

Columbia River System Operation Review

Final Environmental Impact Statement

Appendix S

U.S. Fish & Wildlife Service Coordination Act Report



U.S. Army Corps
of Engineers
North Pacific Division



PUBLIC INVOLVEMENT IN THE SOR PROCESS

The Bureau of Reclamation, Corps of Engineers, and Bonneville Power Administration wish to thank those who reviewed the Columbia River System Operation Review (SOR) Draft EIS and appendices for their comments. Your comments have provided valuable public, agency, and tribal input to the SOR NEPA process. Throughout the SOR, we have made a continuing effort to keep the public informed and involved.

Fourteen public scoping meetings were held in 1990. A series of public roundtables was conducted in November 1991 to provide an update on the status of SOR studies. The lead agencies went back to most of the 14 communities in 1992 with 10 initial system operating strategies developed from the screening process. From those meetings and other consultations, seven SOS alternatives (with options) were developed and subjected to full-scale analysis. The analysis results were presented in the Draft EIS released in July 1994. The lead agencies also developed alternatives for the other proposed SOR actions, including a Columbia River Regional Forum for assisting in the determination of future SOSs, Pacific Northwest Coordination Agreement alternatives for power coordination, and Canadian Entitlement Allocation Agreements alternatives. A series of nine public meetings was held in September and October 1994 to present the Draft EIS and appendices and solicit public input on the SOR. The lead agencies received 282 formal written comments. Your comments have been used to revise and shape the alternatives presented in the Final EIS.

Regular newsletters on the progress of the SOR have been issued. Since 1990, 20 issues of *Streamline* have been sent to individuals, agencies, organizations, and tribes in the region on a mailing list of over 5,000. Several special publications explaining various aspects of the study have also been prepared and mailed to those on the mailing list. Those include:

- The Columbia River: A System Under Stress
- The Columbia River System: The Inside Story
- Screening Analysis: A Summary
- Screening Analysis: Volumes 1 and 2
- Power System Coordination: A Guide to the Pacific Northwest Coordination Agreement
- Modeling the System: How Computers are Used in Columbia River Planning
- Daily/Hourly Hydrosystem Operation: How the Columbia River System Responds to Short-Term Needs

Copies of these documents, the Final EIS, and other appendices can be obtained from any of the lead agencies, or from libraries in your area.

Your questions and comments on these documents should be addressed to:

SOR Interagency Team
P. O. Box 2988
Portland, OR 97208-2988

Fish and Wildlife Coordination Act Report
on the
Columbia River System Operation Review



Columbia River Gorge

October 1995

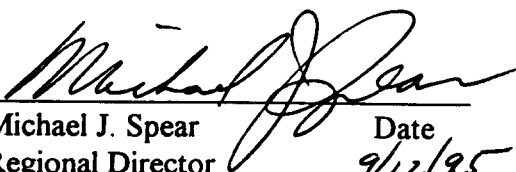
FISH AND WILDLIFE COORDINATION ACT REPORT

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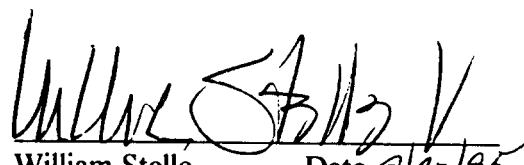
COLUMBIA RIVER SYSTEM OPERATION REVIEW

Prepared by the

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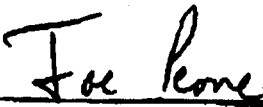
Subject to any comments provided in Appendix B, the undersigned subscribe to this Fish and Wildlife Coordination Act Report on the System Operation Review.



Coeur d'Alene Tribe


Nez Perce Tribe


Confederated Salish and Kootenai Tribes of the Flathead Reservation

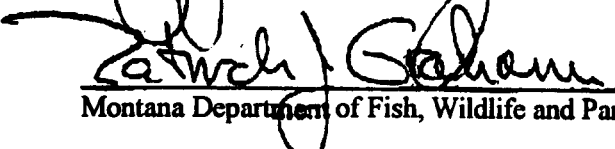

Oregon Department of Fish and Wildlife



Confederated Tribes of the Colville Reservation


Gilbert Farmer, Chairman
~~Chairman~~ FISHERIES POLICY REPRESENTATIVE
Shoshone-Bannock Tribes of Fort Hall


Idaho Department of Fish and Game


Washington Department of Fish and Wildlife


Montana Department of Fish, Wildlife and Parks


Yakama Indian Nation

NOTICE:

In the final U.S. Fish and Wildlife Service printing, additional subscribers may appear on this page and/or additional letters may be included in Appendix B. System Operation Review (SOR) publication deadlines precluded completion of all appropriate regional review processes.

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I. INTRODUCTION

Authorities

This document constitutes the report of the U.S. Fish and Wildlife Service (FWS) relating to the proposed Columbia River System Operation Review (SOR). The SOR was undertaken by the SOR Interagency Team, which consists of the Bureau of Reclamation, the U.S. Army Corps of Engineers, and the Bonneville Power Administration. These federal agencies are responsible for managing the Federal Columbia River Power System. This report is prepared under the authority of Section 2(b) of the Fish and Wildlife Coordination Act of March 10, 1934, as amended. It incorporates those project obligations required to comply with the Endangered Species Act (ESA) and relevant biological opinions.

Project Purpose

The SOR Interagency Team issued a draft environmental impact statement (EIS) for the System Operation Review in July 1994 (SOR Interagency Team 1994). That document contains a description of project elements, several alternatives, and an environmental analysis of alternatives. The Interagency Team has since selected a preferred alternative and describes it in working draft form (SOR Interagency Team 1995). The changes envisioned under the draft EIS and the preferred alternative are related to renegotiation and renewal of the Pacific Northwest Coordination Agreement and to the Canadian Entitlement Allocation Agreement.

The SOR environmental impact statement may also serve as National Environmental Policy Act (NEPA) compliance for some federal agency actions taken to (1) implement recovery measures identified in biological opinions on system operations and/or recovery plans issued by the National Marine Fisheries Service and U.S. Fish and Wildlife Service to protect and recover species listed as "threatened" or "endangered" under the Endangered Species Act; and (2) mitigate, enhance, and restore fish and wildlife as identified in this report. Many of these actions are included and described in detail in other documents, including the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program (NPPC 1994) and the Review Draft of the Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Indian tribes (Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Indian Reservation, and the Confederation Tribes and Bands of the Yakama Indian Nation 1995).

Previous Comments

The U.S. Fish and Wildlife Service coordinated with the Interagency Team throughout the SOR development process. The FWS also participated extensively in the work groups that were established by the Interagency Team to address particular fish and wildlife issues.

On July 19, 1994, the U.S. Fish and Wildlife Service submitted a Planning Aid Report (FWS 1994) to the SOR Interagency Team. The Planning Aid Report assessed the status of the SOR environmental review as it relates to fish and wildlife resources, and was included as Appendix S of the draft EIS. The report specifically addressed:

- A. The seven system operating strategies selected by the SOR Interagency Team for further evaluation, and the need to include options that result in greater protection for certain species.
- B. The limitations concerning the completeness and reliability of various models used to evaluate the biological effects of management alternatives (specifically transportation, gas supersaturation and predation) for juvenile anadromous fish.
- C. The present scientific limitations associated with evaluating impacts of the Federal Columbia River Power System on wildlife species, given present data shortcomings.
- D. The quality of the analysis that is possible to achieve regarding the impacts of the proposed project on fish and wildlife resources.

The Planning Aid Report also provided several general recommendations for improving the draft EIS, including:

- A. Identification of additional opportunities to help resolve uncertainties associated with anadromous fish, including the use of available life-cycle models.
- B. The need for additional data gathering and consultation with local biologists pertaining to resident fish.
- C. The need for additional data gathering, including field work, to augment the professional judgement used to assess impacts to wildlife.

On January 13, 1995, the U.S. Department of the Interior provided the SOR Interagency Team with written comments (FWS 1995) concerning the Columbia River System Operation Review Draft Environmental Impact Statement. Those comments urged the team to expand the ecological scope of the draft EIS and to revise the EIS publication schedule to permit analysis of the impacts of the preferred alternative for this Coordination Act Report. The comments further stated that if properly conducted, the SOR process provides an opportunity to develop and implement a long-term management strategy significantly contributing to the recovery of these species and the ecosystem on which they depend. The comments expressed the need to develop and analyze a full range of alternatives for Columbia River operations, including options that simulate conditions under which species occupying the ecosystem evolved. Those analyses would be expected to help identify additional management actions that could be taken to avoid the potential need to list other species in the future.

In several instances cited in the Planning Aid Report, the U.S. Fish and Wildlife Service committed to providing additional detailed information and/or analysis for inclusion in the Coordination Act Report. These included an overview of current fish and wildlife status, an overview of Native American trust responsibilities and assets, and additional site-specific evaluations regarding wildlife impacts. The anticipated additional data and analyses, however, are not fully presented in this document for the following reasons. First, the time available between the receipt of the working draft of the preferred alternative and the scheduled release of the EIS was extremely short. Little additional data gathering or new quantitative analyses were possible. Secondly, and more importantly, many impacts of the proposed action on fish and wildlife cannot be immediately determined or quantified; this subject is more thoroughly addressed in the following sections of this report.

During the initial phase of the project in 1990, the SOR team also sought the participation of some of the basin's Indian tribes and fish and wildlife management agencies in the study committee. Some tribes and agencies provided initial technical input, but then withdrew due to difficulties associated with the organization, scope and progress of the project. In March 1992, the Columbia Basin Fish and Wildlife Authority was asked by the study team leadership to host a meeting to discuss renewed participation by agency and tribal fisheries and wildlife managers. At that meeting, the SOR team was advised that there was great dissatisfaction with the SOR process to date, that individual agency and tribal entities would participate in selected committees as they saw fit, and that most managers would reserve their commentary for inclusion in the Fish and Wildlife Coordination Act Report.

During the subsequent development and analysis of alternatives, the SOR study team reserved "space holders" for potential operating regimes that the National Marine Fisheries Service might require for salmon under the Endangered Species Act. It was anticipated that those regimes would be hard constraints on the SOR outcome. When the biological opinion was issued for Snake River salmon (NMFS 1995), its provisions essentially became the preferred alternative presented in the SOR final environmental impact statement.

II. PROJECT DESCRIPTION

Introduction

The SOR proposed alternative consists of a number of specific water management manipulations and new management targets for operating the network of existing Federal Columbia River Power System dams and facilities. Some construction to accommodate those new capabilities is also contemplated. The U.S. Army Corps of Engineers is conducting a separate study, the System Configuration Study, which will focus on individual dam modifications and project-specific impacts. Separate documentation, including environmental impact analyses, is being developed for that study.

A preferred alternative was selected by the SOR Interagency Team after extensive consultation with the National Marine Fisheries Service regarding the effects of the proposed project on ESA-listed species of salmon. The U.S. Fish and Wildlife Service received a working draft of the preferred alternative on May 13, 1995. The numerous operational components, lengthy time lines, and dynamic character of the proposed project demand that other fish and wildlife impacts be evaluated through a correspondingly dynamic process. This report, therefore, presents a broader, ecosystem planning and management approach for evaluating and resolving those operational and biological uncertainties.

Potential mitigation, enhancement and restoration actions associated with the preferred alternative will require an adaptive implementation approach. At the present time and as further changes anticipated in SOR operations occur, the complete, ecosystemwide, synergistic effects of the operation of the current Federal Columbia River Power System cannot be adequately ascertained. This Fish and Wildlife Coordination Act Report therefore departs from the conventional "with" and "without project" analysis approach. However, the initial elements of ecosystem-based remedies are presented in Sections IV and V of this report. These remedies are intended to stimulate action to help conserve distressed fish and wildlife populations, while furthering understanding of the impacts of the SOR preferred alternative on the ecosystem. This Coordination Act Report is therefore unique in its comprehensiveness. It is the first attempt to integrate fish and wildlife mitigation, enhancement, recovery and restoration needs with the proposed action and the existing Federal Columbia River Power System. Addressing these matters in an ecosystem context, rather than on a project-by-project basis, is expected to be more effective and biologically prudent.

Ecosystem Considerations

The Columbia River Basin ecosystem occupies a major portion of the northwestern United States and western Canada. It includes portions of Idaho, Oregon, Washington, Montana, Wyoming, Nevada, Utah and British Columbia. The Columbia River is the fourth largest river in North America with a drainage of approximately 260,000 square miles. The watershed stretches

over 1,200 miles and varies in elevation from its headwaters in the Canadian Rockies to the Pacific Ocean.

Prior to construction and operation of the water control structures that are the subject of the EIS, the water discharge of the Columbia River Basin was characterized by high spring flows that gradually decreased throughout the summer, then stabilized at relatively low levels during the fall and winter. Variations in historic flow patterns were caused by the natural forces of the spring melt of high elevation snowpacks and glaciers of the Columbia River Basin headwaters. Fall rains in some locations caused additional variation in flow.

The draft EIS contains a description of the numerous hydroelectric, navigation, and irrigation projects that now produce the regulated flows associated with operation of the present Federal Columbia River Power System. The construction and operation of federal water development projects has greatly altered the hydrography and other key environmental elements of the ecosystem. Figure 1 illustrates the differences between the historic (unregulated) and current (regulated) Columbia River seasonal water flow pattern as estimated at The Dalles, Oregon.

