Conservation of Columbia Basin Fish

Habitat Appendix

A Publication of the Federal Caucus • December 1999

DRAFT

Conservation of Columbia Basin Fish

Habitat Appendix

December 1999

Prepared by
The Federal Caucus

Army Corps of Engineers
Bonneville Power Administration
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
Environmental Protection Agency
Fish and Wildlife Service
Forest Service
National Marine Fisheries Service

TABLE OF CONTENTS

INTRODUCTION TO THE HABITAT APPENDIX

This Habitat Appendix is intended to accompany the Conservation of Columbia River Fish (All-H) paper, and serves to support its discussions. Representatives from several federal agencies (such as the National Marine Fisheries Service, the Bonneville Power Administration, the Bureau of Land Management, U.S. Forest Service, U.S. Bureau of Reclamation, Environmental Protection Agency, and U.S. Army Corps of Engineers) and the Northwest Power Planning Council's Multi-species Framework participants developed the Appendix, which is divided into sections that describe components of a science-based approach to Columbia River Basin (basin) habitat recovery. The sections are presented in an order intended to assist the reader in understanding the All-H paper's habitat recovery framework. This Appendix and its approaches are not tied to individual habitat options of the All-H paper, but to *all* options. The options differ by the extent to which these concepts will be developed, coordinated, and used.

It is important to note that the scientific foundation for the concepts presented in the All-H paper and in this Appendix is still evolving. The approaches provided here represent *ideas* for proceeding through the complexities of habitat recovery; they do not represent *decisions*. The associated intent is to stimulate a dialogue among governments and stakeholders that leads to problem-solving and a regionally accepted framework for basin habitat recovery. We expect that discussion and problem-solving will result in changes to this appendix before it is finalized in spring 2000.

Conceptually, the framework for habitat recovery is simple. However, it will not be simple to carry out: the bio-physical and socio-economic environment within the basin is very complex. First, the region needs a coordinated approach to habitat recovery. Recovery will depend on successful rehabilitation of ecological processes and functions. Second, habitat recovery needs to be science-based, which means that it should be guided by fish production and fish recovery standards and by assessments of risks to and opportunities for improved fish survival. Habitat recovery will require coordinated immediate actions and coordinated science-based assessment, planning, and actions prioritized and targeted to meet fish survival, Clean Water Act, and other regional and local objectives.

A brief overview of the sections is as follows:

Section A provides a complete overview of the federal agency programs and authorities that can proactively contribute to protecting and restoring Columbia Basin habitat. This section illustrates both the breadth and the limitations of federal programs and authorities.

Section B provides a brief summary of Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon. The Nez Perce, Umatilla, Warm Springs, and Yakama Nation tribes provided the Spirit of the Salmon as a framework to restore Columbia River Salmon. The tribes also provided a "Coarse Screening Process," a set of objective, measurable criteria to assess the consistency of land management activities, with the goal of improving salmon habitat conditions and improving the survival of Endangered Species Act (ESA)-listed salmon. The "Coarse Screening Process" is listed in Section G of this Habitat Appendix as an site/project implementation tool; it is

particularly germane to the All-H Habitat objective: prevent further degradation of tributary habitat conditions and water quality.

Section C provides a very brief overview of those state programs in Oregon, Washington, and Idaho that are implemented for salmon and steelhead recovery and watershed management. This section does not include an overview of the many state authorities and departmental programs that contribute to habitat recovery and watershed management. Rather, it reviews the statewide programs that are targeting salmon, steelhead, and watersheds. This background information should be useful in identifying opportunities and roadblocks to greater coordination among the governments operating within the Basin.

Section D describes some pervasive issues that must be resolved for habitat and water quality conditions to recover in the basin: non-federal and federal lands coordination, tributary water quantity, tributary water quality, and the federal role in agricultural lands. Because these issues have complex legal, regulatory, policy, and institutional aspects, they can be extremely difficult to solve at the local level. Therefore, effort at the regional and state levels to provide policy and technical guidance is appropriate to assist and streamline local efforts. This section explores options and approaches for the federal government's role in solving these tough issues. As with all other aspects of this Appendix, the federal agencies do not propose one option over another.

Section E describes the immediate habitat actions that can and should be taken in the Columbia Basin. It presents criteria for determining the type of actions that are needed immediately (e.g., actions that reduce an imminent risk to survival or actions that immediately improve survival). It also provides an example list of the types of immediate actions the federal agencies are currently implementing and should continue to implement in the near-term.

Section F is a more detailed description of the multi-scale analysis, planning and implementation framework introduced in the habitat section of the All-H paper. A theme of the All-H paper is that while immediate actions are necessary, most actions should be implemented as part of a science-based coordinated plan that provides conservation and restoration priorities. The premise of the multi-scale analysis, planning, and implementation framework is that the project-level priority actions that will lead to recovery of species and other objectives (including clean water) and that are sensitive to socio-economic concerns must be derived from science-based assessments and plans at multiple scales.

Section F proposes a framework for this multi-scale assessment, planning and implementation. **Sections G and H** provide some tools and guidance for project implementation and watershed assessment.

Sections I and J provide a more detailed discussion of two important aspects of the multi-scale assessment, planning, and implementation framework: prioritization criteria and performance measures, respectively.

Section I describes a framework for developing prioritization criteria for use in the multi-scale analysis, planning and implementation framework. Decisions must be made at all scales to plan and fund actions. There are number of considerations that could influence decisions for

prioritizing actions. This section suggests a science- and policy-based approach to prioritizing actions at multiple scales.

Section J develops a multi-scale approach to performance measures and standards. Actions should be planned so that they contribute to measurable benefits. Performance measures and standards at multiple scales provide a means of measuring accomplishments at scales that are meaningful to salmon and steelhead and to the governments and stakeholders.

Section K describes research being conducted by the National Marine Fisheries Service's (NMFS) Northwest Regional Science Center, relating freshwater habitat conditions to salmon and steelhead population levels. This approach helps both to plan and prioritize actions for improving fish production and to evaluate the effect of land and water management actions on fish abundance in a watershed. The results of this approach are intended to be used and integrated with results of the Cumulative Risk Integration (CRI) analyses, and other regional science assessments such as the Ecosystem Diagnosis and Treatment (EDT) method, to form the foundation for anadromous species recovery planning.

Section L provides a reasonable estimate of the cost to implement aquatic habitat restoration over the next 15 years. The All-H paper provides for three habitat objectives: (1) prevent further degradation of habitat conditions and water quality; (2) protect existing high-quality habitats; and (3) restore habitats on a priority basis. The first objective needs to be met primarily through the implementation of adequate laws, regulations, and ordinances governing land and water use. There is no attempt to evaluate the costs of objective (1). The others, objectives (2) and(3), can be met through subbasin plans and watershed partnerships that identify, fund, and implement protection and restoration projects. The cost estimates are for implementing actions based on the work of subbasin and watershed action plans to meet objectives (2) and (3). Beginning with detailed estimates from two example watersheds (Yakima and the Grande Ronde), the total basin costs were derived by using simple assumptions to extrapolate these estimates to the entire basin. The estimate is based on whole watershed treatments, ranging from controlling hillside erosion to instream habitat improvements.

Finally, **Section M** provides an annotated bibliography for the existing conditions of freshwater, estuary, and mainstem habitat in the basin.

The All-H Paper provides a conceptual approach to a comprehensive monitoring strategy for the Columbia River Basin. This Habitat Appendix provides detailed discussions of the critical All-H Habitat topics; however, time and personnel constraints did not allow for development of the corresponding critical monitoring approach for habitat. It is recognized that a comprehensive performance measures, monitoring, and feedback approach is critical to successful habitat recovery and needs to be developed.

A. AUTHORITIES THAT FEDERAL AGENCIES CAN USE TO BENEFIT SALMON

INTRODUCTION

This Appendix section documents existing authorities and programs that can currently be used to benefit freshwater and estuary habitat for salmon. Understanding this background is critical to developing an Integrated Plan for salmon recovery. For context, a brief description of the requirements and challenges to such development is summarized below.

The All-H effort aims primarily to develop a conceptual approach to the recovery of salmon of the Columbia River Basin (basin). Requirements for the approach are as follows:

- It must be capable of being implemented by agencies in cooperation with other governments, organizations, and individuals.
- Federal agencies must be able to implement the program of actions individually, together, and in cooperation with others.
- The approach must lead to the recovery of the salmon of the basin.

This section of the All-H paper addresses habitat improvements in subbasins. The effects, therefore, will be protection and recovery of the entire assemblage of fish and wildlife resources, including species of interest, in a given subbasin.

Further requirements are as follows:

- Program objectives, criteria, and processes must be both general enough to accommodate the different authorities and responsibilities of different agencies and local efforts, and specific enough to produce the desired result (recovery of fish and wildlife and their critical habitats) when the actions are integrated.
- The All-H plan must be flexible enough to incorporate the work of others (e.g. states, tribes, local governments, watershed councils, conservation groups and individuals).
- It must be so well-designed and useful that it can be readily incorporated, in part or in total, into the programs of others.

Meeting these objectives will be a significant challenge; reasons are described below.

Agency mandates. Agencies are created to meet a particular societal need. The authorities invested in them are typically limited in scope and responsibility. Those agencies and governments are not necessarily designed to act cooperatively.

- Example: although the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) have management responsibilities for migratory fish and wildlife, the species and geographical areas for which they are responsible are different.

A similar situation exists between the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). This potential divergence and cross-intentions of interests increases as more agencies are added to the mix.

Most agencies have an authorizing statute or statutes that outline its obligations and responsibilities. Sometimes Congress passes laws that confer additional specific authorities and responsibilities (e.g., the Migratory Bird Treaty Act of July 3, 1918, as amended; the National Forest Management Act of 1976; the Taylor Grazing Act of 1934, as amended; and others). Each agency will be challenged to balance the expectation of its primary mandate with the needs of a global issue that crosses boundaries (e.g., power, forest management, and mining needs, versus fish and wildlife recovery needs or resolving the competing needs of migratory fish and predatory migratory birds).

Funding Differences. Another impediment to an integrated plan is source and method of agency funding. Except for Bonneville Power Administration (Bonneville), Congress annually approves the budgets of all the federal agencies (appropriated agencies). If Congress withholds funding for an action, the agency cannot carry it out.

Bonneville, by contrast, is self-financed. Revenues from the sale of power generated at the federal facilities in the basin are for four main purposes:

1. to repay the U.S. Treasury for the cost of constructing and operating these electric generating facilities;
2. to pay debt on bond financing;
3. to cover the administrative costs of Bonneville and the Northwest Power Planning Council (NPPC), and
4. to pay for fish and wildlife mitigation associated with constructing and operating these facilities.

Bonneville's fish and wildlife actions are determined not by an annual appropriation, but largely by the recommendations it receives from NPPC, and the need to meet the biological requirements of various Biological Opinions. However, it is important to remember that the BPA budget is submitted to Congress annually and that, although Congress need not explicitly approve the annual budget, it may give special directives or impose limitations on expenditures.

Inter-dependency. Some federal agencies will have to resolve the problem of how to satisfy a regional program need, while many or all of their actions are determined by others.

- Example: most of the fish and wildlife actions funded by Bonneville are recommended by NPPC. If these actions are not compatible with the proposed All-H recovery plan, the actions may be counterproductive.
- Concomitantly, the actions that are undertaken by the U.S. Army Corps of Engineers (Corps) and the Natural Resource Conservation Service (NRCS) are dependent on requests made by a local sponsor. The challenge here is to ensure that the recovery needs and priority actions are either embedded into the programs of the Corps and NRCS, or that the sponsors adopt salmon recovery as a local objective.

Documented Agreement. The final challenge is to develop a strategy for habitat protection and improvements that the federal agencies and nonfederal recovery participants in the basin will actively support. A special legislation or a special memorandum of agreement will likely need to

be developed to effect an integrated approach. Without some formal agreement to support a commitment to produce and implement integrated plans of work, we are unlikely to achieve that objective.

