies will continue to work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to participate in a regionally developed network of status monitoring programs. Together these regional agency programs will provide the information needed to determine and track the status of ESA populations and their environment (including assessment of performance measures and standards).

The Action Agencies' primary responsibility for status monitoring will be within the hydrosystem corridor. The Action Agencies will also participate in the further development and networking of other agencies' regional monitoring programs outside of the hydrosystem. The Action Agencies will continue to implement tributary and estuary habitat pilot status-monitoring projects, participate in regional coordination activities, and implement policies that support a comprehensive and compatible network of regional programs.

A regional network of status monitoring programs will need to cover hydro corridor, tributary, and estuary habitat components of all ESA listed populations in an integrated approach that includes a landscape level classification framework. The Action Agencies will coordinate and further develop the tributary habitat component through the PNAMP, pilot projects in the Upper Columbia Basin, the John Day subbasin, and potentially a third pilot area within a high priority habitat action area, and the Columbia Basin Fish and Wildlife Authority (CBFWA) Collaborative Systemwide Monitoring and Evaluation Project. We will coordinate and further develop the hydrosystem corridor component through the Corps' AFEP. The estuary component will be coordinated and further developed through implementation of the estuary RM&E Plan in the lower Columbia River below Bonneville Dam.

- The regional, multi-agency network of status monitoring programs needs to be integrated with action effectiveness and critical uncertainty research strategies. An integrative conceptual model will be developed to help link the various monitoring and research efforts and further define the regional monitoring network. This work will be coordinated with development of a regional data network and associated data management pilot projects as part of the data management strategy (see RM&E Strategy 5).

RM&E Status Monitoring Substrategy 1.1: System Level Monitoring

This substrategy identifies status-monitoring actions that are focused at the entire system or are process oriented. Under this substrategy the Action Agencies will continue to develop and implement pilot projects for tributary and estuary habitat status-monitoring, implement the Action Agencies' hydrosystem status-monitoring program, participate in regional coordination activities (such as PNAMP), and implement policies that support regional status-monitoring programs.

Updated Proposed Actions:

- Implement and maintain the Columbia River Basin PIT Tag Information System. Expand the system to systematically plan PIT Tag efforts in the pilot study basins such that production and survival can be estimated throughout the system for wild and hatchery fish.
- Implement fish harvesting incidental mortality monitoring with a focus on Columbia Basin fisheries.
- Fund marking of hatchery releases from Action Agency funded facilities in accordance with marking guidelines provided by NOAA Fisheries, to enable monitoring of hatchery-origin fish in natural spawning areas and the assessment of status of wild populations.

Conservation Actions:

- Implement pilot projects that support a regionally coordinated program for aerial and satellite imagery data.
- Implement a landscape change analysis pilot project using satellite imagery.
- Continue development and implementation of new fish detection and tagging techniques.

RM&E Status Monitoring Substrategy 1.2: Tributary Monitoring

This substrategy includes status-monitoring actions within tributary habitats. Under this substrategy, the Action Agencies will work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to develop a regional network of status-monitoring programs covering fish populations and environmental conditions in the tributaries. To support this effort, the Action Agencies will participate with other regional federal, state, and tribal agencies to support the PNAMP coordination efforts on tributary habitat and fish population status monitoring.

Updated Proposed Actions:

- Implement status monitoring pilot projects within the Upper Columbia action area to further advance the methods and information needed for assessing the status of fish populations and their environment.
- Monitor John Day subbasin adult steelhead spawning and juvenile migration timing, abundance, and rearing densities.

Conservation Measure:

- The Action Agencies will work with NOAA to implement pilot projects for tributary habitat status monitoring in the John Day subbasin and potentially one other action area (to be determined yet) to further advance the methods and information needed for assessing the status of fish populations and their environment.

Conservation Actions:

- Work with the USFWS to further define status monitoring requirements for resident fish and integrate these monitoring requirements with the NOAA Fisheries/Action Agency RM&E Plan.

- Implement the CBFWA Collaborative Systemwide Monitoring and Evaluation Project and collaborate with state, tribal and federal fish agencies on monitoring designs and sampling protocols.
- Inventory tributary status monitoring work in the Columbia River Basin.
- Assess the feasibility of remote monitoring approaches to quantify adult steelhead in select tributaries.

RM&E Status Monitoring Substrategy 1.3: Hydrosystem Corridor Monitoring

This substrategy includes status-monitoring actions that are focused on the hydrosystem corridor.

Updated Proposed Actions: The Action Agencies will continue to implement adult and juvenile migration status monitoring within the hydro corridor and improve upon these capabilities to provide dam specific and system level passage survival information for ESA listed species.

Hydrosystem corridor status monitoring actions include:

- Conduct annual Smolt Monitoring Program (SMP) at seven mainstem Snake and Columbia River dams.
- Monitor wild Snake River spring/summer Chinook salmon smolt migrations.
- Monitor smolt condition relative to biological and environmental conditions.
- Monitor adult returns with the PIT tag detection system.
- Provide in-season statistical support, real-time run predictions, and annual review of run-timing predictions.
- Monitor emergence, growth, migration timing, and survival of Snake River fall Chinook.
- Obtain accurate counts of Snake River fall Chinook salmon redds upriver of Lower Granite Dam.
- Produce digital maps of the riparian areas, wetland features, and stream channel boundaries for mainstem streams.
- Complete downstream migrant kelt assessment to determine magnitude of passage, contribution to population diversity and growth, and potential actions to provide safe passage.