During the principal construction period of the Federal Columbia River Power System, between the 1930s and 1970s, the natural flow patterns that had existed in the ecosystem for thousands of years became increasingly manipulated. The basinwide system of projects continues to serve ever-increasing regional demands for hydropower, irrigation, navigation, flood control and other economic purposes.

The "harnessing" of the Columbia River brought flood protection, hydroelectric power, and water storage that meet a variety of human needs throughout the year. The socio-economic benefits of these water development projects were highly visible and quantifiable. Unfortunately, there were many unintended and often unanticipated adverse impacts to the Columbia River Basin ecosystem and its fish and wildlife resources.

The magnitude of some of the measurable impacts attributable to the Federal Columbia River Power System and other development is illustrated in Figures 2, 3 and 4. Figure 2 graphically displays the extensive loss of salmon spawning habitat. Construction of two major dams, Grand Coulee (federal) and Hells Canyon (Idaho Power Company), vastly reduced salmon spawning habitat and fundamentally altered the ecological composition of the Columbia River Basin. Locally, resident fish and wildlife habitats were eliminated or otherwise adversely affected as well. Figure 3 displays the aggregate decline in Columbia River Basin salmon runs during the past century. Figure 4 displays the decline in Columbia River spring chinook salmon harvest, coincident with the construction and operation of mainstem dams.

Historic Flow Trends At The Dalles

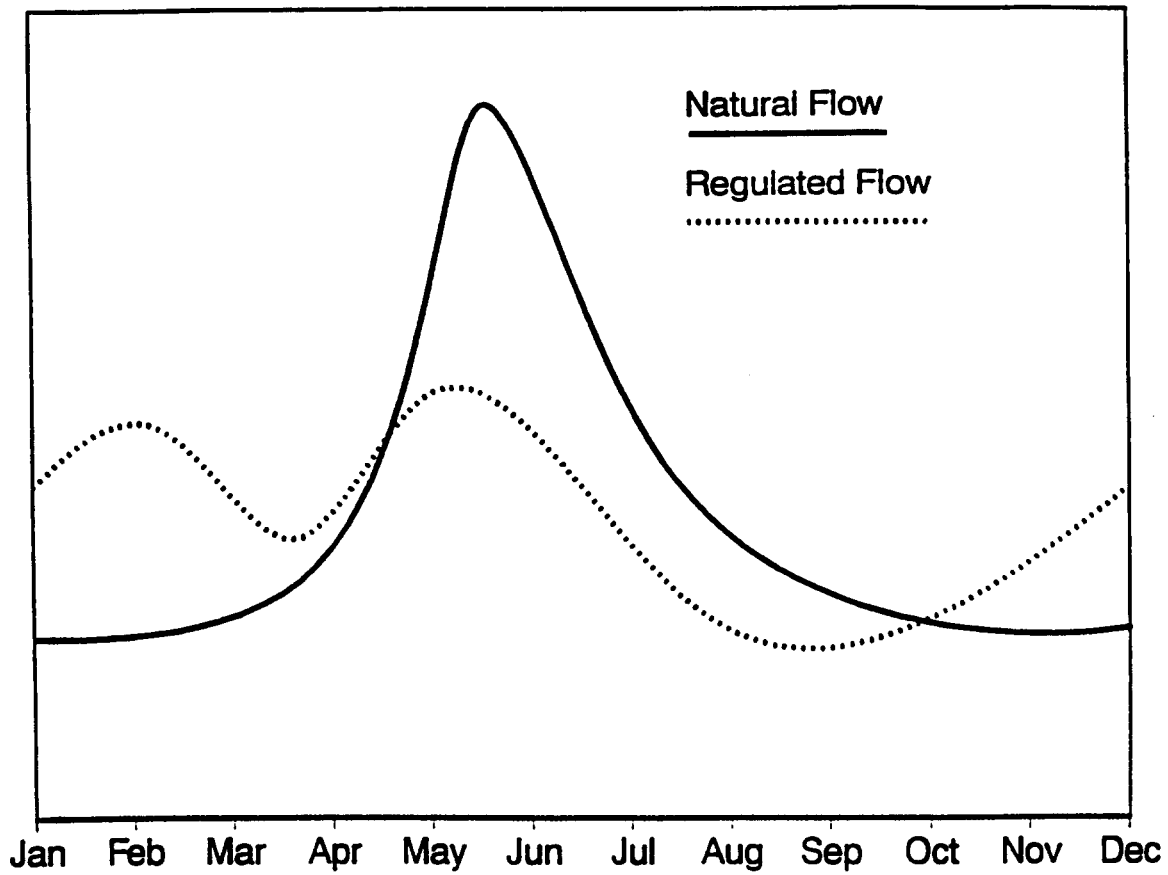


Figure 1. Comparison of current and historic Columbia River water flow patterns as estimated at The Dalles, Oregon.

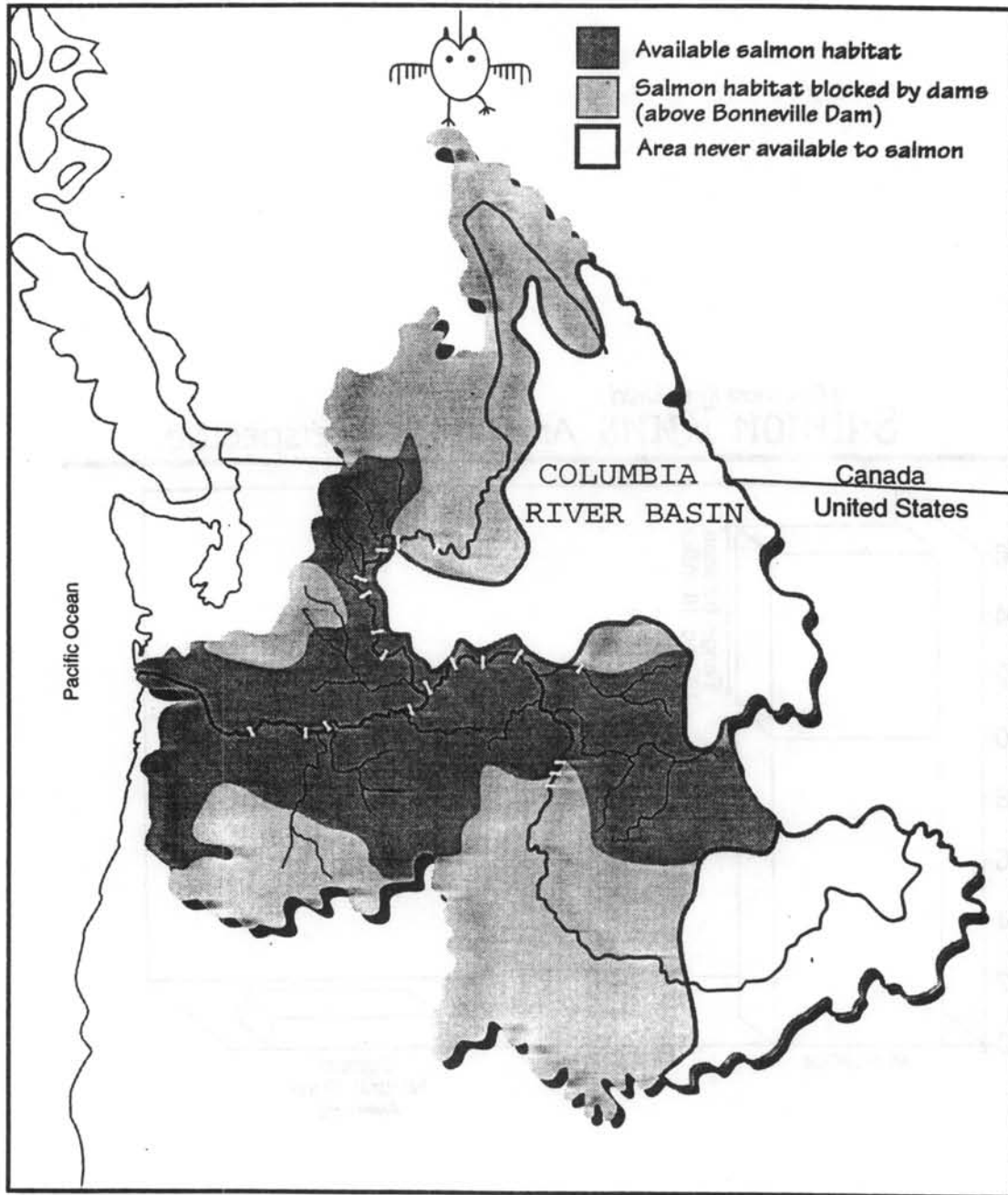


Figure 2. Map of the accessible and blocked anadromous fish habitat in the Columbia River ecosystem (adapted from Nez Perce et al 1995).

Columbia River Basin
Salmon Runs An Historical Perspective

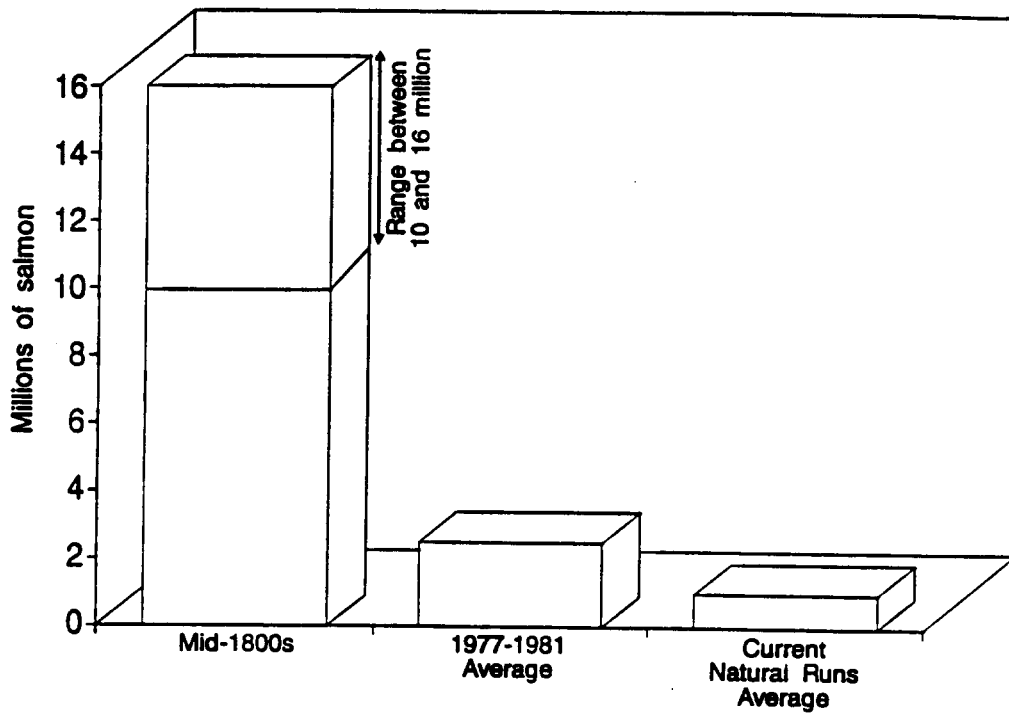


Figure 3. Columbia River Basin salmon runs, historic versus current natural run size average (NPPC 1994).

Dams & Harvest

Upriver Spring Chinook Snake and Lower Columbia River Dams

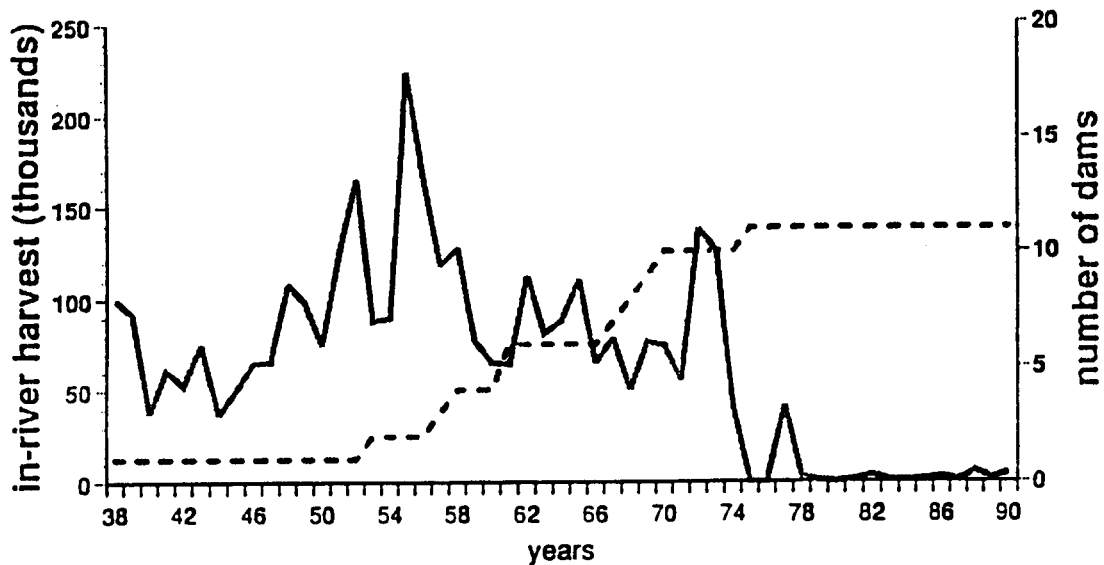


Figure 4. Harvest of upriver-destined Columbia River spring chinook salmon coincident with the construction and operation of mainstem dams (CBFWA, unpublished data).