THE SERVICES' RESPONSIBILITIES FOR ENDANGERED SPECIES ACT (ESA) REGULATIONS AND ENFORCEMENT

NMFS and FWS (the Services) are responsible for determining by regulation whether plant and animal species warrant listing ***as threatened or in danger of extinction (endangered) pursuant to*** the Endangered Species Act (ESA). The Services are also responsible for developing appropriate regulations and recovery plans for listed species, consulting on federal actions to help ensure that federal actions are not likely to jeopardize listed species, developing permits for nonfederal "take"1 of listed species, and enforcing the ESA.

Listing Decisions and Critical Habitat Designations ESA Section 4(a)

The Services are responsible for using the best scientific information available to determine whether, based on a number of factors, a species is threatened or endangered.

If a species is added to the endangered and threatened species list, the Services are also responsible for designating critical habitat for the species.

Rulemaking ESA Section 4(d)

Whenever any species is listed as threatened, the Services are responsible for issuing regulations necessary and advisable to provide for the conservation of the species; the Services may, by regulation, prohibit any act so designated under section 9(a)**.**

NMFS has promulgated 4(d) rules for Snake River spring/summer chinook and Snake River fall chinook. These rules prohibit "take" generally, except for take authorized through incidental or direct take permits. NMFS has not yet promulgated 4(d) rules for the following Columbia Basin ESUs: Snake River Basin, Lower Columbia River, Upper Willamette River and Middle Columbia River steelhead; Columbia River chum; Lower Columbia River chinook; and Upper Willamette River chinook.

In accord with a litigation settlement, NMFS is due to issue proposed 4(d) rules for seven threatened steelhead ESUs in the Northwest and Southwest regions (including the Columbia Basin steelhead ESUs above) no later than December 15, 1999, and to take final action on those proposals no later than June 19, 2000. Publication in the *Federal Register* would follow a few days after issuance in each case. NMFS intends to propose 4(d) rules for the seven other threatened salmonid ESUs in the Northwest region on the same general schedule.

These 4(d) rules may be expected to impose ESA section 9 take prohibitions generally to protect the ESUs. The rules may also identify specific limits on the application of take prohibitions for

1 "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any listed species.

state local or tribal programs that provide a level of protections and/or conservation benefits for the threatened species that makes imposition of federal take prohibitions unnecessary.

Recovery Planning ESA Section 4(f)

The Services are responsible for developing and implementing recovery plans, however they may procure the help of public and private agencies and institutions and other qualified persons. Recovery plans should include the following: a description of such site-specific management actions as may be necessary to achieve the plan's goal for conservation and survival of the species; objective, measurable criteria that, when met, would result in a determination that the species be removed from the endangered species list; and estimates of the time to required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

Enforcement ESA Section 9

The Services enforce the ESA's prohibition against "take" of any listed species. It is illegal to "take" any listed species, unless exempted pursuant to a 4(d) rule, a section 7 incidental take statement (for federal agencies) or a section 10 incidental take permit (for nonfederal entities). As noted on the preceding page, "take" is defined as to harass, harm pursue, hunt, shoot, wound, kill, trap, capture, or collect any listed species. Harm may include significant habitat modification where it actually kills or injures a listed species through impairment of essential behavior (e.g., nesting or reproduction).

ALL FEDERAL AGENCIES RESPONSIBILITIES

Proactive Conservation ESA Section 7(a)(1)

All federal agencies are responsible, in consultation with the Services, for using their authorities and carrying out programs for the conservation of endangered and threatened species.

Consultation ESA Section 7(a)(2)

All federal agencies are responsible for consulting with the Services on any action that may affect listed species. Section 7 consultation insures that any action authorized, funded, or carried out by federal agencies is not likely to jeopardize the continued existence of threatened or endangered species or result in the adverse modification of habitat designated by the Services to be critical to the species. When the Services are "action agencies," they are also required to go through section 7 consultation on the effects of their action.

The Services conduct several forms of these "consultations," including early consultation, informal consultation, and formal consultation. Formal consultations are often accompanied by a permit for incidental "take" of listed species. The Services cover literally hundreds of federal actions each year in the Columbia Basin with section 7 consultations. These consultations cover all federal actions in the four Hs (hatcheries, harvest, habitat, and hydro).

NONFEDERAL RESPONSIBILITIES

All entities are responsible for avoiding illegal take of listed species, as prohibited by section 9 of the ESA. The Services will issue incidental take permits under section 10(a)(1)(b) of the ESA to nonfederal people, agencies, or other entities whose actions may result in a take (see Section 9 enforcement) of listed species that is incidental to an otherwise lawful activity. A Habitat Conservation Plan (HCP) must accompany any application for an incidental take permit. The purpose of the HCP associated with the permit is to ensure that there is adequate minimizing and avoiding of the effects of authorized incidental take.

The Services offer a "no surprises" policy to entities securing incidental take permits. This policy provides that if unforeseen circumstances arise, the Services will not require commitment of additional land, water or other natural resources beyond the level already agreed to in the HCP.

Table A.1, following, describes the HCPs completed or underway in the Columbia Basin.

Table A.1: Northwest Region, NOAA-Fisheries, Washington State Habitat Branch Office HABITAT CONSERVATION PLAN LOG - September 30, 1999: HCPs completed and in development in the Columbia River Basin

APPLICANT	STATE	STATUS	CONTRIBUTION
Champion Pacific Timberlands - Klickitat (eastside)	WA	Preparing draft EA and HCP for public review. Many riparian areas have varying levels of trees damaged by spruce budworm, which infests Doug-fir and grand fir, but not Ponderosa pine or red cedar or hardwoods.	Multi-species HCP on 30,000-acre in-holding on Yakama Nation Reservation. No known anadromous fish use, but resident salmonids are present in the few perennial streams. Most streams only flow seasonally.
Department of Natural resources East of the Cascades as part of the HCP approved Jan '97.	WA	No riparian conservation or coverage for listed fish. Only addresses spotted owls, bald eagle, peregrine falcon, gray wolf, grizzly bear, Columbian white-tailed deer, Aleutian Canada goose, and Oregon silverspot butterfly.	Multi-species HCP with wildlife but **not riparian** strategies on 228,000 acres in eastern WA. State Watershed Analyses continuing but not scheduled.
Mid-Columbia PUDs (Public Utility Districts)	WA	Negotiations completed on mainstem, hatchery, and habitat mitigation. Two PUDs, State, tribes, and federal agencies are jointly involved in plan development. NMFS staff now working on §7 consultations to cover ongoing operations until HCPs are completed.	Aquatic conservation plan for five hydro projects covering 105 river miles on the mainstem of Mid-Columbia River. Highest fish passage survival sought through each project. For unavoidable losses, development of tributary & hatchery mitigation measures.
Plum Creek Timber-I 90 Cascades	WA	Post-issuance monitoring phase. Implementation issues will be addressed as the applicant is ready. Permit amendment in process to include steelhead and chinook. Concluding National Environmental Policy Act (NEPA) on the land exchange with National Forests.	Multi-species HCP with owl NRF and dispersal habitat across the 170,000-acre plan area. Riparian protection & management in addition to Department of Natural Resources watershed analyses being done for entire area by 2001.
Plum Creek Native Fish	MT, ID, WA	Late HCP development.	Native fish species in mostly Montana, and Idaho.

APPLICANT	STATE	STATUS	CONTRIBUTION
Potlatch Corporation	ID	Preliminary discussion stage for one species CCA. Applicant has concerns for HCP re: onerous conservation and NEPA -EIS vs EA.	Aquatic species Candidate Consv Agrmnt for westslope cutthroat for 670,000 acres in eastern ID. Services would like to include bull trout, steelhead & chinook.
WA Dept Fish & Wildlife (WDFW)	WA	Early development stage. A Memorandum of Agreement is expected to be signed by November. Technical work groups have been established that represent WDFW and Washington Department of Ecology	Statewide HCP and general permit for the state's Hydraulic Permit (HPA) program.
Yakama Nation	WA	Mid - development stage of Land Management Plan (LMP). NEPA outline done.	Multi-species LMP across 1 million acres of forest & range lands.
HCPs on the horizon			
Foster Creek Conservation District, & perhaps Douglas Co. Consv. Dist.	WA	Seeking funds from WA Salmon Recovery Team	
Broughton Ranch	WA	32,000 ac. ranch in Columbia Co.	
State of WA (Governor's Office)	WA	Forest & Fish Report, legislation passed 6/99.	Statewide changes in Forest Practices regulated by DNR to become compliant for ESA fish.

The first step to an integrated plan is to identify and describe those actions currently being taken by different agencies to affect actions that contribute to recovery of fish and wildlife of interest and their critical habitats. This Section next contains the necessary information on existing programs and authorities.

BONNEVILLE POWER ADMINISTRATION (BONNEVILLE)

GENERAL AUTHORITY

Bonneville markets hydroelectric power generated by the federal hydroelectric facilities on the Columbia River and tributaries. These hydroelectric facilities are commonly referred to as the Federal Columbia River Power System (FCRPS). The following Acts authorize Bonneville to market this power: the Bonneville Project Act of 1937, the Regional Preference Act of 1964, the Transmission System Act of 1974, and the Northwest Power Act of 1980.

SECTION 4(H) OF PUBLIC LAW 96-501 AS AMENDED (REGIONAL POWER ACT)

Under section 4 of the Northwest Power Act, Bonneville is also required to protect, mitigate and enhance the fish and wildlife affected by the development and operation of the federal hydropower projects on the Columbia River and its tributaries so as to provide treatment for fish and wildlife that is equitable with other project purposes. Bonneville must take into account, to the extent fully practicable, the Fish and Wildlife Program (FWP) that the NPPC adopts and recommends to Bonneville.

These NPPC-adopted Fish and Wildlife actions are recommended by tribal, state, and federal fish and wildlife resources agencies, local governments, universities, watershed councils, and individuals.

Any costs incurred at federal facilities are apportioned by project purposes. Bonneville is responsible for (1) those allocated to the power purpose of the projects, and (2) costs associated with mitigating for the fish and wildlife effects associated with constructing and operating the FCRPS.

Bonneville's Fish and Wildlife Program includes the following:

1) implementation of the NPPC's Fish and Wildlife Program;
2) repayment to the Federal Treasury of the power share of both capital and operation and maintenance costs appropriated by Congress for fish and wildlife mitigation actions undertaken by the Bureau of Reclamation (USBR) and the Corps as part of their construction mitigation responsibilities, and;
3) the cost of purchasing replacement power and the lost revenue impact of operation of the FCRPS to implement the Biological Opinions and the NPPC's Fish and Wildlife Program.

The **Bonneville** Fish and Wildlife Budget Memorandum of Agreement (MOA), signed September 1996 and expiring September 30, 2001, sets the annual budget of these programs (exclusive of operational impacts) at $252 million.

The budget for the **NPPC** Program (about $127 million annually) is divided into three general categories: resident fish and wildlife projects are each allocated about 15 percent of the annual

budget; anadromous fish projects receive approximately 70 percent of that budget; and about 15 percent (or about $18 million) is allocated for anadromous fish habitat work.

Projects funded by this program address the entire array of possible mitigation actions. For example, Bonneville funds the following:

- research projects, marking and tagging projects, monitoring and evaluation projects, and projects that develop new technology useful for monitoring and evaluation.
- a wide array of habitat improvement projects, including screening water diversions, replacing temporary irrigation dams with alternative fish friendly structures, fencing projects, water development projects, vegetative plantings and plant control, and environmental monitoring and evaluation projects.
- land and water acquisitions, conservation easements, mainstem passage improvements, predator control actions, facilities' construction and operations and maintenance (O&M) actions, and watershed coordination.

Scale: Throughout the basin.

Limiting Factors: The lack of a clearly defined program of integrated actions designed to provide measurable benefits and restore salmon and their critical habitat to a normative level.