Additional status monitoring for hydro corridor configuration is listed below. This work will continue to be developed and coordinated through the AFEP and in coordination with the Regional Forum SCT.

Bonneville Dam

- Estimate total project and route-specific juvenile survival and fish passage efficiency for the new Bonneville 2nd powerhouse corner collector and juvenile bypass system, spillway, and 1st powerhouse sluiceway for spring and summer species.
- Complete analysis of adult fallback and make recommendations on potential improvements for passage.

The Dalles Dam

- Characterize stilling basin hydraulic conditions, estimate direct plus indirect survival and injury rates, and estimate juvenile fish travel paths through the forebay and stilling basin. Evaluate fish passage efficiency for all routes of juvenile passage.

John Day Dam

- Estimate project and route specific survival rates, fish passage efficiency and spill passage efficiency, forebay retention time, and tailrace egress for juvenile passing through John Day Project.

McNary Dam

- Estimate project and route specific juvenile survival rates.
- Evaluate adult passage, including kelts, associated with RSWs as warranted.

Ice Harbor

- Estimate project and route specific juvenile survival rates.
- Monitor spillway injury and mortality for juvenile fish.
- Evaluate adult passage, including kelts, associated with RSWs.

Lower Monumental

- Estimate project and route-specific juvenile survival rates.
- Evaluate adult passage, including kelts, associated with RSWs as warranted.

Little Goose

- Evaluate adult passage, including kelts, associated with RSWs as warranted.

Lower Granite

- Estimate passage efficiency and survival of subyearling Chinook with removable spillway weir.
- Evaluate adult passage, including kelts, associated with RSWs.

Hydrosystem

- Complete analysis to assess unaccounted loss and delay of radio tagged fish to develop a strategy for integrating information from adult pit tag monitoring to the baseline studies for adult survival.
- Further development of the adult pit tag system to interrogate adult passage in natal streams. This will allow for further enumeration of pre-spawning mortality and reduced spawning success of adult upstream migrating fish, which may be due to or exacerbated by passage through the FCRPS hydro projects. If measures are identified which will reduce the pre-spawning mortality rate, the Action Agencies will implement these measures, as warranted.
- Evaluate fish ladder temperatures.
- Continue developing potential improvements to juvenile PIT tag detection systems and alternative technologies associated with high discharge fish passageways (e.g., Bonneville corner collector, spillways and turbines) and tributaries.

RM&E Status Monitoring Substrategy 1.4: Estuary/Ocean Plume Monitoring

This substrategy focuses on estuary/ocean status monitoring actions. Under this substrategy, Action Agencies will work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to develop a program to monitor estuary and plume conditions and juvenile salmon growth and survival.

The final draft of the Action Agencies' *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary* (Plan) was produced in July 2004. The Plan identifies the Columbia River estuary as a key element of the basin-wide research, monitoring, and evaluation effort developed for the 2000 BiOp for the operation of the FCRPS. During up and downstream migrations, all the listed anadromous ESUs use the estuary in varying degrees ranging from a conduit to the ocean to extended juvenile rearing that may contribute substantially to their success in the ocean.

Additionally, the Action Agencies RM&E program has recommended several status monitoring actions that should be undertaken in the Columbia River estuary. In developing the RM&E program, the Action Agencies are including recommendations that other regional entities have the responsibility authority to

implement. The intent of this strategy was to develop an RM&E program that was robust and comprehensive, understanding that the program would have to be linked to and coordinated with other agencies, such as the EPA and state regulatory agencies, as well as NOAA Fisheries. The Action Agencies are implementing the following status monitoring actions in the estuary and ocean plume:

- Monitor presence/absence and population identity of juvenile salmonids in the upper reaches of the estuary.
- Evaluate the role of river flow on habitat opportunities and food web structure for juvenile salmon by comparing historic and current conditions using model simulations and empirically derived food-web linkages.
- Evaluate the role of the Columbia River plume in survival of juvenile salmon through long-term observations, fine-scale process studies, retrospective assessments, and modeling to assess management of flow to improve habitat opportunity.
- Habitat monitoring program to develop protocols, procedures, and indicators for measuring habitat condition for both long term habitat monitoring and restoration project monitoring and evaluation requirements; and a toxic contaminant monitoring project to address accumulation of toxic contaminants in sensitive habitat areas, contaminant trends over time, and possible impacts on sensitive species.
- Estimate survival of juvenile salmonids from Bonneville to the mouth of the Columbia River using acoustic tags.
- Determine the relationships between habitat conditions and the life-history diversity, abundance and performance of juvenile salmon and the potential salmonid responses to past and future habitat change.
- Evaluate the relationship among time of ocean entry, physical and biological characteristics of the estuary and plume environment and adult return rates.

The information from status monitoring, both estuary-wide and reference site monitoring, and action effectiveness research will be summarized in periodic reports. In this complex adaptive management process, program evaluation will include adjusting program objectives and methodologies based on new information. The Action Agencies will document changes to the estuary program through our annual progress reports.