Several decades of federally funded fish and wildlife mitigation and enhancement efforts have resulted from the legislative authorizations of the Federal Columbia River Power System. Well-intentioned programs, principally designed to mitigate for salmon losses, include hatchery programs, fish ladders, juvenile fish transportation, fish screens, and some improvement in land and water management. These actions, however, have not been sufficient to overcome project-related losses of the affected species. As a result, the legislative promises that the basin's fish and wildlife resources would be conserved have not been fulfilled.

In general, mitigation and enhancement actions, although sometimes locally successful, have not preserved the essential diversity and population stability of many native species. For some species, mitigation has sometimes been non-existent, while for others, planning delays have arrested meaningful progress.

Several key factors have contributed to these unmet resource conservation obligations. As Columbia River Basin dams and other projects were constructed, local losses were generally

expected and known. From an ecosystem perspective, however, insidious, cumulative losses were mounting. These losses were not always obvious.

As development of the projects progressed, there continued to be an abiding faith that modern engineering and technology could solve or off-set the biological problems encountered. Society could "have its cake and eat it too." There was a social conviction that protecting fish and wildlife was desirable and proper, but often the price of "progress" prevailed over the basic ecological needs of affected resources.

Values placed on fish and wildlife resources were historically very different from today. As the nation emerged from the Great Depression in the 1930s, jobs were the focus of society. Fish and wildlife resources, presumed to be abundant, were considered amenities rather than attributes of society. However, by the early 1970s, the region was faced with both a severe shortage of fish and wildlife, and a heightened environmental awareness. The intrinsic value of natural resources was increasingly recognized and, now, the need for more effective restitution has come to the forefront.

Fish

Perhaps the most often noted fish species in the Columbia Basin are the anadromous salmonids, which historically ascended the river and its various tributaries by the millions each year. Historically, adult salmon and their progeny existed in virtually every watershed. Salmon and other native fish evolved behavioral patterns compatible with the natural water flow and timing characteristics within their particular river systems. Their migrational timing patterns historically coincided with seasonal water regimes, enabling juvenile salmon to exit natal river systems and enter the Pacific Ocean at the most opportune time. The nutrient-rich ocean waters provide a habitat in which the young grow to maturity. Once mature, returning adult salmon have developed additional migrational behaviors as well. Salmon return to their natal streams, spawn, and die, thereby enriching the freshwater trophic system and other fish and wildlife species. These strategies developed over evolutionary timelines and have permitted salmon to best use the environment presented by the ecosystem. In addition to salmon, other endemic anadromous species such as Pacific lamprey, smelt, and sturgeon evolved to meet the seasonal demands of the naturally functioning Columbia River system. Today, the ecologic functions of these species have been impeded or otherwise adversely altered, principally by water development projects and related habitat manipulation.

Numerous, less publicized, but ecologically equally important resident fish species also populate Columbia Basin waters. Their behaviors and habitats, although typically different from salmonids, have been integral components of the ecological system. Native resident fish species are also critically linked to natural water flow patterns and access to habitat.

The persistence of these biologically diverse anadromous and resident species in the naturally functioning ecosystem is reflected in the anthropological record of numerous Columbia Basin Indian tribes. Historically, virtually every Indian tribe relied upon one or more of the various fish species as a food source. For certain tribes, this historical dependence has persisted

through time. Today, fish, especially salmon, remain a tenuous, but intact cultural and religious focal point for many Native Americans in the basin. In large part due to effects of water project construction and operation, numerous fish stocks have been extirpated or severely reduced in population size. This, in turn, has limited or eliminated harvest opportunity for tribal members, thereby directly affecting the tribal cultures and economies that historically depended upon those fish.

Appendix D of the draft SOR environmental impact statement addresses the importance of fisheries to the Native Americans of the basin. Fish and wildlife resources remain closely tied to the cultural identity of the tribes. The Cultural Resources Working Group, established to assist in the development of the SOR, determined that any action taken pursuant to the SOR is likely to adversely affect the cultural resources of one or more tribes, simply because of the proximity of many culturally important sites to the river, itself. The United States carries a specific trust responsibility burden with respect to the tribes and protection of natural resources. Acknowledgment of this responsibility requires that the SOR pay particular attention to tribal views and recommendations.

Many activities, including land- and water-use practices, overharvest, and incomplete or flawed hatchery mitigation programs were detrimental to salmon populations. However, with respect to the Columbia River Basin, fisheries experts generally concur that water project construction and operation, including that reviewed in the SOR, caused key and often irretrievable losses of many salmon and other fish habitats of the ecosystem (NPPC 1986). Off-site hatchery mitigation programs affiliated with Federal Columbia River Power System project authorization did not necessarily benefit the species or stocks of salmon affected. In most cases, hatcheries were constructed well downriver from the project in question. Moreover, salmon stocks and species dissimilar to those affected by upstream projects were typically used in hatchery mitigation programs. Overall, mitigation programs for salmon, resident fish and wildlife have only been partially identified or fulfilled.

Because the magnitude of lost salmon habitat and associated stocks of fish is so great, fisheries scientists generally acknowledge that the natural salmon populations cannot be restored to pre-development levels. However, significant improvements can be made in the quality of the productive capability of remaining habitat. Through various local, state, federal and regional planning efforts, fisheries biologists have identified much suitable, or potentially suitable, fish habitat. That work is referenced in Section IV of this report. Conservation and rehabilitation of remaining habitat is viewed as an absolutely essential component of the conservation and restoration of fish as well as wildlife populations.

An additional problem confronts decision makers. In recent years, precariously low population sizes have tended to confound decisive remedial action by managers due, in part, to concerns that errors in judgment may result in additional damage. Remedial action has been subject to delay while conventional tools and methods are re-evaluated and new methods tested. Section V of this report therefore presents specific recommendations intended to promote action and help resolve management uncertainties where they exist.

Most of the technical information presented in this report is based upon information that was compiled from existing planning documents and from professional fisheries biologists. Specific habitat actions associated with administration of the Endangered Species Act, as well as other opportunities intended to restore fishery resources lost due to the construction and operation of the Federal Columbia River Power System, are included in the recommendation section and the matrix (Sections IV and V).

Wildlife

Mammals, birds and other wildlife have experienced declines similar to those of fish, but losses have generally been more geographically localized when compared with those of anadromous fish. While generalizations regarding wildlife are difficult, several observations are appropriate. As with fishery resources, wildlife species evolved survival strategies that took advantage of the rhythms of the naturally functioning Columbia River Basin ecosystem. However, much high quality, original habitat has been altered, inundated or otherwise lost due to development and operation of the Federal Columbia River Power System. Declines in wildlife populations and species diversity are principally attributable to seasonal, intermittent, or permanent inundation of previously accessible, high quality habitat.

Alluvial floodplain soils previously provided the basis for the highly productive riparian habitats. These areas took thousands of years to evolve geologically, hence, their loss (through inundation) has been an essentially irreplaceable occurrence. Figure 5 displays some the ecosystem functions these inundated habitats formerly provided.

Most creatures make extensive use of habitat niches in proximity to water, such as riparian areas. These habitats are the areas most affected by construction and operation of the Federal Columbia River Power System and the SOR preferred alternative. Many migratory waterfowl species, including ducks and geese, depend upon riparian habitats and islands for nesting, rearing, cover and food. Furbearers and other small mammals such as mink, raccoons, and otter forage in the nutrient-rich riparian habitats. Grizzly and black bears seasonally feed upon the berries and historically fed upon salmon carcasses found along streams. Deer and elk often depend upon riparian areas for winter ranges when their higher elevation summer pastures are covered with deep snow. Aquatic vertebrates and invertebrates found in these highly productive areas comprise an important component of ecosystem relationships for both terrestrial and aquatic species.

With the exception of one short Columbia River reach in the vicinity of the Tri-Cities, Washington, known as the Hanford Reach, the Columbia River mainstem between Bonneville Dam and the Canadian border no longer contains such riverine habitat niches. Water-related project development has transformed historic riverine habitat into lucustrian (lake or reservoir) habitat. Similar inundation has occurred within many tributary rivers and streams. The altered habitats are less productive and generally support considerably fewer native wildlife populations and species.

The SOR Wildlife Working Group identified numerous concerns regarding the past loss of wildlife and the continuing adverse impacts of Federal Columbia River Power System reservoir

water level fluctuations on remaining wildlife and wildlife habitat. The specific recommendations and actions contained in this report therefore tend to focus upon the need to conserve and improve remaining habitats, and to more fully mitigate for past (as well as future SOR) project-related loss of these resources.

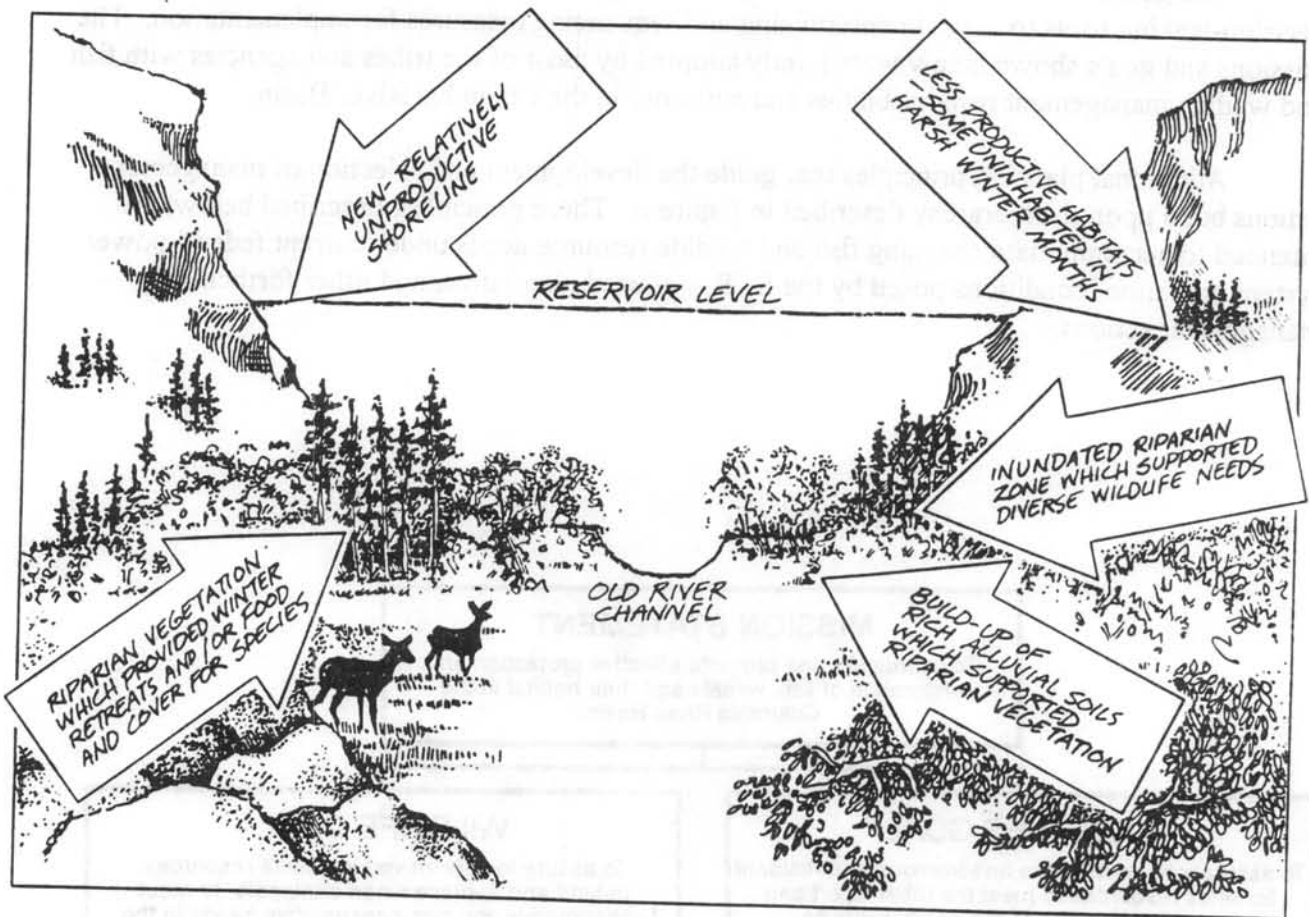


Figure 5. Schematic of a typical Columbia River riparian habitat and some key ecosystem functions.

III. PRINCIPLES AND GUIDELINES

There is a history of independent and collective planning efforts directed toward remedying fish (and to a lesser extent, wildlife) losses associated with the construction and operation of the Federal Columbia River Power System. The Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program stands as the most comprehensive planning and information gathering effort to date. However, no specific, comprehensive strategy for implementing mitigation, restoration or enhancement actions exists. As an initial step, a presentation of fish and wildlife goals and objectives, and a description of planning principles and guidelines is therefore offered here. This section is followed by a matrix of actions and recommendations (Sections IV and V).

The goals, objectives, principles and guidelines presented in this section should be used as decision-making tools to assist in determining and sequencing measures for implementation. The missions and goals shown below were jointly adopted by most of the tribes and agencies with fish and wildlife management responsibilities and authority in the Columbia River Basin.

Additional planning principles that guide the development and selection of management actions build upon the hierarchy described in Figure 6. These principles, described below, are intended to accommodate changing fish and wildlife resource needs under current federal power system operation, conditions posed by the SOR preferred alternative, and other forthcoming management actions.