BUREAU OF RECLAMATION (USBR)

The USBR has no Columbia basin-wide programs and no generic authority to implement programs or actions on non-USBR-owned lands or facilities. The following programs were individually authorized by the Congress. They have elements that can be expected to yield tributary habitat improvements. Any additional programs would require specific authorization.

YAKIMA RIVER BASIN WATER ENHANCEMENT PROJECT, WASHINGTON

This project was authorized as Title XII of the Yavapai-Prescott Indian Tribe Water Rights Settlement Act of 1994, P.L. 103-434, and October 31, 1994.

Discrete sections of the title authorize the development of a Yakima River basin conservation program, including the following:

- the development of water conservation plans, feasibility study of water conservation measures, implementation of those measures, and post implementation monitoring and evaluation;
- improvements to the Wapato Irrigation Project including irrigation demonstration projects; and
- a water supply enhancement program for fish and wildlife and irrigation in Yakima basin tributaries.

Other sections include electrification of Chandler Pumping Plant; augmentation of Kachess Reservoir stored water, and modifications to Cle Elum Dam and Reservoir. All these actions have aspects that could benefit resident and anadromous fish.

The basin conservation program has two main purposes: to improve management of the Yakima River water supply and (thus) to improve streamflow conditions in the Yakima River basin. The program addresses three major elements: instream spawning and rearing habitat, tributary corridor migration, and water temperature issues. These elements are to be implemented based on the completion of feasibility studies, National Environmental Policy Act (NEPA) and permitting requirements, and public involvement requirements. The elements are subject to the availability of appropriated and cost-share funds. Project cooperators include the Yakama Nation, state of Washington, irrigation districts, and local governments. A savings and contingencies section affirms the water rights, treaty rights, and jurisdictions of the United States, the Yakama Nation, state and local agencies, and other public or private entities.

Scale: Includes the drainage basin of the Yakima River in Washington.

Limiting Factors: Each section of the Act contains defined authorized actions and appropriations ceiling. Overall, this multi-year project is authorized for federal appropriations in excess of $175 million. Various levels of state and local cost-share are required, depending upon the authorized action. Actions are phased in, with early action items already yielding habitat improvement benefits.

UMATILLA BASIN PROJECT, OREGON

This project was authorized by the Umatilla Basin Project Act of 1988, P.L. 105-557, Title II, to improve instream habitat for anadromous fish resources in the Umatilla River basin in Oregon.

Facilities that exchange water with the Columbia River are to be constructed in order to preserve Umatilla River flows for migrating, spawning, and rearing salmon and steelhead; water conservation measures; fish passage and protective facilities; and operational considerations. The project was authorized for appropriations of $42.4 million. Project construction is now essentially completed, and monitoring of project accomplishments is underway.

USBR, in partnership with the Confederated Tribes of the Umatilla Indian Reservation, local water districts, and public interest groups, has initiated a feasibility study of Phase III, an additional phase of instream improvements, including a final increment of water exchange features.

Scale: Feasibility study authority is limited to the Umatilla River basin of Oregon.

Limiting Factors: Implementation of Phase III is contingent upon completion of a feasibility report/environmental impact statement (EIS) and Congressional authorization and appropriations. The feasibility report/EIS is scheduled for completion in FY 2002. It is unlikely that implementation of a recommended plan could begin before FY 2004.

TECHNICAL ASSISTANCE TO STATES AND TRIBES

Using general investigation authorities of the Reclamation Act of 1902, USBR provides technical assistance to states and Indian tribes.

In recent years, most of the USBR's Pacific Northwest technical assistance program has focused on providing hydrological modeling assistance, civil engineering, and design assistance for watershed and stream enhancement programs for fish and wildlife resources and water quality. Assistance includes hydrologic modeling to assess opportunities to increase instream flows for aquatic species, and design services to modify or eliminate instream migration blockages for anadromous and resident species. Requests for technical assistance were provided in the Grande Ronde, John Day, Walla Walla, Yakima, and coastal basins in Washington; several west-slope streams in Montana; and several coastal rivers basins in Oregon and in the Salmon River basin in Idaho.

Scale: USBR's technical assistance program is available in the 17 Western contiguous states.

Limiting Factors: The program is limited to providing investigation and design services to state entities or Indian tribes. The assistance is provided for activities that the state or tribe have requested and for projects for which they are the lead entity. The program is limited by appropriations restrictions. In FY 1999, Congress appropriated $140,000 for the Pacific Northwest Region (Oregon, Washington, Idaho, and western Montana). Continued funding of this program at that level is controversial.

WETLANDS DEVELOPMENT

Section 28 of the Reclamation Projects Authorization and Adjustment Act of 1992 (P.L. 102-575) authorized USBR to develop fish and wildlife enhancement projects, including wetland developments, at authorized Reclamation Projects.

Wetlands have been developed to support water quality improvements and enhance habitat for ESA resident and anadromous species in the Pacific Northwest. FY 1999 appropriations for this construction program totaled $738,000. The Reclamation projects in the Columbia River drainage basin include the following: the Columbia Basin Project, Washington; Umatilla Basin Project, Crooked River Project, Deschutes Project, and Tualatin Project, Oregon; Hungry Horse Project, Montana; and Minidoka Project and Boise Project, Idaho.

Scale: Reclamation's wetland development program is available on USBR-owned lands in the contiguous 17 Western states.

Limiting Factors: Authority for this program is limited to those lands owned by USBR that were acquired or withdrawn as part of the development of an authorized Reclamation Project. The authorization requires 50-percent cost-share from nonfederal partners. The location of programs and availability of funds is variable from year-to-year and is highly dependent upon physical opportunities for wetland development, availability of cost-share partners, and annual federal appropriations. Prospects for increased funding of this program are not promising.

U.S. ARMY CORPS OF ENGINEERS (CORPS)

GENERAL INVESTIGATION STUDIES FOR ENVIRONMENTAL RESTORATION: SECTION 306 OF THE WATER RESOURCE DEVELOPMENT ACT (WRDA) OF 1990

Section 306 of WRDA 1990 includes environmental protection as one of the primary missions of the Corps. As such, the Corps may undertake studies and build projects for environmental restoration and for water and related land resources problems and opportunities in response to congressional directives (authorizations). These authorizations are contained in public laws, and in resolutions of either the House Transportation and Infrastructure Committee or the Senate Environment and Public Works Committee. The studies aim to determine whether to recommend a federal project responding to the problems/opportunities, within the general bounds of congressional interest, in authorizing federal participation in water resources development. Section 216 studies, which allow the Corps to look at opportunities for environmental restoration at existing and operating Corps projects, such as navigation and/or flood control projects, are included.

Before any construction, planning studies must be conducted and recommendations approved. The most common studies are conducted in two phases: Reconnaissance and Feasibility, as described below.

Reconnaissance Phase. This phase is fully funded by the Federal Government and is usually completed in less than 12 months. The Phase defines the problems, opportunities, and potential solutions. It also determines, based on costs, the benefits and environmental impacts of the identified potential solutions and a preliminary appraisal of whether the planning should proceed into the Feasibility Phase. This appraisal estimates costs and assesses the support of the local interests for continuing into Feasibility and eventually into construction of the project. The Phase is completed with the signing of the Feasibility Cost-Sharing Agreement (FCSA) by the Corps and the local sponsor. Only then may a Feasibility Study be initiated.

Feasibility Phase. This Phase optimizes the plan or plans to be built; it can take up to 3 years to complete. The Corps and the nonfederal sponsor share Phase costs shared equally. At least 50 percent of the nonfederal share (or 25 percent of the total Phase cost) is to be in cash; the remaining 50 percent may be contributed as in-kind products or services. The report recommends for or against federal participation in solutions to the water resource problems and opportunities identified in the study. A recommendation for federal participation is generally a recommendation for construction authorization.

Environmental restoration is defined as the process of rehabilitating and repairing degraded ecosystems. Such projects are intended to "improve the condition of a disturbed ecosystem, including its plant and animal communities, or portions thereof, to some prior ecological condition." Projects are cost-shared on a case-by-case basis, depending upon real estate acquisition; generally, they are 65 percent federal and 35 percent nonfederal. Project examples include the following:

- environmental restoration features included with other Corps Missions (Flood Control, Navigation, etc.),
- wetland creation and management structures,
- fish by-pass facilities,
- water control management facilities,
- fish and wildlife habitat construction, and
- aquatic habitat construction

SECTION 1135 OF THE WRDA OF 1986 (PROJECT MODIFICATIONS FOR IMPROVEMENTS TO THE ENVIRONMENT)

Section 1135 of the WRDA 1986, as amended, provides authority for the Corps to restore degraded ecosystems.

If the construction or operation of a Corps project has contributed to the degradation of the environment, measures for restoration may be undertaken at the project site. Restoration may be achieved through modifications of or operation of the structure. Measures at other locations affected by the construction or operation of the project can be undertaken, if such measures do not conflict with the authorized project purposes.

A prospective local sponsor must initiate a request for an environmental improvement project under Section 1135 of the WRDA. A local sponsoring agency must provide formal assurance of local cooperation through a Project Cooperation Agreement (PCA). The sponsoring agency must normally agree to the following:

a. Provide without cost to the United States all lands, easements, rights-of-way, relocations, and disposal areas (LERRDs) necessary for the construction and subsequent maintenance of the project.

b. Maintain and operate the project after completion without cost to the United States.

c. Contribute 25 percent of the total project implementation cost as cash, work-in-kind, or LERRDs. Post-feasibility-phase design (including plans and specifications, provision of materials, and project construction) are items eligible for work-in-kind as part of the nonfederal sponsor's share. Up to 80 percent of the sponsor's cost share may be credited as work-in-kind. Contributions such as volunteer labor can also be accepted to reduce total project costs.

d. Assume responsibility for all costs in excess of federal cost limitation of $5 million.

ENVIRONMENTAL RESTORATION PROJECTS IN CONNECTION WITH DREDGING (SECTION 204 OF THE WRDA OF 1992)

Section 204 of the WRDA 1992, as amended, provides authority for the Corps to restore, protect, and create aquatic and wetland habitats in connection with construction or maintenance dredging of an authorized project.

If a prospective sponsoring agency requests investigations of an environmental improvement project under Section 204 authority, it can then be initiated. The local agency must provide formal assurance of local cooperation. The sponsoring agency must normally agree to the same four requirements as those listed above for Section 1135 projects.

SECTION 206 "AQUATIC ECOSYSTEM RESTORATION" (SECTION 206 OF THE WRDA OF 1996)

Section 206 of the WRDA 1996, as amended, provides authority for the Corps to construct aquatic ecosystem restoration and protection projects. Such projects will usually include manipulation of the hydrology in and along bodies of water, including wetlands and riparian areas. A project is adopted for construction only after conducting a detailed investigation. That investigation must determine that (1) the project will improve the quality of the environment, (2) is in the best interest of the public, and (3) clearly shows the engineering feasibility and economic justification of the improvement. Each project is limited to a federal cost share of not more than $5 million. The federal limitation includes all project-related costs for feasibility studies, planning, engineering, construction, and supervision and administration.

a. As with Section 1135 and Section 204 projects, action can be initiated upon receipt of a request from a prospective sponsoring agency. A local sponsoring agency must provide formal assurance of local cooperation. The same four requirements as those listed under Section 1135 also apply here, with this exception: Contribute 35 percent of the total project implementation cost as cash, work-in-kind, or LERRDs. Post-feasibility-phase design, including plans and specifications, provision of materials, and project construction, are items eligible for work-in-kind as part of the nonfederal sponsor's share. The entire nonfederal share of the total project cost may be credited as work-in-kind.

b. If the value of the sponsor's contribution above does not equal or exceed 35 percent of the project cost, provide cash contribution to make the sponsor's total contribution equal to 35 percent.

FLOODPLAIN MANAGEMENT SERVICES

The program's authority is provided by Section 206 of the Flood Control Act of 1960, as amended. Its objective is to foster public understanding and the options in dealing with flood hazards. It also promotes prudent use and management of the Nation's floodplains.