The complexity in identifying performance standards is well documented in the NOAA Fisheries estuary documents; *Salmon at Rivers End,* 1999, and the NOAA Technical Memorandum; *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of Selected Factors on Population Viability*, May 2004. The former offered that we do not know if the estuary is limiting at all for salmon. The more recent paper proposed factors that NOAA Fisheries believes can potentially affect salmonid population viability, and addressed a subset. These are; water flow, availability of salmon habitats, toxics, and predation (primarily Caspian terns).

There are clearly estuary actions with a high probability of benefiting salmon and addressing the NOAA Fisheries proposed factors. These are addressed in this UPA. Performance standards will be developed and monitored as actions are implemented in the adaptive management process concurrent with identifying which factors may be limiting for salmonid viability.

RM&E Strategy 2: Action Effectiveness Monitoring and Research

Rationale: The objective of this strategy is to assess the effects of hydrosystem and non-hydrosystem actions on fish production, survival, fish condition, and habitat condition in a quantitatively rigorous approach. This information will be critical to assessments of the expected benefits of hydrosystem and off-site actions and their relative priority for implementation. This research requires well-designed

experiments, with treatment areas, controls and adequate replication. The Action Agencies will continue to refine and implement habitat action effectiveness research through implementation of pilot studies and coordination through the PNAMP. The habitat effectiveness studies will be integrated with status monitoring, and critical uncertainties research, as part of the broader comprehensive RM&E Program called for in the Federal Caucus' *All-H Strategy* and the Council's Fish and Wildlife Program.

Under the action effectiveness monitoring and research strategy, the Action Agencies expect to implement the UPA and conservation actions in coordination with other regional federal, state, and tribal agencies to achieve the following outcomes:

- Effectiveness research that provides an understanding of the general magnitude and relative effectiveness of different categories of tributary and estuary habitat actions on the productivity of anadromous fish under different limiting conditions.
- Effectiveness research that quantifies the effect of hydrosystem fish passage improvement actions on the survival of juvenile and adult anadromous fish.
- Effectiveness research identifying the effects of changes in hatchery or harvest management practices on ESA-listed anadromous fish.
- Effectiveness research that identifies the effect of selective fishery and reduced incidental take harvest methods.

RM&E Substrategy 2.1 Action Effectiveness Research: Hydrosystem

This substrategy focuses on hydrosystem related action effectiveness research.

Updated Proposed Actions: The Action Agencies will continue to fund studies to advance the understanding of the effectiveness of flow augmentation, spill, transportation, predator control, and changes in system configurations on fish survival, fish condition and habitat for each of the ESUs. Ongoing AFEP research projects will continue to support this work as a primary objective.

Hydrosystem action effectiveness research projects include:

- Study the effect of summer flow augmentation on water temperature, water velocity, and juvenile fall Chinook salmon migratory behavior and survival in Lower Granite Reservoir.
- Determine juvenile fish transportation effectiveness through evaluation of: (1) survival and adult return rates of juvenile salmonids transported compared to in-river migrating fish; (2) post-release losses and barging strategies that minimize post-release mortality; (3) benefits of trucking juvenile salmonids; (4) late-season transportation at McNary Dam; and (5) evaluate D of transported fish relative to in-river migrants.
- A comprehensive evaluation of Snake River fall Chinook transportation is planned to begin when RSWs or other surface-oriented passage is provided at the Snake River collector dams to provide more favorable inriver passage conditions (2007/2008). This study will follow initial determination of related life history attribute considerations influencing transportation success and passage timing through the FCRPS.

Additional effectiveness research projects related to hydrosystem configuration are listed below. This work will continue to be developed and coordinated through the AFEP and in coordination with the SCT.

Bonneville Dam

- Evaluate the effect of improvements to the screen bypass system at the Bonneville Second Powerhouse and determine level of implementation if appropriate.
- Evaluate the effectiveness of the Second Powerhouse Corner Collector at increasing survival of juvenile fish passing the dam.

- Evaluate the effectiveness of the First Powerhouse sluiceway and determine the best survival routes. Determine if additional measures for juvenile survival improvements are needed at the First powerhouse
- Information from these evaluations and others will be used to update the Bonneville Decision Document and assess alternatives for optimizing project survival as needed to meet juvenile and adult performance standards. This assessment will include consideration of juvenile spill operations.

The Dalles Dam

- Evaluate adult delay and fallback with new spill patterns developed with respect to the installation of the spillway training wall.
- Evaluate the effectiveness of the new spill patterns and spillway training wall and determine whether additional improvements to spillway fish survival are warranted.
- Evaluate the behavior of fish in the forebay of The Dalles Dam to determine the feasibility of a physical guidance device for the forebay and assist in design of a device to improve fish passage efficiency.

John Day Dam

- Evaluate project operations and/or alternatives that improve tailrace egress for juvenile fish passing through the powerhouse.
- Evaluate survival and injury rates of juvenile fish that pass through turbine units to help identify the potential for turbine survival improvements.
- Evaluate the potential for surface flow bypass or surface spill alternatives to increase fish passage efficiency.
- Evaluate the potential to improve fish guidance efficiency at John Day Dam. Assess injury and survival with new vertical barrier screens installed.

McNary Dam

- Evaluate effectiveness of Snake River spring/summer Chinook, Snake River fall Chinook and steelhead juvenile fish transportation.