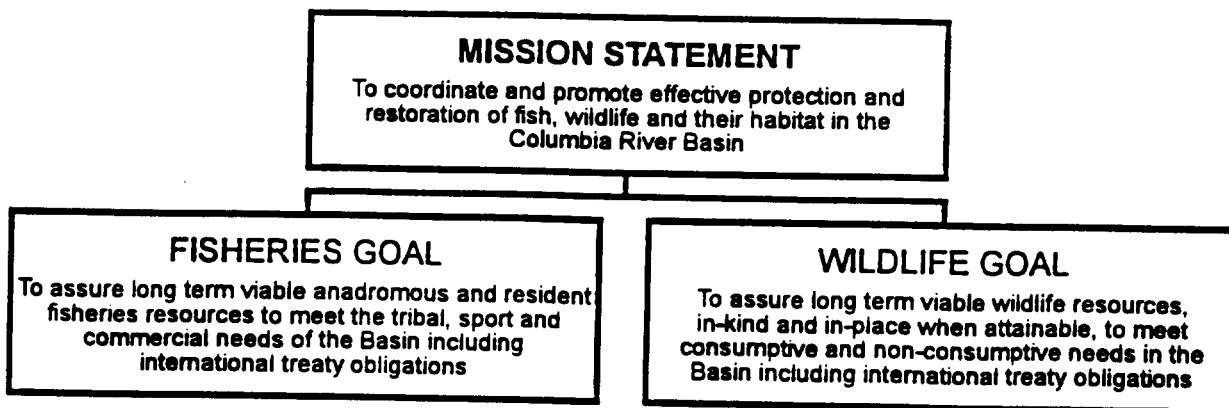


Figure 6. Hierarchy of goals and objectives adopted by the Columbia Basin Fish and Wildlife Authority Members.

Principles

Ecosystemwide Planning

Typically, Fish and Wildlife Coordination Act reports have been prepared in response to project-specific impacts. This approach does not work well within the Columbia River system, as the approach fails to recognize and address the systemwide and cumulative implications for many species. This approach, limited in its focus, also tends to miss opportunities to enhance and mitigate for project impacts "off-site" in instances when losses were irreplaceable "on-site."

There are many unknown or poorly understood ecosystem impacts associated with the construction and operation of the Federal Columbia River Power System. The recommendations in this report offer an ecosystem approach by which losses attributable to project construction and operation can begin to be appraised on an ecosystem basis. A systematic approach will lead to a more comprehensive understanding of the ecosystem and better-informed decisions. The ecosystem approach and the recommendations contained in Sections IV and V are designed to help meet that challenge.

Protection of Biodiversity

The existing Federal Columbia River Power System and the SOR preferred alternative will continue to have significant impacts on the ecosystem. The recent listings of Snake River salmon and Kootenai River sturgeon under the Endangered Species Act dictates that special attention be attached to the subject of biodiversity conservation. Conservation of remaining biodiversity, especially stocks, substocks and races, helps assure that poorly understood, but essential, genetic elements are maintained. Recovery or restoration of fish and wildlife populations following natural or man-caused declines is dependent upon such stewardship and conservation. The biodiversity concept can be used to advance and complement more traditional mitigation planning approaches shown to be ineffective.

Guidelines

Three specific management guidelines are identified for inclusion in this Coordination Act Report. They are as follows.

Restore and/or Replicate Natural River Flows

Priority should be placed upon conserving, restoring and rebuilding those native and endemic species that were distributed throughout the basin prior to construction and operation of the Federal Columbia River Power System. The riverine ecosystem provides essential physical elements. It is, therefore, recommended that restoration and/or replication of natural river flow conditions be sought as beneficial actions for native fish and wildlife species under the Federal Columbia River Power System and SOR preferred alternative.

Stabilize Reservoir Operations

Numerous native aquatic and terrestrial species are dependent upon specific water elevations for feeding, rearing, reproduction, and other functions. These needs require that reservoir surface elevation fluctuations be minimized. In particular, it is anticipated that the needs of salmonids and other aquatic species (especially resident fish) will need to be considered and balanced under future water management regimes.

Avoid Net Loss of Terrestrial Habitats

Priority should be placed on avoiding net losses of terrestrial habitats. Wildlife habitat conservation poses unique problems that are not apparent in resident fish assessments. Two assumptions are implicit: (1) all habitat niches are occupied (when a niche is destroyed either by construction or operation of a project, wildlife species occupying that niche cannot simply move to another already occupied niche), and (2) because there are no unoccupied niches, the opportunities available for restoration and enhancement are extremely limited. Therefore, there is an inherent net loss in wildlife numbers and species diversity associated with most project construction and operation.

To offset this net loss, upgrading the carrying capacity of existing habitats and protecting remaining key habitats are generally the primary mitigation tools available to wildlife managers. Due to the assumptions stated above, these activities frequently require "off-site" habitat acquisition and protection. These and all other available techniques should be used to avoid net loss of wildlife habitats associated with project construction and operation.

IV. FISH AND WILDLIFE RESOURCE LOSSES, ENDANGERED SPECIES ACT REQUIREMENTS, MITIGATION NEEDS AND MITIGATION/ENHANCEMENT OPPORTUNITIES

The matrix introduced in this section and presented in Appendix Tables A-1 and A-2 is intended to provide the reader with a perspective of the scope of impacts that the Federal Columbia River Power System and other development has had on the Columbia River Basin ecosystem. The U.S. Fish and Wildlife Service has solicited the assistance of Columbia Basin fish and wildlife agencies and Indian tribes in compiling the table. Those entities have professional resource management capability and familiarity with locally affected species. As discussed in previous sections, evaluation of the project-specific impacts of the SOR preferred alternative is limited by lack of quantitative data, especially in the context of the unknown cumulative effects of the existing Federal Columbia River Power System. The matrix therefore relies heavily upon existing, often indirect, information and professional expertise. Because the magnitude of lost (e.g., inundated) habitats attributable to development within the Columbia River Basin is so great, many of the planned and potential actions identified in the matrix are not project site-specific.

The first section of the matrix identifies species that are presently under Endangered Species Act protection or review and are potentially affected by the Federal Columbia River Power System (Appendix Table A-1). The nature of the species loss and specific protections or actions, as described in relevant biological opinions or recovery plans relating to the operation of the Federal Columbia River Power System, are also included in the table. It should be recognized that, in most instances, the activities conducted under biological opinions have, or will have, impacts on multiple species and habitats. Biological opinions and recovery plan actions are expected to evolve as determined by new information. The second part of the matrix, Appendix Table A-2, is not limited to species under Endangered Species Act consideration. It presents a wider inventory of impacts, additional opportunities, projects and actions that might be taken to mitigate, enhance or restore additional fish and wildlife species that have been affected by the construction and operation of the Federal Columbia River Power System. These actions, too, will affect or be affected by operational changes that result from implementation of biological opinions and recovery plans conducted pursuant to the Endangered Species Act, as well as by other programs.

The assessment and inventory contained in Appendix Table A-2 relies upon existing documents as well as the professional opinions of many of the management biologists familiar with the impacted species and ecosystem. Appendix Table A-2 does not represent an exhaustive list of impacts or possible actions that might be taken. It does, however, present actions that have been specifically identified and recommended by one or more fish and/or wildlife management entity. For example, the tables include many actions that have been adopted within the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, as well as other actions developed to date through the individual planning and study efforts of the basin's fish and wildlife agencies and Indian tribes. Because of these and other parallel, on-going efforts, the SOR preferred alternative will need to be implemented in a manner that is sufficiently flexible to accommodate new information as it becomes available.

In the case of salmon, many of the actions listed in the 1994-98 NMFS biological opinion issued for the Federal Columbia River Power System (NMFS 1995) and referenced in Appendix Table A-1 of the matrix are intended as short-term actions to "stabilize" listed salmon populations. The actions found in Appendix Table A-2 of the matrix, however, may be designed to go beyond the stabilization level established under the biological opinion. Indeed, many of the actions in the matrix may be considered enhancement or restoration measures, and are therefore not intended to be confused with any legally defined "recovery" or stabilization threshold, as interpreted under the Endangered Species Act.

Measures implemented under relevant ESA biological opinions, as well as other programs, will be monitored over the next few years. With further study, it may be determined that some of the identified options are infeasible, while others may be in conflict with one another. Measures may be added, modified, or eliminated in response to outcomes and resource status. It is also anticipated that existing and future mitigation, enhancement or restoration projects for other fish and wildlife resources will be continuously reviewed for compatibility with existing biological opinions and/or recovery plans.

Recommendations contained in the matrix tend to focus upon selected aspects of fish and wildlife species management and their habitats. There is, however, increasing concern about the

less obvious effects of the Federal Columbia River Power System upon water quality, trophic systems, and basic ecosystem functions. The need to better understand these functions has become increasingly relevant to investigators and decision makers. Future management actions and research are expected to be directed at improving knowledge of the ecosystem so that other less visible native vertebrate and invertebrate species benefit as well.

In presenting the actions found in the matrix, fish and wildlife managers have relied upon information that has been collected, or is planned for collection and analysis, in association with a number of authorities. For salmon, these include the:

- A. United States v. Oregon Columbia River Fish Management Plan.
- B. Endangered Species Act recovery planning and consultation processes.
- C. Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program.
- D. Pacific Salmon Treaty.
- E. Fish and Wildlife Coordination Act (in conjunction with the Corps of Engineers' System Configuration Study).
- F. Other state and local programs.

For resident fish and wildlife species, a number of site-specific studies have been conducted under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program and are included in the matrix. Those studies have focused upon quantifying (often after the fact) the habitats lost due to federal project construction and operation. In some instances, these studies can be used to establish a baseline for determining mitigation requirements.

V. RECOMMENDATIONS

It is recognized that Federal Columbia River Power System operations are continuously being modified as new biological and other information becomes available. The dynamic nature of the system and its management will continue to result in modification of the SOR preferred alternative. Because of the interrelationship of the SOR preferred alternative, the Endangered Species Act, the Northwest Power Act Fish and Wildlife Program, and other concurrent or planned management activities, the following recommendations necessarily require extensive coordination and cooperation with other entities.

- A. Consistent with the guidelines presented in Section III of this report, strive to assure that:
 - 1. Restoration and/or replication of natural river flow conditions are sought as beneficial actions for native fish and wildlife species under the Federal Columbia River Power System and SOR preferred alternative.
 - 2. Reservoir surface elevation fluctuations are minimized.

3. Remaining terrestrial habitat conditions are upgraded and protected to offset the net loss of carrying capacity attributable to Federal Columbia River Power System construction and operation.
- B. Promptly implement watershed planning and other measures adopted by the Northwest Power Planning Council (NPPC 1994). Timely achievement of adopted measures is crucial to species conservation and restoration, and supporting habitats.
 - C. Continue those Northwest Power Planning Council measures and other projects that do not conflict with existing applicable biological opinions and are effective. Pursue alternate recovery and/or mitigation strategies for those that do conflict and/or are relatively ineffective.
 - D. Using the ecosystem approach described in this report:
 1. Review projects listed in the Appendix A matrix for compatibility with the intent of existing and future biological opinions and recovery plans authored by NMFS and the FWS. Reconsult as necessary.
 2. Tier the opportunities identified in this report to complement the short- and long-term system operation strategies presented in the preferred alternative.
 3. Identify alternative funding sources to those now in place.
 4. Commence joint implementation of mitigation/enhancement actions.

The federal agencies are urged to use the assistance of the standing committee structure of the Columbia Basin Fish and Wildlife Authority or other inclusive tribal, state and federal management structures in writing the above report.

- E. Develop and implement monitoring and evaluation needed to fulfill management needs. Emphasize monitoring of the effectiveness of mitigation measures.
- F. New information and/or recommended actions are expected to be developed during the SOR review process, as well as during other parallel efforts such as the Corps' System Configuration Study. Incorporate such information and/or recommendations, as appropriate, into the matrix.
- G. Concurrent with the above recommendations, the Corps of Engineers and Bureau of Reclamation should develop reports detailing the present status of fish and wildlife resource mitigation at their respective projects. The reports should:
 1. Assess the allocation of responsibility for fish and wildlife losses among the Federal Columbia River Power System, irrigation, navigation, flood control and other federally authorized project purposes.
 2. Describe the scope and nature of additional studies that might be necessary to quantify fish and wildlife losses associated with the above activities.

3. Determine the level of mitigation fulfilled to date, relative to Federal Columbia River Power System authorization expectations.
4. Confirm and prioritize remaining mitigation opportunities and identify implementation funding mechanisms.

REFERENCES

- FWS (U.S. Fish and Wildlife Service). 1994. Planning aid report (PAR) as Appendix S of the Columbia River system operation review draft environmental impact statement. U.S. Fish and Wildlife Service, Portland, Oregon. 63 pp.
- FWS (U.S. Fish and Wildlife Service). 1995. Letter and comments on the Columbia River System Operation Review Draft Environmental Impact Statement addressed to Randall Hardy, SOR Interagency Team, Bonneville Power Administration, from Willie Taylor, Director, Office of the Secretary of Interior, U.S. Department of Interior, Washington, D.C. Letter dated January 13, 1995.
- Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Indian Reservation, and the Confederation Tribes and Bands of the Yakama Indian Nation. 1995. Anadromous fish restoration plan: Wy-Kan-Ush-Mi Wa-Kish-Wit: spirit of the salmon. Review draft, Vols. I and II. Columbia River Inter-Tribal Fish Commission, Portland, Oregon.
- NMFS (National Marine Fisheries Service). 1995. Endangered Species Act Section 7 biological opinion on the reinitiation of consultation on 1994-1998 operation of the federal Columbia River power system and juvenile transportation program. 139 pp.
- NPPC (Northwest Power Planning Council). 1986. Compilation of information on salmon and steelhead losses in the Columbia River basin. Appendix D of the 1987 Columbia River basin fish and wildlife program. Northwest Power Planning Council, Portland, Oregon. 252 pp.
- NPPC (Northwest Power Planning Council). 1994. Columbia River basin fish and wildlife program. Northwest Power Planning Council, Portland, Oregon. 165 pp.
- SOR (System Operation Review) Interagency Team. 1994. Columbia River system operation review draft environmental impact statement. DOE/EIS-0170. SOR Interagency Team, Bonneville Power Administration, Portland, Oregon.
- SOR (System Operation Review) Interagency Team. 1995. Working draft of the system operation review final environmental impact statement (unpublished). April 26, 1995. SOR Interagency Team, Bonneville Power Administration, Portland, Oregon. 25 pp.