Land use adjustments, based on proper planning and the employment of techniques for reducing flood damages, provide a rational way to balance the advantages and disadvantages of human settlement on floodplains. These adjustments are the key to sound floodplain management. The

Flood Plain Management Services (FPMS) Program provides the full range of technical services and planning guidance needed to support effective floodplain management.

The program develops or interprets site-specific data on obstructions to flood flows, flood formation and timing; flood depths or stages; floodwater velocities; and the extent, duration, and frequency of flooding. It also provides information on natural and cultural floodplain resources before and after the use of flood plain management measures.

The program provides assistance and guidance in the form of "Special Studies" on all aspects of floodplain management planning. These studies can include the possible impacts of off-floodplain land use changes on the physical, socioeconomic and environmental conditions of the flood plain. They can range from helping a community identify present or future floodplain areas and related problems, to a broad assessment of the various remedial measures that may be effectively used.

Some of the most common types of Special Studies include the following:

- Flood Plain Delineation/Flood Hazard Evaluation Studies,
- Dam Break Analysis Studies,
- Hurricane Evacuation Studies,
- Flood Warning/Preparedness Studies,
- Regulatory Floodway Studies,
- Comprehensive Flood Plain Management Studies,
- Urbanization Impact Studies, and
- Stormwater Management Studies.

The program also provides guidance and assistance for meeting standards of the National Flood Insurance Program and for conducting workshops and seminars on nonstructural floodplain management measures, such as Flood Proofing.

Upon request, program services are provided to state, regional, and local governments, Indian tribes, and other nonfederal public agencies without charge.

Program services are also offered to non-water-resource federal agencies and to the private sector on a 100-percent cost recovery basis. For most of these requests, payment is required before services are provided. A schedule of charges is used to recover the cost of services taking up to one day to provide. Letter requests or signed agreements are used to charge for those that take longer.

All requesters are encouraged to furnish available field survey data, maps, historical flood information, and the like to help reduce the cost of services.

PLANNING ASSISTANCE TO STATES

Section 22 of the WRDA of 1974, as amended, provides certain authority to the Corps to assist states, local governments and other nonfederal entities in preparing comprehensive plans for the development, use, and conservation of water and related land resources. Section 208 of WRDA 1992 amended the WRDA of 1974 to include Native American tribes as equivalent to a state.

Congress annually funds the Planning Assistance to States (PAS) Program federal allotments for each state or tribe from the nationwide appropriation are limited to $500,000 annually, but typically are much less. Individual studies, of which there may be more than one per state or tribe per year, generally cost $25,000 to $100,000. These studies are cost shared on a 50-percent federal, 50-percent nonfederal basis.

The individual state or tribe determines the needed planning assistance. Each state and Indian tribe can provide the Corps an annual request for studies under the program; the Corps then accommodates as many studies as possible within the funding allotment. Typical studies are only planning level of detail; they do not include detailed design for project construction. The studies generally involve the analysis of existing data for planning purposes, using standard engineering techniques, although some data collection is often necessary. Most studies become the basis for state or tribal and local planning decisions.

The program can encompass many types of studies dealing with water resources issues. Types of studies conducted in recent years under the program include the following:

Water Supply and Demand Studies
Environmental Conservation Studies
Wetland Evaluation Studies
Flood Damage Reduction Studies
Land Use Studies.
Water Quality Studies
Environmental Restoration Studies
Dam Safety/Failure Studies
Flood Plain Management

ENVIRONMENTAL PROTECTION AGENCY (EPA)

WATER QUALITY STANDARDS PROGRAM

States are required to conduct a review of selected portions of their state standards every three years. Tribes can apply for "treatment as a state" and promulgate their own water quality standards, or the EPA can promulgate standards for the tribes. The review of existing or proposed water quality standards packages, which is coordinated with EPA, is now subject to consultation by NMFS and FWS. The continued involvement of NMFS and FWS in the water quality standards review process is critical, since water quality standards form the basis of all Clean Water Act (CWA) programs.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PROGRAM (NPDES)

The NPDES permit program was established to govern water pollution from "end of pipe" industrial and municipal sources. Under section 402 of the Clean Water Act, EPA has the authority to establish effluent limitation standards, which are used to establish effluent limitation standards and to establish permit terms for specific pollutants. Under a watershed approach, permit limits under the NPDES program can be designed to support salmonid recovery.

TOTAL MAXIMUM DAILY LOAD (TMDL) PROGRAM

The CWA requires that, every two years, all states identify and list waters that do not meet water quality standards or designated beneficial uses. For each of these waters, a TMDL is prepared to identify how much pollutant loading must be reduced to achieve water quality standards and protect aquatic life. Court decision or settlements have generally determined the pace at which each state will develop and implement TMDLS. Currently, each state establishes a priority list for TMDL development; although it is not required to consider ESA listings, they often contribute to assigning a higher priority to a given water. The most recently approved 303(d) lists included 1,067 waters in Oregon, 666 in Washington, and 962 in Idaho.

Currently, regulatory provisions do not require an implementation plan to be part of TMDLs. The new Section 303(d) regulations, currently under review, propose that each TMDL be accompanied by an implementation plan that identifies how the pollutant load reductions will be achieved. The new regulations also propose an increased emphasis on protecting threatened and endangered (T&E) species in TMDL development and implementation, and on T&E needs (e.g., habitat) as a rationale for listing a waterbody as impaired. The strengthening of the TMDL regulations should make a significant difference in EPA's and the states' abilities to implement this program and in NMFS' and the FWS' contribution to the TMDL development and implementation process. This means that federal and state agencies, tribes, and local governments can all work together on TMDL development and implementation.

Some TMDLs are based all or in part on non-point source pollution. However, non-point source pollutant control through the use of best management practices is not an exact science: progress must be monitored and evaluated (i.e., adaptive management applied) to determine whether or

not water quality standards are attained over time. This approach could mean using a "phased TMDL" in which the TMDL is implemented, monitored for a specified period of time, and then adjusted as necessary to meet water quality standards. Finally, NPDES point source permits, depending on their location and the pollutants limits being set in the permit, can serve as the TMDL for a waterbody segment.

HABITAT CONSERVATION PLANS (HCP)

Under the ESA, HCPs can be developed for private lands to provide enough species protection to eliminate jeopardy decisions. Certainty to landowners under HCP's can be granted for up to 50 years. EPA, FWS, and NMFS are working together to better integrate the TMDL and HCP process to accomplish the common goal of creating healthy conditions for salmonids.

NON-POINT SOURCE (NPS) PROGRAM

Pursuant to section 319 of the CWA, the non-point source program is implemented by the states, with oversight from EPA. The program is designed to award monies and provide technical assistance to the states to implement on-the-ground non-point source control measures. Such projects go through a review process where non-point source projects have and can be further targeted to support TMDL implementation, state-sponsored stream restoration, and watershed council work that contributes to stream restoration at the local level. Funding levels in FY99 are $2.8 million for Oregon, $3.8 million for Washington, and $2.5 million for Idaho.

CLEAN WATER ACTION PLAN (CWAP)

The CWAP is an Administration-initiated effort to emphasize non-point source pollution control in waterbodies across the United States. Carrying out the CWAP includes working on some 111 separate actions implemented by federal and state resource agencies, tribes, and local stakeholders. The CWAP calls for the development of a Unified Federal Policy that will outline how federal agencies will work together to implement the Action Plan.

A significant outcome of the CWAP is the doubling of the CWA section 319 funds available to each state to directly assist with NPS control. To qualify for the additional section 319 funding, each state was required to carry out a unified watershed assessment (UWA) to prioritize restoration activities for the state. The UWA was a multi-agency effort—federal, state, and tribal — that gave high priority to those watersheds with federally listed species and with waters not meeting standards. This UWA priority list should serve as the master list for multiple agencies' restoration activities, but it apparently does not. The list is incorporated into the review process for each state's Section 319 program plan, but does not play a major role in the expenditure of Farm Bill restoration funds or in NMFS restoration decisions.

WETLANDS PROGRAM

Under section 404 of the CWA, this program regulates the dredging or filling of wetlands/waters of the U.S. Permits for the discharge of fill material are issued by the Corps. Permit applicants must meet substantive water protection criteria, as established in the §404(b)(1) guidelines developed by EPA, in conjunction with the Corps. Permits for wetland dredging or filling are

commonly considered on a case-by-case basis. There are also provisions for more comprehensive general permitting where advanced wetland identification and protection efforts are designed within local comprehensive wetland inventory and management plans. Through programmatic consultations with NMFS, the section 404 permitting process could be streamlined and focused toward bank stabilization techniques such as soil bioengineering that would benefit habitat for federally listed species.

NATIONAL ESTUARY PROGRAM

The Lower Columbia River Estuary Program (LCREP) has completed a management plan focused on addressing water quality problems, including physical habitat, identified in the river below Bonneville Dam. A high priority of the management plan involves protecting and restoring aquatic habitat, which will directly benefit salmon and steelhead recovery. The LCREP is now moving from plan development into plan implementation, which will be done under existing authorities and by existing entities, both governmental and non-governmental. Other priorities of implementing the plan will be the initiation of a monitoring program and emphasis on the public education and outreach.

NATIONAL MARINE FISHERIES SERVICE (NMFS)

For information on the agency's responsibilities under the Endangered Species Act, please see the Endangered Species Responsibilities discussion at the beginning of Section A.

THE MITCHELL ACT: IRRIGATION DIVERSION SCREENING PROGRAM

The Mitchell Act (Public Law 75-502, of May 11, 1938; and amended August 8, 1946, Public Law 79-676) authorized NMFS to construct and install devices in the basin to improve feeding and spawning conditions for fish, to protect migratory fish from irrigation projects, and to facilitate free migration of fish over obstructions.

This authorization does not obligate NMFS to construct and install irrigation diversion screens, nor does it relieve operators of irrigation diversions from their responsibility to provide protection for fish trapped by their irrigation diversions. The Mitchell Act does give the NMFS the authority to take immediate action, if funding is available.

Areas of Benefit. The Mitchell Act screening program operates in the basin tributaries above Bonneville Dam. It does not include any mainstem Columbia River diversions or tributaries below Bonneville Dam. It is applied primarily in northeastern Oregon and the Snake River basin in Idaho, as well as other portions of Oregon and Washington. Involvement in Washington has been limited because the state water law that places the requirement for screening on the irrigator is being enforced. However, this limited involvement may change in the future, as new ESA listings increase the pressure to screen unscreened diversions and to bring screens up to current standards.

Time Line. Since 1954, more that $25 million has been allocated to irrigation diversion screening. For the past several years, the annual budget for screening has been approximately $3,400,000. A Report to Congress (March 1995) stated that all major diversions are to be upgraded to current criteria by 2000; all minor diversions, by 2002. Since the available funding ($3,400,000) has been less than the estimated need (approximately $6,000,000 per year), the time line has slipped considerably. The state fisheries agencies are constructing and replacing as many as possible using available funds, but no new estimate for completion has been developed.

ESSENTIAL FISH HABITAT

In 1996, Congress amended the Magnuson-Stevens Fishery Management and Conservation Act (16 U.S.C. 1801 et seq.), declaring that because the continuing loss of marine, estuarine, and other aquatic habitats represented a very serious long-term threat to commercial and recreational fisheries, habitat issues should receive increased attention for the conservation and management of U.S. fishery resources. To address this concern, Congress mandated the identification of all habitats essential to managed fisheries species and implementation of measures to conserve and enhance this habitat by establishing new requirements for "Essential Fish Habitat" (EFH) descriptions in federal fishery management plans (FMPs). (“Essential fish habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” [Magnuson-Stevens Act, §3].)

Consultation

Congress also required consultation with NMFS, as follows:

- Federal agencies must consult with NMFS on all agency actions (undertaking, permitting, or funding activities) that may adversely affect EFH, regardless of location.
- The Magnuson-Stevens Act does not distinguish between actions inside and outside the EFH. Any reasonable attempt to encourage EFH conservation must take into account those actions that occur outside of EFH (e.g., upstream and upslope activities that may have an adverse effect on EFH).
- Section 305(b)(4) of the Magnuson-Stevens Act requires NMFS to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH.
- State agencies and private parties are not required to consult with NMFS unless state or private actions require a federal permit or receive federal funding.