Hydrosystem

- Initiate a turbine passage survival study to develop a strategy for rehabilitation of existing turbine units, develop turbine operating guidelines to improve fish survival and conduct studies to support Ice Harbor turbine replacement.
- Evaluate the effects of changes in fish ladder temperature.
- Evaluate the effects of different entrance designs on the behavior of juvenile fish (e.g., The Dalles sluiceway, Bonneville corner collector, Lower Granite RSW).
- Report on water temperature effects on adult salmonids between McNary Dam and the confluence of the Clearwater River.

RM&E Substrategy 2.2 Action Effectiveness Research: Habitat

This substrategy focuses on tributary and estuary habitat related action effectiveness research. The RM&E work will be guided by the tributary status and action effectiveness research section of the joint NOAA/Action Agency RM&E plan and the associated Upper Columbia monitoring strategy. Metrics will be analyzed and physical and biological responses in pilot project annual reports and 3-year progress reports. This research will help identify the general magnitude and relative effectiveness of different categories of tributary habitat actions and their combined contribution toward meeting any gap deficiencies.

The Action Agencies will implement action effectiveness research through pilot studies in key basins where the research will contribute to the overall goal of understanding how to meet the hydrosystem survival gap most efficiently. The Action Agencies will concentrate on four types of tributary actions in the Action Area: entrainment, instream flow, channel structure, and riparian habitat. These actions affect the primary limiting factors for salmonids in the Action Area: direct mortality, water supply, food supply, temperature, sedimentation, and cover. The action agencies will assess the limiting factors on a periodic basis in those subbasins to ensure that the tributary actions are addressing the correct factors.

The Action Agencies will concentrate action effectiveness research in a series of intensively monitored watersheds. The research will attempt to assess the response of juvenile salmon natural productivity to a suite of habitat actions. The assessment will use reference and treatment watersheds (or treatment watersheds before and after assessments of physical attributes and fish natural productivity) to assess quantitatively the effects of the habitat actions. The physical and biological attributes and sampling protocols will be developed and tested through the PNAMP and the pilot studies. The results of the monitoring activity will be reported annually.

The Action Agencies chose the Upper Columbia pilot study to support the our proposed tributary habitat actions for Upper Columbia spring chinook and Upper Columbia steelhead because: (1) The Upper Columbia ESUs have the largest hydrosystem survival gap and some populations with the lowest productivity in the Columbia River Basin, (2) the State of Washington has made a large commitment toward fish research and monitoring through the State's Regional Technical Team with funding from the Salmon Recovery Fund Board; (3) there is significant involvement with tribes in the upper Columbia; (4) there is an opportunity to develop a significant habitat restoration program by combining efforts with the Mid-Columbia HCP programs; (5) there is substantial local community support for habitat restoration and monitoring; (6) the key limiting factors of hatchery influence, water supply, channel connectivity and riparian cover have been identified.

The Action Agencies have initiated pilot studies in the John Day subbasin that will continue to inform Reclamation's proposed conservation measure for Mid-Columbia steelhead, and these studies will continue for the duration of that conservation measure. The John Day pilot study is important because (1) the John Day subbasin is represented by several populations of the Mid-Columbia steelhead; (2) there is an opportunity to build quickly on past research in the basin to develop answers to key management questions; (3) there is little influence of hatchery fish in the basin; (4) the key limiting factors of water supply, temperature, and sediment have been identified; (5) the basin has key sites where fish traps can be located effectively; and (6) the information from the research is likely to be transferable to other ESUs.

The Action Agencies will continue to work with NOAA to develop tributary population goals and metrics. The Action Agencies will develop a conceptual framework to associate tributary actions with physical and biological metrics with the goal of periodically demonstrating quantitatively the success of the actions toward the achievement of population goals and offsetting the hydrosystem survival gap.

General Structure of Tributary Habitat Action Effectiveness Research. The Action Agencies propose the development and implementation of an effectiveness-monitoring program to confirm the benefits of tributary habitat actions. The overall hierarchical structure of the BiOp tributary restoration action effectiveness monitoring program will be a set of nested monitoring efforts that together addresses the question of change in juvenile salmonid productivity (e.g., life-stage specific survival, smolts/female, fish condition). The program will consist of broad-scale *project implementation and compliance monitoring* whereby all projects implemented will be assessed annually. Of those, a subset – with paired, untreated control reaches - will be assessed for *reach-scale biological and physical effects* to demonstrate that the project implementation causes local physical and biological changes (approximately 25% of projects outside of Productivity Monitored Watersheds (PMWs) and Intensively Monitored Watersheds

(IMWs), but within the Action Area, and all projects within PMW and IMWs). Of those projects that are assessed for reach-scale impact, subsets will be assessed for *population level salmonid productivity effects* in one of two ways: as *PMWs* assessed only at the mouth of the watershed and as *IMWs*, where the assessment is done at the base, plus throughout the watershed with EMAP-style spatial sampling. This system of nested monitoring efforts is an efficient distribution of effort. When coordinated with the design and implementation of the tributary restoration actions, it is expected to yield the information necessary to rigorously quantify the biological benefit of habitat actions. The individual components of the program are presented in more detail below.

Project implementation and compliance monitoring: For the action area, all tributary restoration projects that fall into the four tributary habitat substrategies (entrainment, instream flows, channel morphology, and riparian protection/enhancement) will be monitored for implementation (was the project completed as planned) and compliance (does it continue to work in the future). This will consist of a one-time implementation confirmation to ensure that the project was implemented as designed and on-going compliance monitoring to ensure that the project's designed intent is still being achieved (e.g., screens in place and functioning as designed). The temporal frequency and performance metrics for compliance monitoring will be project specific, but will in general be rapid annual assessments requiring minimal data collection.