APPENDIX A

Mitigation, Enhancement and Restoration Matrix of Opportunities Described in Section IV

Opportunity	Mitigation	Enhancement	Restoration
1. [Faint text]	[Faint text]	[Faint text]	[Faint text]
2. [Faint text]	[Faint text]	[Faint text]	[Faint text]
3. [Faint text]	[Faint text]	[Faint text]	[Faint text]
4. [Faint text]	[Faint text]	[Faint text]	[Faint text]
5. [Faint text]	[Faint text]	[Faint text]	[Faint text]
6. [Faint text]	[Faint text]	[Faint text]	[Faint text]

Appendix Table A-1. Reasonable and prudent alternatives, conservation measures, and recovery plan measures for Columbia River Basin species listed under the Endangered Species Act and those species under consideration for ESA or other specific legal protection.

Loss or Impact due to FCRPS ¹	Species Need	Reasonable and Prudent Alternatives, Conservation Measures, and/or Recovery Plan Measures under the ESA	Sources/ Comments
ANADROMOUS FISH - Endangered Species Act			
Snake River fall, spring, & summer chinook, and sockeye salmon.	Attain population thresholds described in pending recovery plan.	Comply with prescribed reasonable & prudent alternatives.	Sec. 7 consultations, relevant BOs
Snake River fall, spring, & summer chinook, and sockeye salmon.	Attain population thresholds described in pending recovery plan.	Implement identified recovery measures.	NMFS 1995 ⁹
Snake River fall, spring, & summer chinook, and sockeye salmon.	Improve basin water planning to accommodate anadromous fish restoration.	Incorporate anadromous fish needs in Pacific Northwest Coordination Act Agreement.	NMFS 1995 ⁹ , DFOP ⁹
Snake River fall, spring, & summer chinook, and sockeye salmon.	Improve basin water planning to accommodate anadromous fish restoration.	Negotiate non-treaty storage to obtain release of water in July, August & September.	NMFS 1995 ⁹
Snake River fall, spring, & summer chinook, and sockeye salmon.	Improve basin water planning to accommodate anadromous fish restoration.	Ensure that water mgmt. does not result in further habitat destruction.	NMFS 1995 ⁹
RESIDENT FISH - Endangered Species Act			
Bull trout (ESA warranted, but precluded).	Under development.	Under development.	
Kootenai River white sturgeon (endangered)	Meet requirements and reasonable and prudent alternatives described in biological opinion for 1995, and 1996-98 water years.	Actions described in biological opinion include: water management, temperature control and biologic targets.	FWS biological opinion, 3/1/95
Redband trout (candidate species)	Continue population & habitat surveys, genetic studies.	To be determined.	

Loss or Impact due to FCRPS ¹	Species Need	Reasonable and Prudent Alternatives, Conservation Measures, and/or Recovery Plan Measures under the ESA	Sources/ Comments
WILDLIFE - Endangered Species Act			
Bald eagle	Under development.	Under development.	
Ferruginous hawk (candidate sp.)	Under development.	Under development.	
Peregrine falcon affected by Clark Fork and other area water development projects.	Under development.	Under development.	
Sage grouse (candidate sp.)	Under development.	Under development.	
Sharp-tailed grouse (candidate sp.)	Under development.	Under development.	
REPTILES, AMPHIBIANS, INVERTEBRATES - Endangered Species Act			
Snake River snails (threatened & endangered).	Provide instream flows for habitat and improve instream water quality conditions. Minimize flow fluctuations during water delivery.	Deliver augmented flows for salmon as follows: feather flows to achieve steady delivery, slow downramping as spring flood flows diminish. Provide water at lower volume over longer time period throughout the entire year, while shaping flows downstream for salmon.	FWS biological opinion, 3/1/95

See footnotes for Appendix Table A-2.

Appendix Table A-2. Mitigation, enhancement and restoration matrix. No level of relative importance is inferred or implied by the order of listing and presentation.

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
ANADROMOUS FISH			
SHORT TERM - HYDRO			
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile fish survival by flow augmentation & water mgmt (short and long term actions required).	Implement instream flows in the Snake & Columbia rivers to mimic natural runoff.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile fish survival by flow augmentation & water mgmt.	Manage flow augmentation as follows: Upper Snake: 1-3 maf Brownlee: 450 kaf Dworshak: 1.5 maf (spring) 1.0 maf (summer)	Priority source for water is upper Snake storage.
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile fish survival by flow augmentation & water mgmt.	Maintain Columbia R. minimum instream flows at The Dalles Dam, taking into account initial year FELCC ⁵ declarations (see Appendix Table A-3).	Draft TRP ⁴ , DFOP ⁶ , CBFWA 1995 ⁷
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile fish survival by flow augmentation & water mgmt.	Spill to achieve 80% fish passage efficiency; manage for dissolved nitrogen concentrations less than 120-125% daily average total.	Draft TRP ⁴ , DFOP ⁶
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile fish survival by flow augmentation & water mgmt.	Manage spill patterns & dissolved nitrogen to maximize fish passage survival (hydroacoustic).	Draft TRP ⁴ , DFOP ⁶
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile fish survival by flow augmentation & water mgmt.	Operate turbines within 1% of peak efficiency; optimize powerhouse performance.	Draft TRP ⁴ , DFOP ⁶

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Accelerate juvenile salmon migration to ocean; improve salmon survival.	By 1996, operate John Day Dam at elevation 257 (min. operating pool (MOP)); Lower Granite Dam at 710; Little Goose, L. Monumental & Ice Harbor dams at MOP from 4/15-10/31.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Accelerate juvenile salmon migration to ocean; improve salmon survival.	Conduct engineering planning for long-term drawdown on the Snake River & John Day Dam reservoir.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Reduce dissolved nitrogen levels to improve juvenile & adult salmon survival.	Install flip lips at John Day Dam, Ice Harbor, Wanapum & Rocky Reach dams.	Draft TRP ⁴ , DFOP ⁶
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile salmon survival at & adjacent to dams.	Continue removal of bigmouth minnows (northern squawfish); investigate controls for seagulls, bass, walleye, & channel catfish.	Draft TRP ⁴ , DFOP ⁶
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve juvenile salmon survival at dams.	Accelerate surface flow bypass prototype development at Bonneville, John Day, The Dalles, Ice Harbor, Rocky Reach, Priest Rapids, & Wanapum dams. Relax flood control rule curves to accommodate fish & wildlife needs.	Draft TRP ⁴ , DFOP ⁶
LONG TERM - HYDRO			
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Increase ability to mimic natural runoff patterns through flow augmentation & water mgmt.; improve anadromous fish survival.	Operate system to achieve mean historical flows during juvenile salmon migration (see Appendix Table A-4).	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Increase ability to mimic natural runoff patterns through flow augmentation & water mgmt.; improve anadromous fish survival.	Relax flood control rule curves to accommodate fish & wildlife needs.	Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Increase ability to mimic natural runoff patterns through flow augmentation & water mgmt.; improve anadromous fish survival.	Restore natural hydrograph of Clearwater River.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Restore anadromous fish above Hells Canyon Dam Complex.	Initiate salmon, sturgeon & lamprey reintroduction program.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Further improve juvenile salmon survival through additional spill.	Modify controlled spill program to achieve 90% or greater fish passage efficiency.	Draft TRP ⁴ , CBFWA 1995 ⁷
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Further improve juvenile salmon survival through turbines.	Retrofit existing turbines; automate and improve design & efficiency.	Draft TRP
OTHER RIVER MANAGEMENT			
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Conserve remaining anadromous fish rearing habitat & water quality to improve survival of all anadromous fish species.	Protect remaining wetlands & intertidal areas in estuary.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Conserve remaining anadromous fish rearing habitat & water quality to improve survival of all anadromous fish species.	Inventory remaining & potential estuary habitat; reclaim former wetland areas when possible.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Conserve remaining anadromous fish rearing habitat & water quality to improve survival of all anadromous fish species.	Re-establish sustained peaking flows that drive river & estuarine ecological processes.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Conserve remaining anadromous fish rearing habitat & water quality to improve survival of all anadromous fish species.	Restrict new hydro, navigation, shoreline development & water withdrawals on estuarine ecosystem impacts.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Increase adult salmon survival and fall-back of adult fish at mainstem dams.	Correct adult fishways to achieve conformance with 1994 DFOP ⁶ .	Draft TRP ⁴ , DFOP ⁶