Salmon EFH

For the salmon fishery, EFH means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. To achieve that level of production, EFH must include all those streams, lakes, ponds, wetlands, and other currently viable water bodies, as well as most of the habitat historically accessible to salmon, in Washington, Oregon, Idaho, and California. In the estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore from Washington, Oregon, and California north of Point Conception. (Foreign waters off Canada, while still salmon habitat, are not included in salmon EFH because they are outside U.S. jurisdiction.) The Pacific coast salmon fishery EFH also includes those marine areas off Alaska that the North Pacific Fishery Management Council has designated as salmon EFH.

Freshwater EFH

The geographic extent of freshwater EFH is specifically defined as all currently viable waters and most of the habitat historically accessible to salmon within the United States Geological Survey (USGS) hydrologic units. Salmon EFH excludes areas upstream of longstanding naturally impassable barriers (i.e., natural waterfalls in existence for several hundred years). Salmon EFH includes aquatic areas above all artificial barriers; the exception is the impassible barriers (dams) listed in Table 1-2 of Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (Pacific Fisheries Management Council, 1999). However, activities occurring *above* impassable barriers that are likely to adversely affect EFH *below* impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act.

Requirements

The Act and NMFS EFH regulations (50 CFR 600) require interagency coordination and consultation to further the conservation and enhancement of EFH. Among the requirements of the Act are the following:

- Federal agencies must consult with NMFS regarding any action or proposed action that may adversely affect EFH. The EFH regulations encourage using existing procedures for environmental reviews in order to streamline this process. NMFS has developed or is developing agreements with Federal agencies to use existing environmental mandates such as the Endangered Species Act, the National Environmental Policy Act, the Clean Water Act, the Fish and Wildlife Coordination Act, the Federal Power Act, or the Rivers and Harbor Act to accomplish EFH consultation. In the absence of an existing process, the regulations establish procedures to accomplish the mandated consultations.
- Any Fishery Management Council(s) may comment and make recommendations to NMFS and any Federal agency undertaking actions that may adversely affect the habitat, including EFH, of any fishery resource under its authority; and must comment if the action may adversely affect the habitat of an anadromous fishery resource under its authority.
- After receiving information from a Council or Federal or state agency concerning an action or proposed action that would adversely affect any EFH, NMFS must recommend measures to the Federal or state agency to conserve such habitat.
- Within 30 days of receiving a NMFS EFH recommendation, a Federal agency must respond in writing to NMFS and any Council(s), if appropriate. The response should detail the measures that will be taken to avoid, mitigate, or offset the adverse effects to EFH and explain the reasons for any actions inconsistent with the NMFS EFH recommendations.

References

Pacific Fisheries Management Council. 1999.
Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and recommended Conservation Measures for Salmon. Portland, OR.

NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

CONSERVATION TECHNICAL ASSISTANCE (CTA)

This program is designed to assist land-users, communities, units of state and local government, and other federal agencies in planning and implementing conservation systems. Those systems are intended to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

The NRCS provides assistance to individual land users, communities, conservation districts, and other units of state and local government and federal agencies to meet their goals for resource stewardship and help individuals to comply with state and local requirements. The NRCS Field Office Technical Guide furnishes the basic science and planning standards for the conservation assistance. NRCS assistance to individuals is provided through conservation districts, in accordance with a memorandum of understanding signed by the Secretary of Agriculture, the Governor of the State, and the conservation district. Assistance is provided to land users voluntarily applying conservation and to those who must comply with local or state laws and regulations.

This base program provides NRCS funding for staffing and supporting field offices (generally at the county level).

Scale: Statewide through local and county field offices. Oregon, Washington, and Idaho are also organized into basins or multi-county teams. Possibility to target or increase staffing in high workload offices.

Limiting Factors: Recent agency work load analysis estimated that the three states need two-to-three times their current staff numbers to meet the demands for planning stimulated by the ESA and the CWA.

CONSERVATION RESERVE PROGRAM (CRP)

The CRP reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat and enhances forest and wetland resources. It encourages farmers to convert highly erodable cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. The Farm Services Agency (FSA) administers the CRP, while NRCS provides technical support to farmers and ranchers interested in enrolling in the program.

The CRP includes both the standard program and continuous signup. The **Standard CRP** opens bid periods each year when farmers can offer lands to enroll in the program. The goal is to enroll large blocks on highly erodable land into the program. Continuous signup targets the

environmentally sensitive acreage (needing riparian area protection, filter strips, grassed waterways, shelterbelts and windbreaks). Enrollment can occur anytime.

Total cumulative CRP enrolled acres at this time total 31.3 million acres nation-wide; there are 778,000 enrolled acres in Idaho, 417,000 in Oregon and 1,039,000 in Washington.

Scale: Program applies statewide to agricultural lands that are highly erodable or sensitive. There are few eligible lands in western Oregon and Washington.

Limiting factors: About 31.3 million acres (of a cap of 36.4 million acres) have already been enrolled.

CONSERVATION RESERVE ENHANCEMENT PROGRAM (CREP)

CREP is a state-federal conservation partnership program that targets specific state and nationally significant water quality, soil erosion and wildlife habitat issues related to agricultural use. The FSA administers the CREP, while NRCS provides technical support to farmers and ranchers interested in enrolling in the program. In Washington and Oregon, CREP focuses on restoring riparian vegetation, wetland vegetation adjacent to streams, and rivers that are important to salmon and trout species listed under the ESA. The program uses financial incentives to encourage farmers and ranchers to voluntarily enroll for 10- to 15-year contract periods, to remove lands from agricultural production. This community-based conservation program provides a flexible design of conservation practices and financial incentives to address environmental issues.

Table A.2: Conservation Reserve Enhancement Programs in Oregon and Washington

State	Status	Acres	Total Cost (Millions)	Incentive Rate	Target Area	Environmental Objective
OR	Agreement Signed 10/17/98 Funding must be committed by 12/31/2002	100,000	$250	25% for filterstrips; 35% for riparian buffers; 50% for wetland restoration; Cumulative impact bonus equal to four times base rental rate	Streams providing habitat for endangered salmon and trout statewide	Restoration of salmon habitat through enhancement of riparian areas and wetland restoration.
WA	Agreement signed October 19, 1998. Funding must be committed by 12/31/2002	100,000	$250	50% Plus an additional 10% if designated under State growth management law	Salmon spawning streams statewide	Restore habitat for native anadro-mous fish species using riparian buffer conserva-tion practice.

Scale: Statewide in Oregon, Washington. The state of Idaho is working on a proposal.

Limiting factors: Further limited by the targeted area—salmon spawning habitat in Washington. Stream systems providing habitat for endangered salmon or trout in Oregon. Rental rates may not be economically acceptable in some regions. Landowners want "certainty," but agencies have not yet defined how to provide that certainty.

ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP)

EQIP provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program, funded through the Commodity Credit Corporation, assists farmers and ranchers in complying with federal, state, and tribal environmental laws, and encourages environmental enhancement.

Program purposes are achieved by implementing a conservation plan that includes structural, vegetative, and land management practices on eligible land. Five- to ten-year contracts are made with eligible producers. Cost-share payments may be made to implement one or more eligible structural or vegetative practice, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices (e.g., nutrient management, pest management, and grazing land management).

Fifty percent of the available funding will be targeted at natural resource concerns relating to livestock production. The program is carried out mainly in priority areas (which may be watersheds, regions, or multi-state areas) and for significant statewide natural resource concerns that are outside of geographic priority area.

Scale: Statewide; but 70 percent of the funding is allocated to Geographic Priority Areas that are local, watershed-scale initiatives.

Limiting factors: Local requests for funding exceed available dollars by 100-150 percent.

SOIL SURVEY PROGRAMS

The National Cooperative Soil Survey Program (NCSS) is a partnership (led by NRCS of federal land management agencies), state agricultural experiment stations, and state and local units of government. This partnership provides soil survey information necessary for understanding, managing, conserving, and sustaining the nation's limited soil resources.

Scale: Statewide. Status maps for each state can be obtained showing those areas with soil surveys completed, no soil surveys and surveys in progress.

Limitation: Staffing and budget. Many soils surveys are outdated and need to be modernized and made available via Geographic Information Systems (GIS).

SNOW SURVEY AND WATER SUPPLY FORECASTS

This program aims to provide western states and Alaska with information on future water supplies. NRCS field staff collect and analyze data on depth and water equivalent of the snowpack at more than 1,200 mountain sites, and estimate annual water availability, spring runoff, and summer streamflows. Individuals, organizations, and state and federal agencies use these forecasts for decisions relating to agricultural production, fish and wildlife management, municipal and industrial water supply, urban development, flood control, recreation power generation, and water quality management. The National Weather Service includes the forecasts in their river forecasting function.

Scale: Monitoring sites are adequate for predicting snow melt for stream flow in most areas.

WATERSHED SURVEYS AND PLANNING

The Watershed and Flood Prevention Act, P.L. 83-566, August 4, 1954, (16 U.S.C. 1001-1008) authorized this program. Before FY 1996, small watershed planning activities and the cooperative river basin surveys and investigations authorized by Section 6 of the Act were operated as separate programs. The 1996 appropriations act combined the activities into a single program entitled the Watershed Surveys and Planning Program. Activities under both programs are continuing under this authority.

The program acts to help federal, state, and local agencies and tribal governments to protect watersheds against damage caused by erosion, floodwater, and sediments, and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries.

Types of surveys and plans include watershed plans, river basin surveys and studies, flood hazard analyses, and floodplain management assistance. These plans focus on identifying solutions that use land treatment and nonstructural measures to solve resource problems.

The Small Watershed Program works through local government sponsors. It helps participants solve natural resource and related economic problems on a watershed basis. Projects include watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres. Both technical and financial assistance is available.

Scale: Program initiated by requests from local sponsors. Program limited to watershed 250,000 acres or less in size.

Limiting Factors: Funding for planning and implementation has been significantly reduced over the last 10 to 15 years. Significant backlog in planned projects awaiting implementation funds nationally. Because of the program's de-emphasis, few NRCS staffs have maintained watershed-planning personnel.

RESOURCE CONSERVATION & DEVELOPMENT PROGRAM (RC&D)

The RC&D Program aims to accelerate the conservation, development, and use of natural resources. The program is also expected to improve the general level of economic activity and to enhance the environment and standard of living in authorized RC&D areas. It improves the capability of state, tribal, and local units of government and local nonprofit organizations in rural areas to plan, develop, and carry out programs for resource conservation and development. The program also establishes or improves coordination systems in rural areas.

Current program objectives focus on improving of the quality of life achieved through natural resources conservation and community development that leads to sustainable communities, prudent use (development), and the management and conservation of natural resources. The Secretary of Agriculture designates authorized, locally sponsored RC&D areas for RC&D technical and financial assistance program funds. NRCS can provide grants for land conservation, water management, community development, and environmental needs in authorized RC&D areas.

Scale: Much of Oregon, Washington and Idaho lie within an organized RC&D area, see Figure A.1, page 34.

STEWARDSHIP INCENTIVES PROGRAM (SIP)

The Stewardship Incentive Program provides technical and financial assistance. It is designed to encourage non-industrial private forest landowners to keep their lands and natural resources productive and healthy. Qualifying land may be owned by a private individual, group, association, corporation, Indian tribe or other legal private entity; it includes rural lands with existing tree cover or land suitable for growing trees. Eligible landowners must have an approved Forest Stewardship Plan and own 1,000 or fewer acres of qualifying land. Authorizations may be obtained for exceptions of up to 5,000 acres.

Scale: Statewide.

Limiting Factors: Funding.