Reach-scale biological and physical impact: For the action areas, a sub-set of the restoration actions will be assessed for reach-scale biological and physical habitat impacts. This will occur only in IMW's and PMW's. This assessment will be done in a Before-After-Control-Impact context using biological and physical indicators appropriate to the project type and spatial scale. The "before" and "control" components are necessary to confirm the impact of the project in time and space. The control area is most relevant if located immediately adjacent to the action. The temporal scale of sampling will be appropriate for the action type, and may be less frequent than annually.

Population level salmonid productivity effects: For the Action Area, restoration actions grouped by watersheds will be assessed for the population scale biological impact on the productivity of juvenile salmonids. This assessment will be done in a Before-After-Control-Impact context using one or more traditional indicators of juvenile productivity (e.g., life-stage specific survival, smolts per female, fish condition). The watersheds included in this component will be smaller than true demographic units (e.g., Interior Columbia TRT defined populations), but large enough to encompass most of the tributary rearing phase, with minimal immigration/emigration during monitoring period. The spatial design for the population level productivity assessments will depend on the distribution of projects, size of watersheds, and expected effect size of each action such that the number of sites per subbasin will be determined so that the productivity impact can be detected in five years with a reasonable degree of confidence. The assessments will be done annually at two fundamentally different levels of effort: Productivity Monitored Watersheds (PMWs) and Intensively Monitored Watersheds (IMWs).

PMWs: PMWs will be assessed for the effects of actions on fish productivity by sampling only at the mouth of the watershed (see Figure 17). The question being addressed is: in total, and without knowing the direct mechanism, is the juvenile productivity different between watersheds with restoration actions of the type implemented by the Action and those without? To quantify the response, watersheds will be compared to nearby "control" watersheds with similar fish monitoring but no habitat actions.

IMWs: In addition to the PMWs, IMWs will be assessed for population fish productivity impacts in the Upper Columbia, John Day, and potentially one other site yet to be determined. IMWs will be accomplished by sampling throughout a watershed with a spatially balanced sampling scheme. The design of IMWs will be consistent and further informed by similar efforts within NOAA managed PCSRF

IMW projects and information gained from ongoing pilot study efforts in the Wenatchee and John Day subbasins.

Tributary action effectiveness research is expected to be implemented on the following schedule:

1) Intensively monitored restoration activity watersheds and controls will be monitored and all metrics recorded annually. Metrics will be analyzed and physical and biological responses reported at three and five years after the BiOp is signed.
2) By the end of year 2 (Dec 2006) all three levels of monitoring will be in place (project tracking year 1, reach-scale monitoring year 2, population productivity effects, year 2)
3) In year 3, and each year thereafter, integration of all three levels to assess if anticipated improvements are being achieved.

Tributary Updated Proposed Actions:

- The Action Agencies will work with NOAA to implement a tributary habitat effectiveness project in the Upper Columbia through the program as outlined above.
- Tributary action effectiveness efforts will be coordinated with other Federal Caucus agencies, the states and the tribes through the Upper Columbia Basin Monitoring Strategy and PNAMP.

Estuary Updated Proposed Actions:

- The effects of estuary habitat improvements will be guided by the Action Agencies' *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary.* A new pilot project may be implemented in the lower Columbia below Bonneville to test and coordinate effectiveness monitoring activities in the estuary.
- The action effectiveness research will develop an understanding and quantification of the effect of habitat improvement actions on juvenile salmon in the Columbia River estuary and plume.
- The effects of estuary habitat improvements will be addressed on both a landscape and project scale through implementation of the Thom et al study, *Evaluating Cumulative Ecosystem Response to Restoration Projects in the Columbia River Estuary*. This study is part of the broader Estuary RM&E program detailed in the Estuary Habitat Actions portion of Section E. 1. of this UPA.

Conservation Measure:

- The Action Agencies will work with NOAA to implement a tributary habitat effectiveness project in the John Day subbasin and potentially one other study area to be determined yet.

Conservation Actions:

- Work with PNAMP participating agencies to advance the development and/or adoption of standardized, compatible protocols for sampling designs and data collection for evaluating the effectiveness of management actions.
- Work with PNAMP as necessary and feasible to develop reach specific research and monitoring to assess the effectiveness of specific actions.
- Work with PNAMP participating agencies to identify a regional network of Intensively Monitored Watersheds and reach specific studies for action effectiveness research with agency specific responsibilities identified for key components of the network.
- Continue implementation of nutrient enhancement effectiveness studies.
- Work with the Nez Perce Tribe to evaluate how effective road removal, culvert replacement, riparian restoration, and stream channel restoration actions are for improving stream habitat quality and salmonid populations in the Upper Clearwater.

- Evaluate effectiveness of restoration projects for producing long-term watershed improvements; use data and trends developed to provide guidance for subbasin planning and future land management decisions.
- The effects of site specific actions will be evaluated through project specific action effectiveness research and monitoring at Crims Island, Fort Columbia, Sandy and Chinook Rivers.