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Increase adult salmon survival and fall-back of adult fish at mainstem dams.	Improve fishway attraction flows; install additional ladders; modify exits.	Draft TRP ⁴ , DFOP ⁶
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Increase adult salmon survival and fall-back of adult fish at mainstem dams.	Use designs that incorporate fluid mechanics & fish behavior.	Orsborn 1987 ⁸
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve basin water planning to accommodate anadromous fish restoration.	Incorporate anadromous fish needs in Pacific Northwest Coordination Act Agreement.	NMFS 1995 ⁹ , DFOP ⁶
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve basin water planning to accommodate anadromous fish restoration.	Negotiate non-treaty storage to obtain release of water in July, August & September.	NMFS 1995 ⁹
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve basin water planning to accommodate anadromous fish restoration.	Ensure that water mgmt. does not result in further habitat destruction.	NMFS 1995 ⁹
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve anadromous fish habitat conditions in mainstem.	Manage powerhouse discharge to reduce flow fluctuations in forebay & tailrace areas of dams.	DFOP ⁶ , Junge 1971 ¹⁰ , Young et al. 1974 ¹¹ , Young et al. 1977 ¹² , Wagner 1971 ¹³
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve anadromous fish habitat conditions in mainstem.	Analyze Umatilla Tribal Option 9D for inclusion in SOR.	Tribal comments on SOR
Spring, summer & fall chinook, sockeye, coho, steelhead, white sturgeon & Pacific lamprey	Improve anadromous fish habitat conditions in mainstem.	Improve gas monitoring program of Corps of Engineers & PUDs to improve reliability of information.	DFOP ⁶
Anadromous fish, and resident fish & wildlife in Snake & Columbia R. basins due to construction, operation, maintenance of FCRPS & other water development.	Restore natural habitat conditions.	Draw down lower Snake R. dams to permanent, natural conditions; mimic conditions of healthy riverine & riparian ecosystem.	Shoshone-Bannock Tribes, Tribal Council Resolution dated 11/1/94 Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring & fall chinook, coho, steelhead, and lamprey loss in mainstem Columbia R. from Bonneville Dam to McNary Dam.	Restore species diversity and populations in related natural production areas, including Wind, Little White Salmon, Big White Salmon, other affected rivers.	For salmon, use existing hatchery facilities to rear appropriate stocks & species for release in affected areas. Facilities include Oxbow, Carson, Washougal, Spring Creek & Willard hatcheries (see tribal plan for details).	Draft TRP ⁴
Lamprey loss due to construction & operation of dams (Bonneville Dam to McNary Dam).	Restore lamprey through habitat protection & improvement.	Improve screening, passage obstruction, & instream flows; restore riparian vegetation; reduce sedimentation by restricting logging.	Draft TRP ⁴
Spring & fall chinook, coho & lamprey in Klickitat River & mainstem Columbia River	Restore species diversity and populations in natural production areas of Klickitat River.	Implement Klickitat Production Project; acclimate U.S. v Oregon coho.	Draft TRP ⁴
Spring & fall chinook, coho & lamprey in Klickitat River & mainstem Columbia River	Restore species diversity and populations in natural production areas of Klickitat River.	Develop lamprey program; remove passage barriers; improve land use activities; improve water quality in Klickitat River.	Draft TRP ⁴
Spring & fall chinook, coho & steelhead in Hood River and mainstem Columbia River	Restore species diversity and populations in natural production areas of Hood River.	Implement Hood River Production Project; enforce water quality standards; improve instream flows; improve screening.	Draft TRP ⁴
Winter steelhead in Fifteenmile Creek & mainstem Columbia River	Restore population of winter steelhead in natural production areas of Fifteenmile Creek.	Protect & enhance aquatic & riparian habitat; increase streambank protection; improve passage.	Draft TRP ⁴
Spring & fall chinook, steelhead & sockeye in Deschutes River & mainstem Columbia River	Improve population size & stability; increase species diversity in Deschutes River.	Implement new broodstock programs & release strategies; improve passage; protect riparian areas; enhance gravel.	Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring & fall chinook steelhead, coho & lamprey in John Day River & mainstem Columbia River	Improve population size & stability; increase species diversity in John Day River.	Evaluate historical coho & fall chinook status; improve land & water mgmt.; adopt new regulations as needed.	Draft TRP ⁴
Spring & fall chinook, steelhead, coho, chum & lamprey in Umatilla River	Restore populations & species diversity in Umatilla River system.	Resolve technical problems at Umatilla Hatchery; complete construction of South Fork Walla Walla River facility; increase coho production.	Draft TRP ⁴
Spring & fall chinook, steelhead, coho, chum & lamprey in Umatilla River	Restore populations & species diversity in Umatilla River system.	Discontinue catchable trout programs that adversely affect anadromous fish; evaluate chum restoration options.	Draft TRP ⁴
Spring & fall chinook, steelhead, coho, chum & lamprey in Umatilla River	Restore populations & species diversity in Umatilla River system.	Restore lamprey using habitat (flow, passage, land mgmt.) techniques described in tribal plan.	Draft TRP ⁴
Fall chinook, steelhead & lamprey in mainstem Columbia R. from McNary Dam to Chief Joseph Dam	Restore populations & species diversity in related natural production areas, including mainstem spawning areas from McNary to Chief Joseph dams.	For salmon, modify or augment existing hatchery programs to rear appropriate stocks for release in affected areas. Facilities include Ringold, K-Pond, & Turtle Rock hatcheries.	Draft TRP ⁴
Fall chinook, steelhead & lamprey in mainstem Columbia R. from McNary Dam to Chief Joseph Dam	For lamprey, improve & protect habitat.	In tributaries & mainstem, improve passage, secure instream flows, and improve land & watershed mgmt.; modify laws as needed.	Draft TRP ⁴
Spring chinook, coho, chum, steelhead & lamprey of Walla Walla River	Restore populations & species diversity in natural production areas of Walla Walla River.	For salmon, modify existing Carson Hatchery program to rear appropriate stocks for release in affected areas of Walla Walla & Touchet rivers.	Draft TRP ⁴
Spring chinook, coho, chum, steelhead & lamprey of Walla Walla River	Restore populations & species diversity in natural production areas of Walla Walla River.	Phase out existing steelhead program; use native stock of steelhead. Discontinue catchable trout programs that adversely affect salmon.	Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring chinook, coho, chum, steelhead & lamprey of Walla Walla River	Restore populations & species diversity in natural production areas of Walla Walla River.	Evaluate potential of coho and chum salmon reintroduction.	Draft TRP ⁴
Lamprey of Walla Walla River	Restore lamprey through habitat protection & improvement.	Develop program for tributary streams; secure instream flows; improve water mgmt.; and modify laws & agreements as needed.	Draft TRP ⁴
Spring, summer, fall chinook; coho; sockeye; steelhead; & lamprey of Yakima River	Restore populations & species diversity in natural production areas of Yakima River Basin.	Implement Yakima/Klickitat Fisheries Project for salmon. For lamprey, develop program, improve screening, water quality, and watershed mgmt. in upland & riparian areas. Provide necessary seasonal flows.	Draft TRP ⁴
Spring, summer, fall chinook; coho; sockeye; steelhead; & lamprey of Wenatchee River	Restore populations & species diversity in natural production areas of Wenatchee River.	For salmon, modify Leavenworth Hatchery to rear appropriate stocks for release in affected areas.	Draft TRP ⁴
Spring, summer, fall chinook; coho; sockeye; steelhead; & lamprey of Wenatchee River	Restore populations & species diversity in natural production areas of Wenatchee River.	For coho, reprogram existing lower river hatchery.	Draft TRP ⁴
Spring, summer, fall chinook; coho; sockeye; steelhead; & lamprey of Wenatchee River	Restore populations & species diversity in natural production areas of Wenatchee River.	For lamprey, improve passage, secure instream flows, improve riparian and uplands watershed mgmt., modify laws as needed.	Draft TRP ⁴
Spring, summer, fall chinook; coho; steelhead; & lamprey of Entiat River	Restore populations & species diversity in natural production areas of Entiat River.	For salmon, modify Entiat Hatchery to rear appropriate stocks for release in affected areas.	Draft TRP ⁴
Spring, summer, fall chinook; coho; steelhead; & lamprey of Entiat River	Restore populations & species diversity in natural production areas of Entiat River.	For lamprey, improve passage, secure instream flows, improve riparian and uplands watershed mgmt., modify laws as needed, & cease issuance of further hydraulic permits.	Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring & summer chinook, coho, steelhead & lamprey in Methow River	Restore populations & species diversity in natural production areas of Methow River.	For salmon, modify Winthrop Hatchery to rear appropriate stocks for release in affected areas.	Draft TRP ⁴
Spring & summer chinook, coho, steelhead & lamprey in Methow River	Restore populations & species diversity in natural production areas of Methow River.	For coho, reprogram lower river hatchery or Rocky Reach Hatchery, and modify Turtle Rock Hatchery.	Draft TRP ⁴
Spring & summer chinook, coho, steelhead & lamprey in Methow River	Restore populations & species diversity in natural production areas of Methow River.	For lamprey, construct passage facilities, line irrigation systems, change to pump irrigation, modify riparian and upland watershed mgmt.	Draft TRP ⁴
Spring & summer chinook, coho, sockeye, steelhead & lamprey in Okanogan River	Restore populations & species diversity in natural production areas of Okanogan River.	For salmon, modify Turtle Rock & Well hatcheries; improve Turtle Rock Hatchery to provide coho.	Draft TRP ⁴
Spring & summer chinook, coho, sockeye, steelhead & lamprey in Okanogan River	Restore populations & species diversity in natural production areas of Okanogan River.	For lamprey, construct passage facilities, renegotiate boundary water treaty, improve water quality, & reduce thermal barrier.	Draft TRP ⁴
Spring & summer chinook, coho, sockeye, steelhead & lamprey in Okanogan River	Restore populations & species diversity in natural production areas of Okanogan River.	Enforce Clean Water Act, process effluent, modify riparian & upland watershed mgmt.	Draft TRP ⁴
Spring, summer & fall chinook, steelhead & lamprey of mainstem Snake River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Snake River.	For salmon, use new and existing propagation facilities to rear appropriate spring & fall chinook in tributaries and above Lower Granite Dam.	Draft TRP ⁴
Spring, summer & fall chinook, steelhead & lamprey of mainstem Snake River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Snake River.	Revise steelhead program, use native broodstock. Discontinue catchable trout programs that adversely affect anadromous fish.	Draft TRP ⁴
Spring, summer & fall chinook, steelhead & lamprey of mainstem Snake River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Snake River.	For lamprey, develop program.	Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring & fall chinook, steelhead, coho & lamprey of Tucannon River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Tucannon River.	For salmon, use existing and new facilities to rear appropriate salmon for release in natural production areas.	Draft TRP ⁴
Spring & fall chinook, steelhead, coho & lamprey of Tucannon River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Tucannon River.	Revise steelhead program, use native broodstock. Evaluate coho potential. Discontinue catchable trout programs that adversely affect anadromous fish.	Draft TRP ⁴
Spring & fall chinook, steelhead, coho & lamprey of Tucannon River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Tucannon River.	For lamprey, develop program, improve water quality, secure additional water flows, improve watershed mgmt., enact and/or enforce laws to protect habitat.	Draft TRP ⁴
Spring, summer & fall chinook, coho, steelhead & lamprey of Clearwater River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Clearwater River.	For salmon, construct Nez Perce Tribal Hatchery; modify Kooskia, Dworshak & Clearwater hatcheries to rear & release appropriate stocks in affected areas.	Draft TRP ⁴
Spring, summer & fall chinook, coho, steelhead & lamprey of Clearwater River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Clearwater River.	Reprogram lower river coho for reintroduction program.	Draft TRP ⁴
Spring, summer & fall chinook, coho, steelhead & lamprey of Clearwater River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Clearwater River.	For lamprey, construct passage facilities, improve riparian & upland watershed mgmt., enforce Clean Water Act.	Draft TRP ⁴
Spring & fall chinook, sockeye, coho, steelhead & lamprey of Grande Ronde River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Grande Ronde River.	For all salmon species, construct adult/juvenile facilities in affected natural production areas. Reprogram lower river coho. Discontinue use of non-native steelhead. Reestablish sockeye. Discontinue catchable trout programs that adversely affect anadromous fish.	Draft TRP ⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Spring & fall chinook, sockeye, coho, steelhead & lamprey of Grande Ronde River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Grande Ronde River.	For lamprey, develop program, secure water flows, improve riparian & upland watershed mgmt., enforce land use & water laws.	Draft TRP ⁴
Spring & summer chinook, sockeye, steelhead & lamprey of Salmon River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Salmon River.	For salmon, modify Sawtooth, McCall, Pahsimeroi, Rapid River, Magic Valley, Hagerman & Niagara Springs Hatchery facilities to rear appropriate stocks for affected natural production areas.	Draft TRP ⁴
Spring & summer chinook, sockeye, steelhead & lamprey of Salmon River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Salmon River.	Construct Nez Perce Tribal Hatchery. Construct necessary facilities, including those for sockeye.	Draft TRP ⁴
Spring & summer chinook, sockeye, steelhead & lamprey of Salmon River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Salmon River.	For lamprey, develop program, secure water flows, improve riparian & upland watershed mgmt., enforce land use & water laws.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, steelhead & lamprey of Imnaha River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Imnaha River.	For salmon, modify Lookingglass & Irrigon hatcheries to assist in restoring spring chinook in natural production areas. Develop program for summer & fall chinook and coho.	Draft TRP ⁴
Spring, summer & fall chinook, sockeye, steelhead & lamprey of Imnaha River	Restore populations & species diversity in affected natural production areas of mainstem & tributaries of Imnaha River.	For lamprey, develop program, secure instream flows, correct passage barriers, improve riparian & upland watershed mgmt.	Draft TRP ⁴
RESIDENT FISH			
Albeni Falls Dam: reduced kokanee pop. is negatively affecting forage base for rainbow, bull trout, eagles. Also decline in sport fishery.	Improve water mgmt. to benefit various species of fish and wildlife.	Stabilize reservoir levels; provide access to high quality spawning habitat for kokanee. Develop and implement watershed restoration projects, conservation agreements and/or easements for bull trout.	IDFG, pers. comm., 6/21/95

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Loss of overwintering habitat for warmwater resident fish in Pend Oreille River.	Improve water mgmt. to benefit various species of fish and wildlife.		IDFG, pers. comm., 6/21/95
Loss of stable wetland environments along shorelines, deltas, etc.	Improve water mgmt. to benefit various species of fish and wildlife.	Reduce water fluctuations to reduce slumping of saturated streambanks; permit wetland vegetation to develop. Continue BPA/IDFG wildlife mitigation efforts for Pack, Clark Fork rivers & Lake Pend Oreille.	IDFG, pers. comm., 6/21/95
Lake Koocanusa (Libby Dam) & Kootenai River: white sturgeon reproductive failure. Depressed fish production capability is reducing pop. size & viability of kokanee. Other affected species include bull trout, cutthroat, burbot.	Improve productivity & survival of native fish species in-river, and native & sport fish in-reservoir.	Modify dam operations to approximate a more natural hydrograph; adopt integrated rule curves to balance dam operations; coordinate with Montana FW&P.	IDFG, pers. comm., 6/21/95; FWS, pers. comm., 6/30/95
Hungry Horse Reservoir/Dam	Improve reservoir mgmt.	Modify dam operations: adopt integrated rule curves.	FWS, pers. comm., 7/31/95
Lake Koocanusa (Libby Dam) & Kootenai River: depressed to seriously depressed populations of bull trout, rainbow, cutthroat & kokanee.	Restore productivity to Kootenai River and Lake Koocanusa by adopting integrated rule curves.	Restore riparian & floodplain dynamics along Kootenai River; improve reservoir/tributary fish access & habitat.	IDFG, pers. comm., 6/21/95; FWS, pers. comm. 6/30/95
Cabinet Gorge Dam: access blocked to most of Clark Fork River from Pend Oreille Lake. Affected migratory species of fish — bull trout, cutthroat, kokanee, mountain whitefish, rainbow trout.	Restore genetic interaction & reproductive opportunity for affected species.	Restore fish passage past dam; rehabilitate tributaries to restore spawning & rearing success.	IDFG, pers. comm., 6/21/95
Cabinet Gorge Dam: loss of fish & wildlife habitat stability; spawning gravel & sediment recruitment needed to maintain downstream islands & wetland areas has been reduced or lost	Adjust hydroelectric operations to improve fish survival & stabilize river environment.	Limit daily peaking operations at dam.	IDFG, pers. comm., 6/21/95