FORESTRY INCENTIVES PROGRAM (FIP)

The Forestry Incentives Program (FIP) supports good forest management practices on privately owned, non-industrial forestlands nationwide. The FIP is designed to benefit the environment, while meeting future demands for wood products. Eligible practices are tree planting, timber stand improvement, site preparation for natural regeneration, and other related activities. FIP is available in counties designated by a USFS survey of eligible private timber acreage.

Scale: Statewide.

Limiting Factors: Funding.

WETLANDS RESERVE PROGRAM (WRP)

The WRP is a voluntary program to restore wetlands. Participating landowners can establish conservation easements of either permanent or 30-year duration, or can enter restoration cost-share agreements where no easement is involved. In exchange for establishing a permanent easement, the landowner receives payment up to the agricultural value of the land, and 100 percent of the restoration costs for restoring the wetlands. The 30-year easement payment is 75 percent of what would be provided for a permanent easement on the same site and 75 percent of the restoration cost. The voluntary agreements are for a minimum 10-year duration and provide for 75 percent of the cost of restoring the involved wetlands. Easements and restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the easement or agreement. In all instances, landowners continue to control access to their land.

Scale: Statewide on agricultural lands.

Limiting Factors: Funding.

WILDLIFE HABITAT INCENTIVES PROGRAM (WHIP)

This Program provides financial incentives to develop habitat for fish and wildlife on private lands. Participants agree to implement a wildlife habitat development plan. The U.S. Department of Agriculture (USDA) agrees to provide cost-share assistance for the initial implementation of wildlife habitat development practices. The USDA and program participants enter into a cost-share agreement that generally lasts at least 10 years. Oregon, Washington, and Idaho WHIP programs have both riparian and upland components.

Scale: Statewide where criteria apply.

Limiting Factors: Funding.

EMERGENCY WATERSHED PROTECTION (EWP)

The EWP program helps protect lives and property threatened by natural disasters such as floods, hurricanes, tornadoes, and wildfires. The USDA's NRCS administers the program, providing technical and financial assistance to preserve life and property threatened by excessive erosion and flooding.

EWP provides funding to project sponsors for such work as clearing debris from clogged waterways, restoring vegetation, and stabilizing riverbanks. Measures taken must be environmentally and economically sound, and must generally benefit more than one property owner. NRCS provides up to 75 percent of funds that are needed to restore the natural function of a watershed. The community or local sponsor of the work pays the remaining 25 percent, which can be provided by cash or in-kind services.

A new option on agricultural land, authorized in the 1996 Farm Bill, gives producers the opportunity to offer their land for a floodplain easement. To be eligible, flooding must have

damaged the land to the extent that the cost of restoring it and associated structures would be greater than the value of the land after restoration. The easements provide permanent restoration of the natural floodplain hydrology as an alternative to traditional attempts to restore damaged levees, lands, and structures. The easement lands would be ineligible for future federal disaster assistance.

Scale: Applies only to areas that experienced a natural disaster.

NATIONAL RESOURCES INVENTORY (NRI)

Every 5 years, the NRCS conducts this comprehensive inventory assessment of the use, treatment, condition, and trend of natural resources on nonfederal lands. The NRI provides a statistically accurate overview of the condition of natural resources and use of nonfederal lands in Oregon. This information helps Oregonians in the public and private sector make environmental and land-use decisions—including protecting land from erosion, slowing the rate of wetland loss, enhancing wildlife habitat, and protecting prime farmland.

Scale: Statistically relevant to county level; questionable at the 4-digit hydrologic unit code (HUC).

Limiting Factors: Conducted once every 5 years.

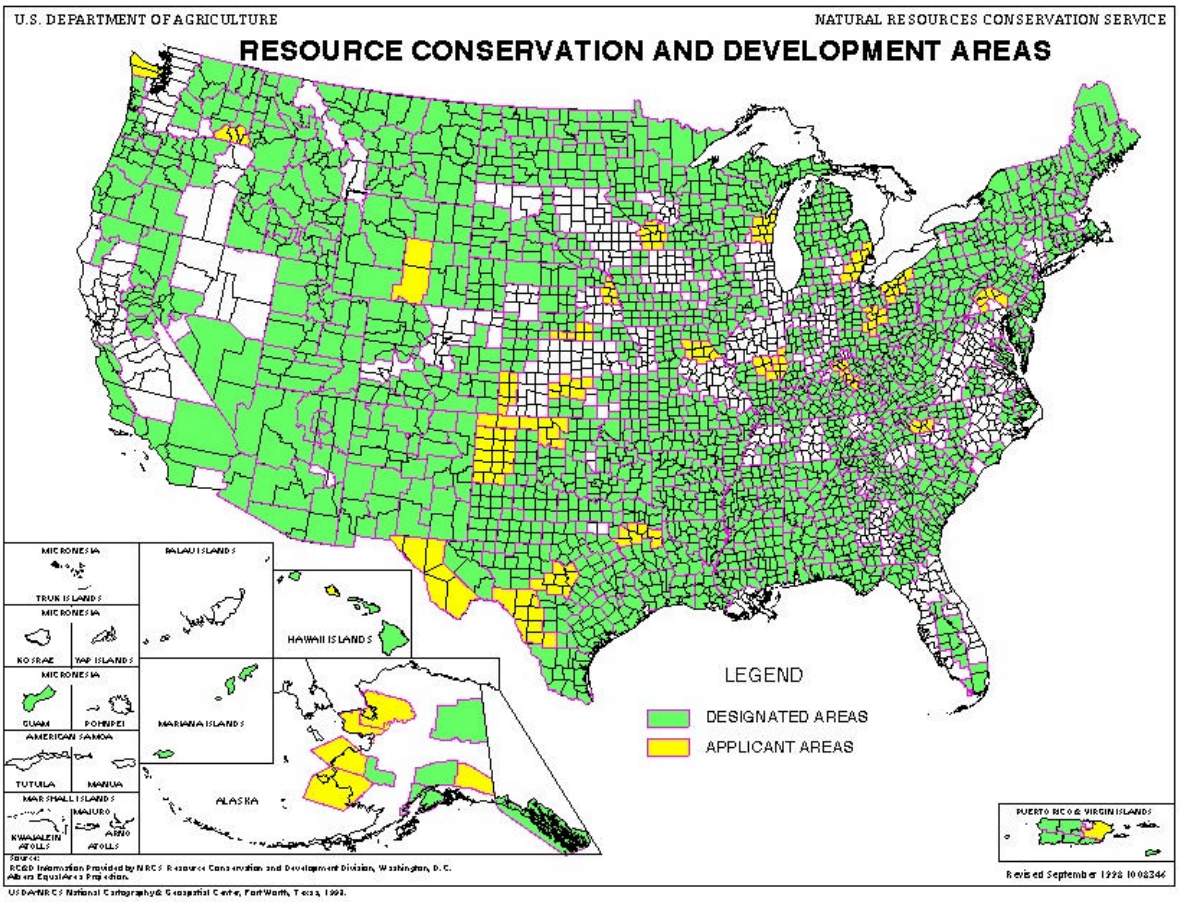
PLANT MATERIALS PROGRAM (PMP)

NRCS works cooperatively with individuals, NRCS field offices, Conservation Districts, tribes, universities, and state and federal agencies to assemble, test, and release plan materials to help solve natural resource problems; determine techniques for their successful use; provide for their commercial increase; and promote the use of plant materials needed to meet objectives and priorities of the conservation program (e.g., the development of species for riparian recovery and other habitats).

Scale: Individual site application level.

Limiting Factors: Funding.

Figure A.1: Resource Conservation and Development Areas



U.S. FISH AND WILDLIFE SERVICE (FWS)

For information on the agency's responsibilities under the Endangered Species Act, please see the Endangered Species Responsibilities discussion at the beginning of Section A.

PARTNERS FOR FISH AND WILDLIFE

Through the Partners for Fish and Wildlife Program, FWS enters into agreements with private landowners to protect and restore fish and wildlife habitat. Approximately $500,000 is available annually for cost-share projects in the basin. Much of the focus is on wetlands and streams in agricultural areas. Projects include the following: fencing wetlands and streams; planting native vegetation; stabilizing stream banks; and creating and enhancing wetlands. Many projects are small-scale ($5,000 - $10,000). Results are measured in miles of streams protected/enhanced and acres of wetlands created/improved/restored. FWS has approximately six full-time staff dedicated to the Partners for Wildlife program in the basin.

Scale: Throughout the basin.

Limiting Factors: Funding and staff are the two principal limiting factors.

U.S. FOREST SERVICE (USFS) AND BUREAU OF LAND MANAGEMENT (BLM)

The Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) manage over 75 million acres of federal lands and over 50 percent of the current spawning and rearing areas in the Columbia River Basin (basin). In general, the public lands containing anadromous fish tend to be located in the upper and mid-elevation portions of watersheds, with private lands occupying the lower valleys. Both agencies manage lands under multiple use and sustained yield mandates to provide for production of commodity and non-commodity goods, while maintaining and restoring ecosystems.

Major laws governing BLM and/or USFS actions include: The National Environmental Policy Act (NEPA), National Forest Management Act (NFMA), Fish and Wildlife Coordination Act (FWCA), Federal Land Policy and Management Act (FLPMA), Oregon and California Lands Acts (O&C), Endangered Species Act (ESA), Coastal Zone Management Act (CZMA), Clean Air Act (CAA), and the Clean Water Act (CWA).

The BLM and USFS have comprehensive aquatic conservation strategies for all lands under their jurisdiction within the basin. Federal lands within the Willamette River Basin are managed under the provisions of the **Northwest Forest Plan,** which set in motion unprecedented actions to protect and restore 25 million acres of federal lands within western Oregon, Washington and Northern California. In February 1995, BLM and the USFS adopted **PACFISH**, which established interim strategies for managing anadromous-fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. PACFISH significantly improved the protection of salmon habitats on federal lands in the interior Columbia River Basin by amending land use plans to establish strict standards for land management activities, including timber, mining, grazing, road building, fire suppression, etc. A comparable aquatic strategy was extended to Bull trout and other native fish species by **INFISH** in June 1995. These three strategies are similar in that they:

- establish watershed and riparian goals to maintain or restore all fish habitat;
- establish aquatic and riparian habitat management objectives;
- delineate riparian management areas;
- provide specific standards and guidelines for management activities in riparian areas;
- either establish or provide mechanisms to delineate a system of key watersheds to protect and restore important fish habitats; and
- provide for watershed analysis, an analytical framework for assessing land management activities in a watershed context.

There are four key elements in the three strategies: Riparian Reserves and Riparian Habitat Conservation Areas, Key Watersheds, and Watershed Analysis and Watershed Restoration.

- **Riparian Reserves (NW Forest Plan) and Riparian Habitat Conservation Areas (PACFISH/INFISH)** are portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and

guidelines. The width of these areas varies, depending on whether they are on fish-bearing, permanently flowing, or intermittent streams; and whether they are designed to maintain ecological function and to protect streams and riparian habitat and water quality.

- Key watersheds currently contain important aquatic habitats for at-risk anadromous fish and Bull trout, and contribute to a network across the landscape that provides for the long-term conservation of these fish species.
- Watershed analysis is a systematic procedure for characterizing watershed and ecosystem processes to meet specific management and social objectives. Analysis findings guide planning and help identify restoration strategies. Watershed analysis provides a process for linking federal and non-federal land coordination and planning.
- Watershed restoration is the direct linkage of activities that contribute to the recovery of fish and improvement of riparian habitat and water quality. Three important elements include control and prevention of road-related runoff and sediment, improvement of riparian vegetation, and improvement of instream habitat.

These key elements help establish the context and process for defining management actions that are consistent with restoring, protecting, and maintaining aquatic habitat. The use of these tools, across whole basins, will assist agencies in developing an appropriate timing and sequencing of management and restoration.