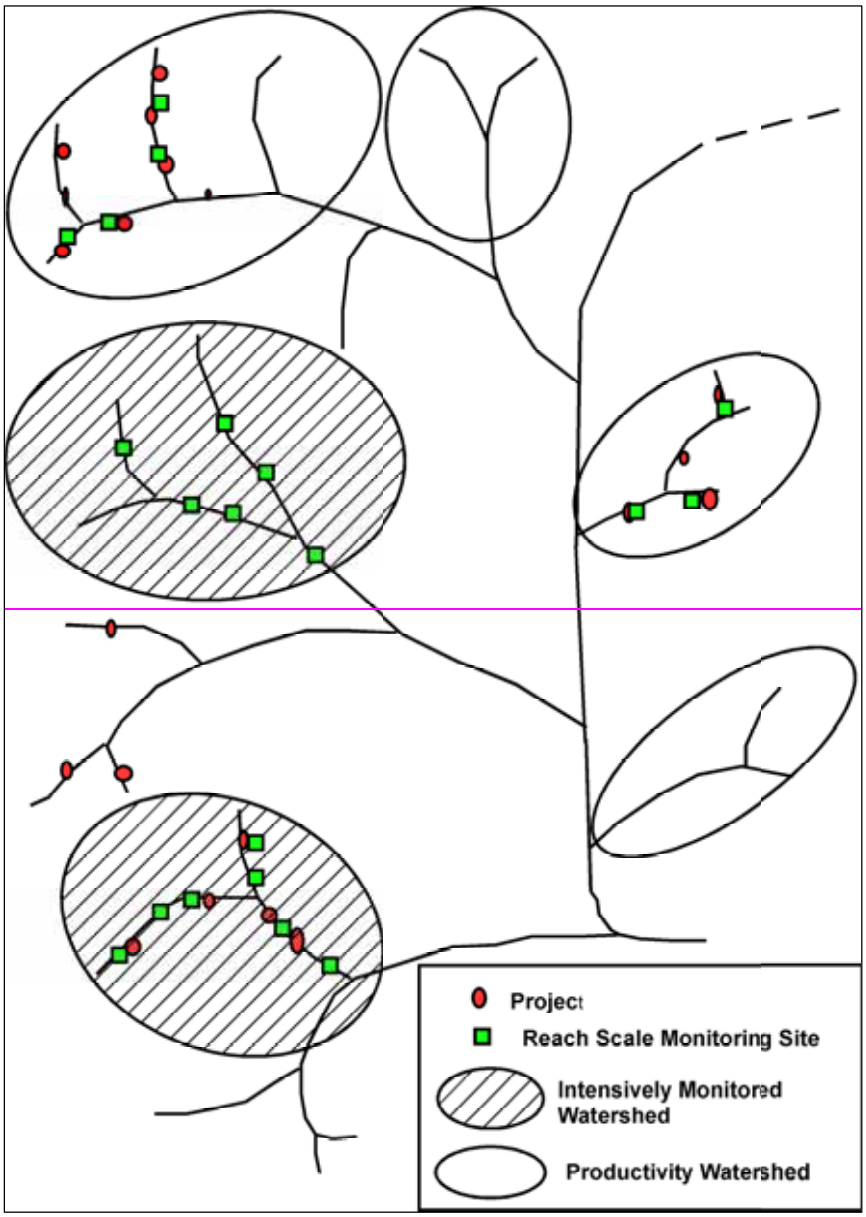

Figure 17 Sampling of PMWs.

RM&E Substrategy 2.3 Action Effectiveness Research: Hatchery

This substrategy focuses on hatchery related action effectiveness research.

Updated Proposed Action: The Action Agencies will continue to fund hatchery RM&E to determine whether safety-net hatchery programs contribute to recovery of targeted populations of salmon and steelhead.

Conservation Actions:

- Estimate ecological and genetic impacts of hatchery fish on wild populations.
- Develop a framework for evaluating risks and benefits of hatchery reforms and supplementation.
- Evaluate the effectiveness of hatchery supplementation.

- Evaluate the effectiveness of reconditioning steelhead kelts and reproductive success of kelts.

RM&E Substrategy 2.4 Action Effectiveness Research: Harvest

This substrategy would focus on harvest related action effectiveness research if an ESA program is identified.

Conservation Action: The Action Agencies will continue to develop and implement a biologically sound harvest monitoring program, including research on non-retention mortalities. We will also continue research on the effectiveness of harvest strategies that are consistent with treaty reserved fishing rights.

RM&E Substrategy 2.5 Action Effectiveness Research: Predator Control

This substrategy focuses on action effectiveness research for predator control actions.

Updated Proposed Action:

***Expanded Northern Pikeminnow Management Program*:** The juvenile salmonid survival benefits associated with an increased incentive program will be estimated by modeling the additional removals in the same way that we have evaluated and estimated the cumulative benefits of the NPMP to date. We would apply an appropriate northern pikeminnow consumption rate on juvenile salmonids (temporally and spatially) to the number of additional northern pikeminnow removed (temporally and spatially) to determine "number of smolts" not eaten. This will indicate potential incremental benefit of increased removals, assuming no significant inter- or intra-specific compensation.

***Other fish predation*:** Action effectiveness monitoring is contingent upon future program adoption and development.

***Caspian tern redistribution*:** In addition to continuing research efforts on Caspian tern predation rates on salmonids in the Columbia River estuary, we will monitor and evaluate the response to the proposed management action.