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Post Falls Dam: loss of riparian & riverine habitats in Spokane & Coeur d'Alene rivers, and St. Joe River upstream of Post Falls. Reduced quality of riverine environment below Post Falls Dam.	Adjust hydroelectric operations to improve fish survival & stabilize river environment.	Maintain adequate, continuous water flows below dam to improve fish survival; restore & stabilize riparian areas upstream of dam.	IDFG, pers. comm., 6/21/95
White sturgeon, kokanee, bull trout, burbot, red band trout, west slope cutthroat trout & others spp.	Implement resident fish projects in blocked areas above Chief Joseph, Grand Coulee, Dworshak & Hells Canyon dams.	Implement resident fish substitution & resident fish projects to assess impacts of reservoir operations.	NPPC 1995 ¹⁵
White sturgeon, kokanee, bull trout, burbot, red band trout, west slope cutthroat trout & others spp.	Assess resident fish losses.	Complete loss assessments as developed by agencies and tribes.	NPPC 1995 ¹⁵
White sturgeon, kokanee, bull trout, burbot, red band trout, west slope cutthroat trout & others spp.	Protect & improve habitat, including vegetation plantings.	Develop comprehensive watershed mgmt. plans. Develop test vegetation plantings at appropriate reservoirs.	NPPC 1995 ¹⁵
Hungry Horse Dam impacts to Flathead R. fish spp. & invertebrates	Provide favorable biological conditions & flows in the Flathead River.	Implement selective water withdrawal mgmt. in reservoir and monitor biological response in river.	NPPC 1995 ¹⁵
Hungry Horse Dam impacts to cutthroat trout & other fish spp. & invertebrates	Provide favorable biological conditions in Hungry Horse Reservoir.	Monitor & evaluate the biological effectiveness of integrated rule curve.	NPPC 1995 ¹⁵
Hungry Horse Dam operations impact to downstream kokanee recruitment	Implement long-term resident fish plan.	Develop long-term hatchery stocking project for reintroduction.	NPPC 1995 ¹⁵
Libby Dam kokanee, bull trout, west slope cutthroat trout, rainbow trout, burbot	Develop operation procedures to ensure sufficient flows to protect resident fish in the Kootenai River & Lake Kootenai.	Refine integrated rule curve to limit drawdown of Libby Reservoir.	NPPC 1995 ¹⁵
Libby Dam kokanee, bull trout, west slope cutthroat trout, rainbow trout	Re-establish natural recruitment with interim hatchery genetic preservation stocking. Implement habitat improvement projects.	Develop mitigation projects to restore natural propagation in the Kootenai River system & Lake Kootenai.	NPPC 1995 ¹⁵

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Dworshak Dam kokanee, west slope cutthroat trout, rainbow trout	Monitor & evaluate activities to determine impacts of multi-purpose flow operations on resident fish in Dworshak Reservoir.	Develop biological & integrated rule curves for reservoir operations.	NPPC 1995 ¹⁵
Dworshak Dam project kokanee	Avoid or minimize entrainment of kokanee at Dworshak Dam.	Test kokanee deterrent devices.	NPPC 1995 ¹⁵
Dworshak Dam project kokanee	Develop population data base for kokanee in Dworshak Reservoir.	Conduct annual kokanee spawner counts in tributaries & creeks of the reservoir & determine kokanee population within the reservoir.	NPPC 1995 ¹⁵
North Fork Clearwater River west slope cutthroat trout, rainbow trout	Determine the population status of the endemic west slope cutthroat trout & introduce rainbow trout.	Implement a genetic inventory in the North Fork Clearwater drainage.	NPPC 1995 ¹⁵
Sturgeon	Research impacts of development & operation of the hydropower system.	Prepare evaluation & biological risk assessment to determine best means by which to rebuild sturgeon populations.	NPPC 1995 ¹⁵
Sturgeon	Develop facilities to enhance white sturgeon by supplementation of depressed populations.	Develop, design & operate experimental white sturgeon research facility.	NPPC 1995 ¹⁵
Sturgeon	Perform baseline assessment of sturgeon in Lake Roosevelt, including the Spokane River arm.	Prepare three-year study to assess all relevant biological factors relating to life history.	NPPC 1995 ¹⁵
Bull trout	Study & evaluate bull trout population & habitat needs.	Develop population & habitat surveys for Middle Fork Willamette, McKenzie, Deschutes, Grande Ronde, Hood, John Day & Umatilla rivers. Develop genetic sampling program for bull trout in the Flathead River Basin.	NPPC 1995 ¹⁵

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Anadromous fish above blocked areas requiring resident fish substitutions, including areas above Chief Joseph & Grand Coulee dams, the Hells Canyon complex, Dworshak Dam & Pelton Dam.	On- and off-project site projects include Lake Roosevelt, tributaries & reservoirs of the Box Canyon reach of the Pend Oreille River, tributaries of the Coeur D'Alene Lake on the Coeur d'Alene Indian Reservation, Kootenai River, lakes & streams of the Colville Indian Reservation, Moses Lake in the blocked areas above Chief Joseph & Grand Coulee dams, as well as Shoshone-Paiute Tribe projects located in the Owyhee drainage and the Nez Perce Tribe on-reservation trout facilities.	Implement the biological objectives & the associated strategies to achieve them developed by the collective fishery managers. See specific project listing with implementing strategies as submitted to the NPPC Columbia River Basin Fish and Wildlife Program.	NPPC 1995 ¹⁵
Naturally spawning adfluvial rainbow trout % kokanee in Lake Roosevelt	Increase reservoir productivity; reduce reservoir entrainment; improve tributary passage/habitat conditions	Implement reservoir operating guidelines as identified in NPPC Fish and Wildlife Program; continue habitat, passage and kokanee enhancement projects	NPPC 1995 ¹⁵
WILDLIFE			
Willamette Subbasin: Riparian/riverine habitat types including mudflats & islands	Acquire and/or enhance lost or diminished habitat types or habitat niches.	At least 59 sites with potential for mitigation of one or more niches in riparian/riverine habitats within subbasin.	ODFW 1993 ¹⁴
Lake/pond habitat types	Acquire and/or enhance lost or diminished habitat types or habitat niches.	At least 8 sites with potential for lake/pond habitat mitigation within subbasin.	ODFW 1993 ¹⁴

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Grassland habitat types	Acquire and/or enhance lost or diminished habitat types or habitat niches.	At least 11 sites with potential for grassland habitat mitigation within subbasin.	ODFW 1993 ¹⁴
Wetland habitat types	Acquire and/or enhance lost or diminished habitat types or habitat niches.	At least 41 sites with potential for wetland habitat mitigation within the subbasin. Amazon Basin/Willow Creek (330 acres)	ODFW 1993 ¹⁴ BPA 1991 ¹⁷
Forest habitat types including deciduous, old growth & other coniferous stands	Acquire and/or enhance lost or diminished habitat types or habitat niches.	At least 55 sites with potential for forest habitat mitigation within the subbasin. Simpson Creek proposal (7,277 acres), Gold Creek (66 acres)	ODFW 1993 ¹⁴ BPA 1991 ¹⁷
Lower Columbia Subbasin: Riparian/riverine habitat types	Acquire and/or enhance lost habitats to replace Habitat Units (HU) identified in Habitat Evaluation Procedures (HEP) using Habitat Suitability Indices (HSI) models for great blue herons or other riparian/riverine spp.	At least 97 sites with potential for riparian/riverine habitat mitigation within subbasin. Lower Columbia River Island (748 acres), Butte Creek (34,200 acres), Vancouver Lowlands (814 acres), Willow Creek (1,500 acres), Buck Hollow Ranch (5,242 acres), Trafton/Willow Creek (249 acres), Blalock Island (165 acres), Brix Maritime Tract (626 acres), Paterson Slough (200 acres)	ODFW 1993 ¹⁴ NPPC 1994 ¹⁶ BPA 1991 ¹⁷
Riparian/riverine habitat types	Key habitat replacement and/or upgrade for Umatilla National Wildlife Refuge due to John Day Dam drawdown.	Seek in-place, in-kind mitigation; off-site mitigation only if above alternative is infeasible.	FWS, pers. comm., 6/30/95
Riparian/riverine habitat types	Key habitat replacement and/or upgrade for Umatilla National Wildlife Refuge due to John Day Dam drawdown.	Retain existing wetlands by diking and providing water from McNary Reservoir.	FWS, pers. comm., 6/30/95

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Lake/pond habitat types	Acquire/enhance habitats using HSI models for the Western pond turtle or other lake/pond spp.	At least 21 sites with potential for lake/pond habitat mitigation within subbasin.	ODFW 1993 ¹⁴ , NPPC 1994 ¹⁶
Wetland habitat types	Acquire/enhance habitats using HSI models for the great blue heron, band-tailed pigeon and/or other wetland spp.	<p>At least 58 sites with potential for wetland habitat mitigation within subbasin.</p> <p>Rufus Wetland (524 acres), Proposed Oregon Western Pond Turtle Mgmt. Study, Ladd Marsh Addition (380 acres), Yakima Valley Project (4,780 acres), Hanford Island Protection (133 acres), Strawberry Island Protection (100 acres), Straub Tract (200 acres), Crimes Island Tract (581 acres), Post Office Lake (80 acres), Jones Property (125 acres), Smith & Bybee Lakes Mgmt. (1,800 acres), Fisher Island (240 acres), McCormack Slough proposal (450 acres), Whitcomb Slough (100 acres), Kenny Pond (50 acres)</p>	ODFW 1993 ¹⁴ , NPPC 1994 ¹⁶ BPA 1991 ¹⁷
Wetland habitat loss due to John Day Dam drawdown operation elevation 257 ft.	Loss of 2,850 acres calculated. Acquire emergent wetland and shallow water habitat for shore birds, waterfowl, furbearers, painted turtles, etc.	All on-site and off-site mitigation opportunities being evaluated.	Rasmussen, FWS, pers. comm., 6/30/95
Shrub/sage habitat types		At least 47 sites with potential for shrub/sage habitat mitigation within subbasin.	ODFW 1993 ¹⁴ , NPPC 1994 ¹⁶
Forest habitat types, including juniper, deciduous, old growth, & other coniferous stands.	Acquire/enhance habitats using HSI models for northern spotted owls, ruffed grouse, elk, black bears, or other forest spp.	At least 52 sites with potential for forest habitat mitigation within subbasin.	ODFW 1993 ¹⁴ , NPPC 1994 ¹⁶

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Upper Columbia Subbasin: Riparian/riverine habitat types including islands	Acquire/enhance habitats using HSI models for breeding bald eagles, black-capped chickadees, peregrine falcons, white pelicans or other riparian/riverine spp.	Pend Oreille River shoreline (550 acres); Island proposal (360 acres); and Peregrine Falcon Reintroduction Proposal.	NPPC 1994 ¹⁶ BPA 1991 ¹⁷
Shrub/steppe and other grassland habitat types	Acquire/enhance habitats using HSI models for sharp-tailed grouse, pygmy rabbit, sage grouse, mule deer, or other upland spp.	Hell's Gate project, Washington (500 acres), Blue Creek project (2,000 acres)	NPPC 1994 ¹⁶ BPA 1991 ¹⁷ WDG 1986 ¹⁸
Agricultural land habitats (e.g., borders and fringes)	Acquire/enhance habitats using HSI models for Swainson's hawks, ring-necked pheasants or other agricultural land spp.		NPPC 1994 ¹⁶
Wetland habitat types	Acquire/enhance habitats using HSI models for mallard ducks, redhead ducks or other wetland spp.	Pend River (1,000 acres), Lake Pend Oreille, Redhead, Idaho (2400 acres), Wetlands, Idaho (3,100 acres), Hoodoo Creek (1,130 acres).	NPPC 1994 ¹⁶ BPA 1991 ¹⁷
Snake River Subbasin: Riparian/riverine habitat types	Acquire/enhance habitats using HSI models for breeding and wintering bald eagles, river otter, black-capped chickadees, peregrine falcons, ruffed grouse or other riparian/riverine spp.	Minidoka River Otter Project (1,880 acres), Clearwater Riparian Project (339 acres)	NPPC 1994 ¹⁶ BPA 1991 ¹⁷
Wetland habitat types	Acquire/enhance habitats using HSI models for mallard ducks or other wetland spp.	Owyhee River Wetland Enhancement (2,500 acres), Alpine Wetland (250 acres), Camas Prairie Marsh (6,100 acres), Market/Mud Lakes (1,150 acres)	NPPC 1994 ¹⁶ BPA 1991 ¹⁷
Native grasslands & shrubland habitats	Acquire/enhance habitats using HSI models for mule deer, elk, white-tailed deer, sharp-tailed grouse or other upland spp.	IDFG Sharp-tailed Grouse Habitat & Translocation Proposal, Sand Creek WMA (3,070 acres), Bruneau Hills (6,400-15,500 acres), Nelson Ranch (1,315 acres)	NPPC 1994 ¹⁶ BPA 1991 ¹⁷

Loss or Impact due to FCRPS ¹	Mitigation, Enhancement and Restoration Needed ²	Opportunities to Meet Needs ³	Sources/ Comments
Forest habitat types, including lowland forests, old growth and other coniferous stands	Acquire/enhance habitats using HSI models for elk, pileated woodpecker, white-tailed deer or other forest spp.	Clearwater Big-game Project (2,035 acres)	NPPC 1994 ¹⁶ BPA 1991 ¹⁷

¹ In the case of anadromous fish, loss identification and the relative magnitude of losses, where identified, were taken from various sources, including the Northwest Power Planning Council's 1987 *Columbia River Basin Fish and Wildlife Program*, Appendices D and E. FCRPS refers to the Federal Columbia River Power System.

² In the case of wildlife, one estimate of the magnitude of habitat unit (HU) losses for some species in selected habitat types is shown in the Northwest Power Planning Council's 1994 *Columbia River Basin Fish and Wildlife Program*, Pages 11-11 to 11-16.

³ In the case of anadromous fish, actions to meet recovery thresholds as determined under the Endangered Species Act are established in the applicable biological opinions and/or recovery plans. Opportunities displayed in this column represent the best available science. The technical and feasibility merits, however, are sometimes viewed differently. It should be noted that, generally, enhancement and restoration will require more action than that required to satisfy population thresholds as determined by the Endangered Species Act.