Several biological opinions (BOs) issued by NMFS for listed salmon and steelhead trout and by the FWS for Bull trout have concluded that PACFISH and INFISH avoid jeopardy and conserve recovery options until long-term restoration strategies can be established. In addition, consultations on thousands of specific BLM and USFS land management activities are occurring (either individually or "batched" by watershed) following the Interagency Streamlining Consultation Procedures established by USFS, BLM, FWS and NMFS in May 1995. To comply with the requirement in the BOs mentioned above, and to oversee the streamlining consultation process, the regional executives (FWS, NMFS, BLM OR/WA and ID, and USFS Regions 1, 4, and 6) chartered the Interagency Implementation Team (IIT) in December 1998. The IIT, comprised of senior staff and managers from the above organizations, were charged with oversight responsibilities to implement the commitments made in the BAs and BOs. Based on their semi-annual assessment, the NMFS and FWS are generally satisfied with the progress the BLM and USFS have made to date in implementing the provisions of the BOs.

A long-term aquatic restoration strategy for federal lands is currently being developed by the **Interior Columbia Basin Ecosystem Management Project (ICBEMP)** that will replace the interim PACFISH and INFISH strategies. ICBEMP was initiated in 1993 to address broad ecosystem issues in the basin: decline of salmon and other aquatic species, poor forest health leading to catastrophic fires, and the expansion of noxious weeds on degraded rangelands. BLM and USFS recognized that these problems were interrelated and therefore must be approached from a landscape, watershed perspective. A major goal of ICBEMP is to bring a consistent ecosystem approach to management by 45 separate Forest Service and BLM administrative units covering over 65 million acres (about half of the total area) in eastern Oregon and Washington, Idaho, and Montana.

To date, the project has produced a comprehensive Science Assessment of the basin and has issued a draft EIS (May 1997) that analyzed seven management alternatives. Because of the nature and large number (over 83,000) of the comments received on the draft EIS, a supplemental draft EIS is currently being prepared, to be released in the early 2000. The preferred alternative will attempt to integrate upland and aquatic management and restoration priorities through ecosystem analysis at several scales. It is anticipated that the final ICBEMP EIS and record of decision (ROD) will be issued in late 2000.

Key findings in the Science Assessment are as follows:

1) the management requirements and aquatic conservation strategy proposed in ICBEMP will result in significantly improved aquatic habitats on federal lands over time, and
2) prioritizing actions based on assessing status, risk, and opportunity at multiple scales should lead to the most efficient and effective approach to restoration.

In addition, assessments by agency field biologists indicate that the capacity for spawning and rearing of anadromous fish on many federal lands (in particular, the Upper Snake River Basin) is many times greater than is presently being realized due to lack of adult escapement to use these headwater areas. Therefore, recovery of salmon and steelhead populations will likely require successful integration of aquatic habitats restoration efforts on federal lands, with similar efforts on nonfederal lands and changes in harvest, hatcheries, and hydropower programs.

BLM/USFS COOPERATION WITH HABITAT RESTORATION ON PRIVATE LANDS

Implementation of the aquatic conservation strategies in the Northwest Forest Plan, PACFISH/INFISH, and ICBEMP will help to establish the context and process for defining management actions that are consistent with restoring, protecting, and maintaining aquatic habitat on federal lands. In addition, the USFS and the BLM have authority to work cooperatively with other governmental entities and private enterprises to carry out work consistent with their missions. In particular, the Wyden Amendment authorizes both agencies to contribute funds to restoration projects located on private lands that benefit fish and wildlife resources on public lands. Field offices also provide technical expertise and other help to local watershed councils and groups to plan and carry out priority restoration projects on both federal and nonfederal lands.

Limiting Factors: The major factors limiting BLM and USFS cooperative efforts to restore aquatic habitat on both federal and non federal lands are funding and staffing

B. TRIBAL PROGRAMS AND AUTHORITIES

TRIBAL SALMON RECOVERY PROGRAM

WY-KAN-USH-MI WA-KISH-WIT, SPIRIT OF THE SALMON: THE COLUMBIA RIVER ANADROMOUS FISH PLAN, AND THE COARSE SCREENING PROCESS

Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon: The Columbia River Anadromous Fish Plan

In *Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon*, the Nez Perce, Umatilla, Warm Springs, and Yakama Nation tribes ("the four tribes") provide a framework to restore Columbia River Salmon. The stated focus of the plan is to "put the fish back into the rivers." The tribal salmon restoration plan outlines the cultural, biological, legal, institutional and economic context within which the region's salmon restoration efforts are taking place. The Spirit of the Salmon is intended to be a long-term plan that addresses virtually all causes of salmon decline and roadblocks to salmon restoration for all anadromous stocks: chinook, coho, sockeye, steelhead, chum, eels (Pacific lamprey) and sturgeon, above Bonneville Dam. The approach taken is one of "gravel to gravel" management, where all habitats (tributary, mainstem, estuary, and ocean) and commonly recognized sources of mortality (passage, habitat, harvest, and production) are addressed.

The plan lays out goals and objectives that pertain to management in Hydro, Habitat, Hatcheries, and Harvest; it consistently ties together goals and objectives for each "H." For purposes of the Habitat Appendix, some of the key *habitat* recommendations are reviewed here.

To accomplish its objectives, Volume I of the plan sets out proposals for institutional change and recommended actions. Volume 2 contains subbasin by subbasin return goals, and those restoration actions that must be undertaken to achieve them. The following technical recommendations pertain specifically to habitat and are extracted from the first volume and the Columbia River Inter-Tribal Fish Commission's (CRITFC) web site (www.critfc.org).

- Begin improving in-channel stream conditions for anadromous fish by improving or eliminating land-use practices that degrade water quality.
- Protect and increase instream flows by limiting additional consumptive water withdrawals, using the most efficient irrigation methods, preventing soil compaction and riparian vegetation removal, and wetland destruction; where necessary, restore soil, restore riparian vegetation, and re-create wetlands.
- Actively restore watersheds where salmon populations are in imminent danger of extirpation. Use "**Coarse Screening Process**" to develop demonstration projects.
- Protect and restore estuary habitat.
- Improve water quality by eliminating sources of toxic pollution that accumulates in fish tissue and by reducing discharges of other contaminants to meet water-quality criteria for anadromous fish.
- Closely monitor tributary production and escapement to improve management.

The Coarse Screening Process

The "Coarse Screening Process" is documented in "A coarse screening process for evaluation of the effect of land management activities on salmon spawning and rearing in ESA consultations. (Rhodes et al., 1994)

The Coarse Screening Process is intended to provide objective, measurable criteria to assess the consistency of land management activities with the goal of improving salmon habitat conditions and improving the survival of Endangered Species Act (ESA)-listed salmon species. Although ESA-listed anadromous salmonid populations are affected by a variety of activities throughout their migratory range, the Coarse Screening Process focuses only on land management activities and their effect on salmon survival in spawning and rearing habitat.

The Process relies on three sets of criteria that assess the consistency of land-management activities with improvement and protection of habitat conditions. The criteria include biologically based habitat standards, land-use standards, and data availability. The specific criteria values can be found in Tables A and B within the original report (Rhodes et al., 1994).

The biologically based habitat standards are a core set of measurable habitat variables that are used to assess whether changes are needed in land management activities. Changes may be needed to ensure consistency, with the goal of improving degraded habitat conditions and salmon survival. Where existing habitat conditions do not comply with the biologically based habitat standards, it is likely that salmon survival has been reduced by a combination of natural- and management-induced conditions. In these cases, the screening process requires passive restoration: curtailing and deferring activities that contribute to or forestall the recovery of poor habitat conditions. Active restoration (e.g., road obliteration), should also be considered as a means to speed habitat recovery in watersheds that do not meet habitat standards.

Land-use standards are used to screen out land-management practices that generally have negative effects on salmon habitat over time. These land-use standards were developed based on the review and synthesis of available information on the ecological functions of watersheds, the effects of land disturbance, the downstream response of habitat conditions to these effects, and salmon response to habitat alteration.

The screening process also provides a framework for establishing minimum monitoring requirements for habitat evaluation. If insufficient data exist, activities should be deferred or curtailed until data on conditions set as standards are collected and summarized.

The screening process relies on "adaptive management" through monitoring. The adaptive management approach (see the flow chart in the Plan), wherein improving habitat conditions or compliance with biologically based habitat standards results in a determination that additional land-disturbing activities can go forward, provided they comply with land-use standards; and where deteriorating habitat conditions results in a determination that passive and active restoration efforts, should be re-doubled.

The coarse screening process is particularly germane to the All-H habitat objective: prevent further degradation of tributary habitats and water quality.

C. STATE PROGRAMS AND AUTHORITIES

STATE OF OREGON

OREGON WATERSHED ENHANCEMENT BOARD (OWEB) (FORMERLY GWEB)

1987. The OWEB program, created by the legislature in 1987as the Oregon Governor's Watershed Enhancement Board (GWEB), helps Oregonians improve the state's watersheds. Its primary functions are to provide technical assistance; administer a grant program; promote education and public awareness about watershed enhancement benefits, concepts, and techniques; and support the work of local watershed councils.

1995. The 1995 Legislature made several changes:

- It brought the Watershed Health Program under OWEB's guidance.
- It made watershed councils subject to local government recognition.
- It directed OWEB to administer approximately $5.5 million in Watershed Health Program grants.
- It provided $2.6 million in lottery revenues for the 1995-97 biennium for program administration and new watershed enhancement and education grants.

1997. The Legislature authorized $20 million for the OWEB program as part of the Oregon Plan for Salmon and Watersheds.

During the 1997-1999 biennium, OWEB awarded almost 350 grants, totaling $15 million, to landowners, watershed councils, Soil and Water Conservation Districts, and others to assist with implementation of watershed enhancement projects across the state. The grants are used for watershed assessment and monitoring, watershed council support, watershed restoration projects and education/outreach efforts. As directed by the Legislature, OWEB has also entered into several interagency agreements that provide research assistance to Oregon State University, assistance to forest landowners through the Oregon Department of Forestry and Soil and Water Conservation Districts, assistance to agricultural landowners under SB 1010, and assistance to watershed councils engaged in water quality monitoring.

1999. During 1999, GWEB became OWEB, which is responsible for administration of Measure 66 salmon and watershed funds totaling $44 million for 1999-2000 biennium.

Contact:

Executive Director: Geoff Huntington – (503) 378-3589 x 833
Deputy Director: Ken Bierly – (503) 378-3589 x 831
Board Chair: Louise Solliday – Governor's Watershed Advisor – (503) 378-3589 x 823

Web Site Address:
http://www/4sos.org/group/oswebprogram.html

THE OREGON PLAN FOR SALMON AND WATERSHEDS (THE OREGON PLAN)

The Oregon Plan focuses on restoring salmon populations and improving water quality throughout the state.

In October 1995, Governor Kitzhaber announced a science-based approach to restore the health of coastal salmon populations. A final version of the Oregon Plan, focusing on coastal salmon populations, was released in March of 1997; it received significant funding and bipartisan support from the state legislature. Since the publication of the Steelhead Supplement in December of 1997, the Oregon Plan has evolved into a statewide framework for addressing salmonid and water-quality issues and has gained national recognition for its innovative and comprehensive approach.

The plan relies on developing involvement, ownership, and commitment through community based watershed groups. Although the plan provides for review of existing fish management and habitat protection laws, rules, regulations, and policies, most efforts will focus on improving compliance with existing environmental protection laws. The plan recognizes a role for *hatchery* production, but focuses on ensuring compatibility with *wild fish* conservation. (Harvest of coho salmon will be deferred to enhance recovery rates.) The plan focuses on restoring native populations and their habitats through such measures as improved fish passage, maintaining or decommissioning roads, and instream structure development.

The federal agencies have pledged significant support for monitoring, watershed council activities and projects, and technical efforts such as watershed assessment and education and outreach. The state recognizes the Northwest Forest Plan as a major anchor for the Oregon Plan's habitat restoration strategy.

The plan calls for cooperative monitoring efforts. To ensure that progress is being made in recovering the salmon populations, an independent science team will complete an annual audit on the Plan's strengths and weaknesses and present it to the Governor and the National Marine Fisheries Service (NMFS).