***Cormorant management*:** Action effectiveness monitoring is contingent upon future program adoption and development.

RM&E Strategy 3: Critical Uncertainties Research

Rationale: There are critical areas of uncertainty in biological assessments of the survival conditions and the needed survival improvements for ESA listed fish populations. Critical uncertainties include the magnitude of delayed differential mortality of transported smolts (D) and the extent of extra mortality and its causes. Critical uncertainties are related to the assessment methods and data required to evaluate future population performance and needed survival improvements. Projects under this strategy are associated with BiOp actions that address large, systematic research needs and improvements in analytical methods required for more robust and confident assessments of population status and needed survival improvements for each ESU.

Current activities regarding research on juvenile transportation include the following:

- A research plan has been developed and research was started in 2002 to evaluate transport at McNary. This work will continue through 2005 with adult return through 2008. The final report will be available in 2009.

- The transportation evaluation of transport to inriver return ratios for wild Snake River yearling chinook salmon and steelhead from Lower Granite will continue. Adults will be monitored through 2006 and a final report will be available in 2007.
- Baseline estimates for delayed mortality (D) have been incorporated into the study design for the Lower Granite and McNary transport evaluations by maintaining an inriver release group. The D estimates will be provided for Lower Granite in 2007 and McNary in 2009.
- Evaluation of the homing of adult fish that were transported as juveniles is currently being conducted through the adult telemetry work with a final report in 2006. Future evaluations will be conducted with the aid of PIT-tagged fish and adult pit tag detectors.
- The Corps is investigating conducting research in 2005-2007 on holding densities of spring Chinook. In 2005, planning will begin to evaluate barge releases in the lower river/estuary. This study is proposed for 2006-2008 with adult returns through 2011 and a final report on adult returns in 2012.

Specific research on adults is continuing and includes the following:

- Studies on the causes of headburn in adult salmonids continued through 2004 and a final report has been completed. Corrective measures will be determined based on results and regional discussions within Fish Facilities Design Review Work Group (FFDRWG).
- Radio telemetry monitoring of fallback has been completed. Data analysis will be conducted through 2005 and a final report will be available in 2006. Actions for remediation will be assessed at that time.
- Evaluation of temperature impacts on adult delays, homing, straying, and survival will continue. Data analysis will be conducted through 2005 and a final report will be available in 2006.
- Adult telemetry evaluation to help identify factors that contribute to successful spawning or unaccounted loss continued in 2004. Data analysis is scheduled through 2005 and the final report will be available in 2006. PIT tag evaluations are planned for future years.

Updated Proposed Actions: The Action Agencies will continue to fund studies to address the following critical uncertainties.

- Uncertainty of in-river juvenile migration survival.
- Relative survival difference of in-river versus transported fish.
- Effect of ocean entry timing.
- Delayed mortality related to hydrosystem passage.
- Uncertainty of different dam passage histories relative to health and delayed mortality.
- Extra mortality and its causes.

Conservation Actions:

- Reproductive success of hatchery fish relative to wild fish.
- Effect of hydrosystem flow modifications on the estuary.
- Relationships among time of ocean entry, physical and biological characteristics of the estuary and plume environments and adult return rates.
- Salmonid use of the estuary.
- Restoration potential of Snake River fall chinook salmon spawning habitat.
- Effects of sea lions on adult salmonids immediately below Bonneville Dam.
- Provide key information on the migratory behavior and feeding areas of individual stocks of salmon in the ocean.
- Survey the size, condition, and biological condition of juvenile salmon occupying the British Columbia and southeast Alaskan continental shelf regions.

RM&E Strategy 4: Project Implementation Monitoring

Rationale: Project implementation and compliance monitoring are necessary to determine how well management actions are implemented. All projects should have explicit deliverables and should be evaluated to determine how well these deliverables were met. From a biological perspective, this monitoring will help to distinguish between actions that did not work and actions that were not implemented successfully. This tracking will also assist in the programmatic crediting of actions. In addition, it is essential for designing and managing action effectiveness research to know what kind of projects are being implemented within the study areas and where they are located.

Updated Proposed Actions:

- Adopt a standardized set of reporting protocols for project deliverables that are consistent with PCSRF reporting metrics and include GIS spatial coordinates for habitat projects. These reporting protocols will be coordinated with other regional entities for consistency in regional tracking of projects and project deliverables.
- Develop and implement a compliance-auditing program that evaluates the success of achieving and maintaining habitat project deliverables. This will be implemented by randomly selecting at least 25 percent of proposed habitat improvement projects that are part of the UPA for compliance evaluations to ensure that habitat projects are being successfully implemented.
- Develop and maintain a database system for project tracking and progress reporting.

RM&E Strategy 5: Data Management System

Rationale: The key objectives of a regionally coordinated data management effort include: (1) support for monitoring and evaluation and scientific research efforts; (2) access to biological data; (3) integration and free exchange of information.

The Action Agencies will continue to work with regional federal, state and tribal agencies to establish a coordinated information system network to support the RM&E program and related performance assessments. The coordination of this development will occur primarily through participation in the Northwest Environmental Data-network (NED) workgroup, the PNAMP data group and the RM&E pilot studies in the Wenatchee, John Day, Upper Salmon, and estuary.

Updated Proposed Action: The Action Agencies will implement data management pilot projects in the Upper Columbia (Wenatchee, and possibly the Entiat, Methow), the John Day subbasin and a third pilot area within a high priority habitat action area, and the lower Columbia estuary.