⁴ Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Indian Reservation, and the Confederation Tribes and Bands of the Yakama Indian Nation. 1995. *Anadromous fish restoration plan: Wy-Kan-Ush-Mi Wa-Kish-Wit: spirit of the salmon*. Review draft, Vols. I and II. Columbia River Inter-Tribal Fish Commission, Portland, Oregon.

⁵ Firm energy load carrying capability as defined by the Pacific Northwest Coordination Agreement.

⁶ Columbia Basin Indian Tribes, and the State and Federal Fish and Wildlife Agencies. 1993. *Detailed fishery operating plan with 1994 operating criteria*. Portland, Oregon.

⁷ Columbia Basin Fish and Wildlife Authority. 1995. *Recommendations to the Northwest Power Planning Council for amendment of the Columbia Basin Fish and Wildlife Program, juvenile salmon migration*. Columbia Basin Fish and Wildlife Authority, Portland, Oregon.

⁸ Orsbom, J.F. 1987. *Fishways, historical assessment of design practices*. *American Fisheries Society Symposium* 1:122-130.

⁹ National Marine Fisheries Service. 1995. *Proposed recovery plan for Snake River salmon*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Washington D.C.

¹⁰ Junge, C. 1971. *Effect of peaking operations on passage of adult salmonids over Columbia River dams*. Oregon Fish Commission. Final report to U.S. Army Corps of Engineers, Portland, Oregon. Contract DACW 68-71-C-0020.

¹¹ Young, F.R., R.T. Michimoto, G.G. Gibson, R.T. Westfall, H.E. Jensen, and D.W. Nichols. 1974. *An investigation of the effects of power peaking upon adult salmon in the Columbia River*. Annual report. Fish Commission of Oregon, Portland.

- ¹² Young, F.R., R.T. Michimoto, and G.G. Gibson. 1977. *Passage problems of adult chinook salmon and steelhead trout in the Columbia River between Bonneville and McNary dams during 1975. Annual report. Oregon Department of Fish and Wildlife, Portland.*
- ¹³ Wagner, C.H. 1971. *Fish passage and power peaking at Ice Harbor Dam. Draft report. National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, Columbia River Program Office, Portland, Oregon.*
- ¹⁴ ODFW (Oregon Department of Fish and Wildlife). 1993. *Oregon trust agreement planning project, potential mitigation to the impacts on Oregon wildlife resources associated with relevant mainstem Columbia River and Willamette River hydroelectric projects. Prepared for the Bonneville Power Administration, Contract DE-B179-92BP90299, Portland, Oregon.*
- ¹⁵ NPPC (Northwest Power Planning Council). 1995. *Proposed resident fish and wildlife amendments to the Columbia River basin fish and wildlife program. Northwest Power Planning Council, Portland, Oregon.*
- ¹⁶ NPPC (Northwest Power Planning Council). 1994. *Columbia River basin fish and wildlife program. Northwest Power Planning Council, Portland, Oregon.*
- ¹⁷ BPA (Bonneville Power Administration). 1991. *Wildlife Scoping Group, Implementation Planning Process. Unpublished data.*
- ¹⁸ WDG (Washington Department of Game). 1986. *Wildlife Protection, Mitigation and Enhancement Planning for Grand Coulee Dam.*

Appendix Table A-3. Sliding scale flow targets to be achieved at The Dalles Dam. (Maintain by drafting Canadian reservoirs on an equitable basis. Increase flows based upon storage such that 40% of runoff above average volume at Hungry Horse and Libby dams is added to targets.) Source: CRITFC, 1995 pers. comm.

Date	KCFS		
	First year	Second year	Third year
April 15-30	300	260	220
May	300	260	220
June 1-15	300	260	220
June 16-30	250	250	200
July	200	200	200
August 1-15	160	160	160
August 16-31	160	160	160
Sept. 1-30	120	120	120

Appendix Table A-4. Target minimum flows based upon the mean streamflow, adjusted for storage for the period of record 1927-1978 (Columbia River Water Management Reports 1981, 1990). Source: CRITFC, 1995. Pers. comm.

Dam	Minimum flows (kcfs)							
	Ap1	Ap2	May	Jun	July	Au1	Au2	Sep
Mica	6	8	29	58	58	46	34	22
Hungry Horse	4	6	7	6	3	1.5	1.5	1.5
Libby	7	9	26	35	20	10	9	7
Albeni Falls	25	31	55	68	34	16	12	12
Priest Rapids	100	140	295	358	214	130	92	69
The Dalles	210	235	426	483	265	170	113	99
Dworshak	10	13	16	11	4	2	2	2
Brownlee	28	32	28	25	12	10	10	12
Lower Granite	70	94	122	113	40	21	21	21

APPENDIX B
Letters of Comment



COEUR D'ALENE TRIBE

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October 3, 1995

Michael Spear, Regional Director
U.S. Fish and Wildlife Service
911 NE 11th Avenue
Portland, Oregon 97232-4181

Dear Mr. Spear:

As Chairman of the Coeur d'Alene Tribe I have signed the U.S. Fish and Wildlife Service Coordination Act Report on the Columbia River System Operation Review. However I have several concerns which I wish to express. These concerns, which were included in my response to the Preliminary Final Environmental Impact Statement for the SOR, should be included in Appendix B of this document.

Appendix B: Fish and Wildlife Coordination Act Report

The draft Coordination Act Report (CAR) included with the Preliminary Final Environmental Impact Statement (PFEIS) is not the latest version as prepared by the U.S. Fish and Wildlife Service.

Information provided the Tribal staff indicates that the SOR managers were aware a revised version would be prepared for inclusion in the PFEIS, yet they chose to incorporate the initial draft. My comments are based on the review done on the revision provided the Coeur d'Alene Tribe by letter dated September 11, 1995.

On July 31, 1995, the Tribe responded to the Columbia Basin Fish and Wildlife Authority request to review the draft CAR covering the SOR. At that time written comments were made concerning the draft document and requested that the points we raised be included with the original draft CAR. In addition, staff members had several discussions with members of the Columbia Basin Fish and Wildlife Authority regarding our comments. Many of our concerns were included in the revised draft of the document.

I wish to call attention to figures 1, 3, and 4 on pages 6, 8 and 9 of the CAR. As a very simplistic and direct visual aid these figures show what has happened to the Columbia River system and the anadromous fish runs. Especially graphic is the influence of the dams constructed in the early and middle 1970's and the reduction in spring chinook salmon runs.

If the Federal agencies are really interested in saving salmon stocks then a close look must be taken at changing how the system is operated. The CAR should make an effort to describe the chronology of the construction of the dams and develop an analysis for each dam evaluating the adverse effects on the salmon stocks. It is recognized that Federal structures are the subject of the SOR. However the privately owned utility dams in the Columbia system should be also considered when looking at the reduction in salmon stocks.

On page 3 the CAR incorrectly states the tribes were involved with the SOR process. On numerous occasions the Coeur d'Alene Tribe joined other tribes in raising the issue that the tribes of the Columbia Basin were not initially involved in the scoping process of the SOR. This lack of participation was not changed by the SOR managers until September of 1993. This caused many problems related to the way the tribes feel the process has worked. It is important to either change the way page 3 of the CAR is written, or acknowledge that the tribes feel left out of the process.

While fish and wildlife issues are covered in the CAR, water quality appears to be either downplayed or ignored. The quality of water plays an important part of the whole system. Little research or documentation of the needs of the fish within the system have been developed to address the adverse effects of farm chemicals, waste dumping by industry, sediment loading to the system and poor flushing of the whole river due to the reservoirs. The CAR does not mention this lack of information. The only references which may reflect water quality relate to water temperatures and dissolved gases.

The Columbia River ecosystem is entirely too complex to study in a short 3 or 4 year time frame. Too much of the system is ignored, as discussed in the January 13, 1995, letter from the Fish and Wildlife Service to Randy Hardy. Due to political considerations no attempt has been made to correlate the influence the Canadian portion of the system or the upper Snake system into the SOR process. As mentioned in the Fish and Wildlife letter, it appears that treaty negotiations will result in an agreement outside the

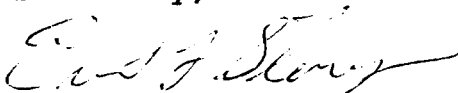
framework of the SOR, potentially resulting in further adverse effects on the fish and wildlife of the system. The CAR does not mention this in the document.

It should be noted that the upriver tribes have never been fully compensated for losses sustained from the construction of Grand Coulee and Chief Joseph dams. The Enhancement and Restoration Matrix covers mitigation which addresses base case or current operating strategies and does not address past mitigation for early damages, ie: actual construction and subsequent operation of Grand Coulee. We feel this would also apply to the tribes in the Snake River system. The Coeur d'Alene Tribe fears that the Biological Opinion (BO) will ultimately adversely affect the Tribe in its efforts to develop adequate resident fish substitutions for the loss of salmon runs. The CAR does not address this in the document.

We fully agree with the last 3 paragraphs on page 11 of the September 11 draft of the CAR. Additionally, the list of recommendations shown on pages 18, 19, and 20, as well as the Mitigation, Enhancement and Restoration Matrix shown in Appendix A of the CAR should become an integral part of the preferred alternative of the SOR as well as the Record of Decision.

I would like to express my appreciation for the efforts made in considering the past comments of the Tribe in developing the October 1995 draft of the Coordination Act Report. I ask that the additional concerns I have raised be incorporated in the CAR. If there is additional information required you should contact me at (208) 686-1800.

Sincerely,



Ernest L. Stensgar, Chairman
Coeur d'Alene Tribe



IDAHO FISH & GAME

600 South Walnut / Box 25
Boise, Idaho 83707-0025

Phil Batt / Governor
Jerry M. Conley / Director

October 16, 1995

Michael Spear, Regional Director
U.S. Fish and Wildlife Service
911 NE 11th Avenue
Portland, OR 97232-4181

Dear Mike:

We appreciate the efforts of the U.S. Fish and Wildlife Service in assembling the Fish and Wildlife Coordination Act Report on the System Operation Review (SOR). The evolution of the SOR was a long and arduous one.

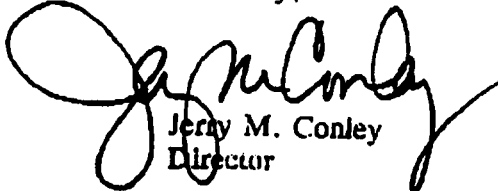
We certainly support the need for an ecosystem approach to the restoration of the basin fish and wildlife that is well founded in adaptive management and maintaining biodiversity. The Coordination Act Report does a good job of identifying ways of protecting anadromous fish, resident fish, and wildlife that relied on numerous basinwide efforts, including the Power Planning Council and NMFS salmon recovery processes.

Recognizing that the report identified both long- and short- term options to the anadromous need, we are not in support of flow-based solutions using more than 427 kaf from the upper Snake River. Flow augmentation is not the answer to restoring healthy and fishable anadromous runs in the Snake River. It also will not meet the long-term needs of the resident fish and wildlife.

The Idaho Department Fish and Game has concerns about some of the recommendations of the draft Tribal Recovery Plan dealing with production and supplementation. NMFS is planning to address these issues by developing a detailed framework on the role of supplementation in the recovery and rebuilding of Snake River salmon.

As we progress toward restoration of the basin's fish and wildlife populations, it will be imperative that we focus on limiting factors that will get the best and quickest result. This is what adaptive management is all about.

Sincerely,



Jerry M. Conley
Director

JMC:BB:alb

The SHOSHONE-BANNOCK TRIBES

FORT HALL INDIAN RESERVATION
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P. O. BOX 306
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October 17, 1995

Michael Spear, Regional Director
U.S. Fish and Wildlife Service
911 NE 11th Avenue
Portland, OR 97232-4181

RE: Concerns of the Shoshone-Bannock Tribes

Dear Mr. Spear:

The Shoshone-Bannock Tribes (Tribes), through the Fort Hall Business Council, have agreed to sign the Fish and Wildlife Coordination Act Report (CAR) on the Columbia River System Operation Review (SOR). The Tribes agree that there are many positive aspects of this report, however, by signing this document, the Tribes do not agree or accept the SOR process. The position of the Tribes is that the SOR process has been flawed from the beginning because of its failure to recognize the paramount interests of the Indian Tribes and the failure of this process to address the treaty rights of the Tribes and the trust responsibility of the federal government to the Tribes and their rights.

The Tribes sincerely believe that if the SOR process had started over and properly accommodated the interests of the Tribes, the aspects of the natural riverine ecosystem would have received higher priority and there would be direct actions to reach that result. The Tribes believe that part of the CAR does not go far enough as it has only accorded the additional actions described by the majority of the resource managers and Tribes as discretionary as evidenced by Appendix Table A-2. The Tribes do have some concerns that the CAR has adopted the ESA biological opinions and conservation measures as mandatory as set forth in Appendix Table A-1. The limited constraints of Table A-1 simply do not go far enough to protect and recover the natural river and resources of the Columbia River system.

The policy of the Tribes remains to pursue and promote efforts to restore the Snake River system and affected unoccupied lands to a natural condition, and the ecological features associated with the natural riverine ecosystem in whatever available forum. We believe the U.S. Fish and Wildlife Service must seek to mandate these natural resource conditions as part of their fiduciary responsibilities to the Shoshone-Bannock Tribes. Please contact me directly or Lionel Boyer, Tribal Fisheries Policy Representative, if you have any comments, questions or concerns.

Sincerely yours,

Delbert Farmer
Delbert Farmer
Chairman

**Technical assistance provided by the
Columbia Basin Fish & Wildlife Authority
Portland, Oregon**