Conservation Actions: The Action Agencies will work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to develop a regional data management network for fish population and habitat data needed to support status monitoring, action effectiveness research and critical uncertainty research. The Action Agencies will participate in this regional effort through the implementation of data management pilot projects, continued development and maintenance of data bases supporting the Action Agencies' hydrosystem status-monitoring program, participation in regional coordination activities on data management, and implementation of policies that support the strategy of a regional data network.

RM&E Strategy 6: Regional Coordination

Rationale: Appropriate levels of coordination will help maximize the amount and quality of RM&E across the region within limited budgets.

Conservation Actions:

- The Action Agencies will coordinate the development and implementation of their RM&E projects with other federal, state, and tribal programs and will take advantage of the current monitoring data and overlapping monitoring programs.
- Status monitoring and tributary habitat action effectiveness RM&E coordination will primarily occur through the PNAMP.
    - Work with regional entities as a partner in the PNAMP to develop common monitoring design and sampling protocols that will be identified as standard monitoring project requirements.
    - Develop common status and effectiveness monitoring designs and sampling protocols in the Wenatchee, John Day, and a third pilot area within a high priority habitat action area that are consistent and compatible with regional level development of these same protocols through PNAMP.
    - Identify a regional network of status monitoring programs for fish and watershed conditions with agency specific responsibilities for key components of the network.
    - Identify a regional network of Intensively Monitored Watersheds and reach specific studies for action effectiveness research.
    - Develop common metrics and protocols for programmatic level and site-specific tracking of habitat enhancement and fish production projects across the region.
- Hydrosystem RM&E will continue to be coordinated through the Corps' AFEP and the staff of NOAA Fisheries' hydrosystem branches.
- Hatchery and harvest RM&E coordination will continue to occur through the Council's Fish and Wildlife Program, in the sense that all projects funded through the program will be subjected to evaluation by the ISRP and CBFWA.
- Regional coordination of the estuary/ocean RM&E will continue to occur through the CBFWA and ISRP reviews of Council's Fish and Wildlife Program project proposals. Review and planning of research projects will also occur through the Corps' AFEP program.

V. Conclusion

This UPA for the operation of the FCRPS responds to the judicial remand related to the 2000 BiOp, the revised jeopardy analysis prepared by NOAA Fisheries, and the status of current biological information and actions continuing under the 2000 BiOp. This includes the framework and measures in the 2000 BiOp that the Action Agencies will implement. The UPA does not rely on actions by other federal or non-federal entities, unless the Action Agencies share in the responsibility to achieve completion of such actions. The UPA also adds greater focus and specificity, consistent with these recent developments and directives.

The UPA relies first and foremost on operation of the FCRPS and continuing improvements to the dams and facilities. Modest, or low, survival improvements are expected from these actions, since most of the larger improvements that are possible have already been made. These actions benefit all ESUs. Second, the UPA includes expanded predator control programs designed to increase both juvenile and adult salmonid survival. This part of our avian and northern pikeminnow proposal is expected to benefit all ESUs, and to provide another increment of improved survival. For most ESUs, the Action Agencies believe that implementation of these two types of actions –operations/dam modifications and expanded predator control – will be sufficient to ensure that the operation of the FCRPS as proposed is not likely to jeopardize the continued existence of these listed species.

For ESUs that have a larger need based on the preliminary jeopardy analysis (Upper Columbia spring Chinook and steelhead, Snake River fall Chinook, and certain Mid-Columbia runs), the UPA includes tributary and estuary habitat improvements. These actions are described in detail as to ESU, location, and metrics for accomplishment. In keeping with NOAA's analysis of habitat potentials, our proposal targets key limiting factors in tributaries and the estuary. For these ESUs, the Action Agencies believe that the proposed action with these additional habitat actions is not likely to jeopardize the continued existence of the listed species.

Critical habitat has been designated for 3 ESUs that are the subject of the new BiOp (Snake River sockeye, Snake River spring/summer Chinook and Snake River fall Chinook). The essential features of the areas designated as critical habitat for these species are: 1) substrate (especially gravel for spawning); 2) water quality; 3) water quantity; 4) water temperature; 5) water velocity; 6) cover/shelter; 7) food; 8) riparian vegetation; 9) space; and 10) migration conditions. (58 FR 68543, published on December 28, 1993). The Action Agencies believe that implementation of the actions contained in the UPA will not adversely modify critical habitat.

Finally, this collection of focused actions will be overseen through a carefully defined program of research, monitoring and evaluation. Over time, this information will be used to adjust our actions through annual implementation plans, based on performance measures and adaptive management. Every three years, we will "check in" on our cumulative performance to make sure we are on track and meeting our commitments. In this way, we will keep our progress current and effective. The proposed research and performance standards, annual implementation plans and progress reports, and three year check-ins will collectively assure that the Action Agencies will continue to implement actions in a manner that the FCRPS is not likely to jeopardize the continued existence of the listed species or adversely modify critical habitat as we implement the UPA.

The actions described in this document serve a number of purposes. They explicitly address the Action Agencies' implementation of their obligations for listed salmon and steelhead under the Endangered Species Act. However, agencies will also be implementing these actions pursuant to their obligations

under the Northwest Power Act and Clean Water Act. As a result, regional planning and coordination with the Council, affected tribes, and other regional parties underlie our proposals.