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY-ADMINISTERED PROGRAMS RELATED TO WATERSHED MANAGEMENT

Water Quality Grants Programs

The programs described below are awarded biennially to eligible state and local agencies, based on competitive review of grant applications. All three programs are administered by the Water Quality Program of the Department of Ecology.

- Centennial Clean Water Funds – provides grants and low-interest loans to local governments and Indian tribes for water pollution control facilities and water pollution control activities designed to prevent and control water pollution to surface and ground water.
- Washington State Water Pollution Control Revolving Fund Programs – provides low-interest loans to local governments for projects that improve and protect the state's water quality. It provides low-cost financing or refinancing of eligible costs for projects including publicly owned wastewater treatment facilities, nonpoint source pollution control projects, and comprehensive estuary conservation and management programs.
- Clean Water Act (CWA) Section 319 Nonpoint Source Program – provides grant funding to local governments for projects that improve and protect the state's water quality.

Watershed Management Act

The Watershed Management Act was enacted in 1998 to establish a locally driven framework for addressing the state's water resource, water quality, instream flow, and fish habitat needs. Twelve state agencies signed a Memorandum of Understanding identifying roles and responsibilities for coordination under the Watershed Management Act. The Department of Ecology received $9 million in the 1999 legislative process to pass on to local planning efforts for the continued support of watershed planning. Up to $4.5 million can be appropriated for each fiscal year.

The state is divided into 62 Water Resource Inventory Areas (WRIA). Participation is optional. Watersheds must include county governments, tribes (if located within a WRIA), the largest city or town, and a water supply utility. Watershed plans must, at a minimum, address water quantity issues; but can also address water quality and habitat.

Available grants to each WRIA include $50,000 for organization; $200,000 for watershed assessments; and $250,000 for planning and actions.

Salmon Recovery Act

The Governor's Office has established a Salmon Recovery Office and has drafted a salmon recovery strategy. The strategy includes goals and specific actions for state agencies; it will guide more specific local recovery actions. A Salmon Recovery Funding Board guides spending

of funds targeted for recovery activities and projects. The board can be contacted by calling 360-902-3000, or by sending an e-mail to Salmon@iac.wa.gov

STATE OF IDAHO

IDAHO STATE FUNDING FOR WATERSHED ENHANCEMENT AND RESTORATION

The State of Idaho has no programs specifically designed to fund watershed enhancement or restoration projects. There are, however, several avenues by which Idaho state programs participate as funding partners in watershed planning and implementation projects or provide the necessary infrastructure to coordinate other funding sources.

The Idaho Soil Conservation Commission (Idaho Department of Agriculture) will administer funds appropriated by the state for an agricultural water quality cost-share program. This *Agricultural Water Quality Cost-Share Program for Idaho* will begin soon; it replaces the *Idaho State Agricultural Water Quality Program*. The new program has been designed to increase flexibility and allocation of state funds to decrease nonpoint source pollution generated from activities on private agricultural lands. The old program, in general, resulted in planning and implementation projects within watershed units. The new program will not preclude watershed project implementation.

Idaho Soil and Water Conservation Districts are subdivisions of state government (Title 22, Chapter 27, Idaho Code). Each is governed by a five or seven-person board that serves without pay. All supervisors are local residents elected to office; they must be landowners (including urban property owners located within district boundaries) or farm operators in the district from which they are elected. Soil and water conservation districts develop and implement programs, frequently organized by watershed, to protect and conserve natural resources on nonfederal lands. Districts organize technical advisory groups for projects and call upon local, state, tribal and federal agency specialists, industry representatives, and interested individuals. They regularly seek project funding from federal, state, local, and private sources.

Basin advisory groups (BAG) and watershed advisory groups (WAG) are mandated by the Idaho Water Quality Law (Title 39, Chapter 36, Idaho Code). A basin advisory group is named for each major river basin in the state to advise the director of the Idaho Department of Health and Welfare on water quality objectives. They in turn recommend members for watershed advisory groups in watersheds of concern within a basin. Watershed advisory groups recommend actions needed to control point and nonpoint sources of pollution so that designated beneficial uses can be fully supported to comply with water quality law. Through these efforts, water quality priorities are established and projects developed, often by soil and water conservation districts coordinating multiple funding sources.

The USDA Natural Resources Conservation Service (NRCS) sponsors the River Basin Study Program. Requests for river basin (watershed) assistance are made by Soil and Water Conservation Districts to investigate, plan, and implement watershed restoration actions. Idaho state agencies participate with technical and financial assistance in river basin studies, depending on management responsibilities and available budgets.

D. OPTIONS AND APPROACHS FOR TOUGH IMPLEMENTATION ISSUES

There are some pervasive issues that must be resolved for habitat and water quality conditions to recover in the Columbia River Basin 9basin). Because these issues have complex legal, regulatory, policy, and institutional aspects, they can be extremely difficult to solve at the local level. Therefore, it is appropriate to make efforts at the regional and state levels to provide policy and technical guidance to assist and streamline local efforts. This section of the Habitat Appendix explores a range[2] of options and approaches for the federal government's role in solving these tough issues. The goal is to stimulate dialogue and problem-solving that will lead to regional solutions. The federal agencies do not propose one option over another.

NON-FEDERAL LANDS/PROGRAMS AND FEDERAL ROLE IN IMPLEMENTATION

Issue: How can federal and non-federal land management be better coordinated?

The basin is large and diverse. Different parts of it support different species and opportunities for habitat protection. Problems of habitat degradation vary from one watershed to another. Given this diversity, it is hazardous to generalize about habitat solutions. In general, habitat measures can be effectively identified and implemented only after on-the-ground assessment.

At the same time, there is a clear need to coordinate management of federal and nonfederal land. While to this point much of the attention in salmon recovery has been focused on federal lands, nonfederal areas are biologically rich and may be high priorities for protection or restoration. If conservation efforts are *limited* to federal lands, not only will they risk falling short of species recovery goals, but they may also increase commercial pressure on non-federal lands, offsetting federal gains. Moreover, even if it we wished to limit efforts to federal lands, fish that spawn on federal uplands must pass through, and in many cases rear, in nonfederal lowlands. For all these reasons, effective conservation efforts require effective nonfederal land and water management, stronger linkages between federal and nonfederal programs, and much better coordinated monitoring and evaluation.

Before discussing how these linkages might be developed, it is important to understand the linkages that already exist. The discussion below describes these connections in a general way, and then discusses issues and alternatives for building on them.

Federal Lands

Federal land has a single administrator—the federal government. While different federal agencies administer different lands, and federal lands are subject to multiple mandates and demands, the fact that they are owned by a single entity means that federal lands can be more amenable to integrated management. Particularly since 1993, when the Northwest Forest Plan (NWFP) was adopted, federal agencies have taken important steps toward a common vision of land management.

2 This is not a complete or exhaustive review.

The NWFP established common goals for management of national forests in the Pacific Northwest within the range of the northern spotted owl. One of the NWFP's purposes was to assure protection of species on federal lands so as to ease the need for restrictions on nonfederal lands. To deliver on this promise, federal agencies had to fundamentally change the way they relate to each other.

Before the NWFP, federal agencies tended to operate relatively independently and sometimes at cross-purposes. The NWFP gave the agencies a common focus, required federal agencies to coordinate their actions broadly, and set up a structure for regularly obtaining advice from states, tribes, counties, and others on critical implementation issues. The NWFP also encouraged the development of common data standards, mapping capabilities, and ways to share information; streamlined consultation processes under the Endangered Species Act; assessments of watershed and late-successional reserve areas; and adaptive management plans and joint research and monitoring plans. Overall, the NWFP represented a movement toward (1) landscape-level planning, (2) collaborative agency efforts, (3) broader public participation, and (4) a balance of economic, social, and ecological interests.

In 1996, the regional directors of the federal participants in the NWFP asked for an assessment of the Plan and its implementation. The resulting report recommended that the agencies broaden their focus to look for early involvement in areas where the greatest gains can be achieved on the entire landscape, not just on federal lands. Among other things, the report recommended that federal agencies carry out the following:

1. increase collaboration with states, tribes, local governments, and local landowners where mutual interests can be advanced;
2. rededicate themselves to achieving a "seamless web" of information across the landscape;
3. move toward an intermediate level of analysis (Province level) between the regional and site-specific scale;
4. recommit to develop effective models of adaptive management;
5. make greater effort to carry out research and monitoring to validate the assumptions underlying the NWFP;
6. consider ways to secure stable, long-term funding for NWFP initiatives, especially for long term monitoring and evaluation; and
7. create province-level advisory committees to bring federal, state, tribal, and other interests into the effort.

Since the report, federal agencies have made significant efforts to carry out these recommendations.

An ecosystem-scale assessment of federal land management has also been developed for the eastern part of the basin: the Interior Columbia Basin Ecosystem Management Project (ICBEMP). That process, nearly complete, affords another opportunity to bring federal land management into a broad, collaborative approach to the basin's management.

Nonfederal Lands

Nonfederal lands are owned mainly by private parties. Although local, state, tribal, and federal requirements influence private land use, as a rule private land is much more sensitive to individual and commercial values and much less sensitive to government policy. It is therefore difficult to bring private land into an integrated pattern of resource management.

Nonetheless, many private landowners consider themselves stewards of their land and the species that inhabit them. Individual landowners participate in various conservation efforts, some personal and some related to broader programs, such as the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) Conservation Reserve Program, and other USDA and other conservation programs. In many parts of the region, watershed councils have sprung up in which private and government managers come together to work jointly on resource issues. Initiatives such as the Henry's Fork Coalition, the Applegate Partnership, the Deschutes River Conservancy and others have achieved levels of collaboration that never could be designed by government. Working with various watershed assessment methods, these efforts have carried out improvements in a great number of watersheds.

Federal agencies supply technical help for these local efforts. For example, the NRCS has a long history of working with local communities on soil and water conservation. In a 1998 memorandum of understanding with the National Marine Fisheries Service (NMFS), the NRCS agreed to update its guidelines to be consistent with Endangered Species Act (ESA) requirements for anadromous fish. The Bureau of Reclamation (USBR) has provided technical assistance to replace push-up dams, consolidate diversions, install fish screens and ladders, and provide engineering for stream restoration work. The Environmental Protection Agency (EPA) has an extensive program oriented toward meeting water-quality needs on a watershed basis.

At the state level, Washington's Timber, Fish and Wildlife Plan and the Oregon Plan for Salmon Restoration represent significant efforts to manage federal and private lands collaboratively to accomplish ecological objectives. State land management agencies are also developing plans under which state and private lands can be managed consistent with ESA, Clean Water Act (CWA) and other requirements. Many of these initiatives involve close collaboration between state agencies and federal agencies responsible for ESA and CWA implementation.

There are important tribal land plans and programs on Indian reservations in the Basin. The historic trust relationship between tribes and federal agencies requires federal agencies generally to consult with tribes to ensure that due protection is afforded tribal trust resources. A federal Executive Order formalizes these requirements for ESA processes. While this relationship plays out differently between different tribes and agencies, the federal-tribal relationship is an important factor in inter-jurisdictional collaboration.

Finally, Bonneville Power Administration (Bonneville) hydropower revenues play a significant role in funding habitat measures on nonfederal land. Those revenues are invested consistent with the Northwest Power Planning Council's (NPPC) fish and wildlife program (FWP), which is intended to address the effect of hydropower impacts on fish and wildlife. Currently, Bonneville spends more than $100 million per year on these fish and wildlife measures; approximately $15

million of that sum goes to habitat projects. Proposals are selected for funding through an annual process in which fish and wildlife managers and others propose projects and recommend priorities. These proposals are reviewed and evaluated by an Independent Scientific Review Panel; the proposals and the Panel's review are made available for public comment. The NPPC reviews the resulting record and makes final funding recommendations to Bonneville.

This review underscores the fact that there are many habitat protection and restoration processes underway; many of them are promising. Virtually all are reaching out to coordinate with other interests to accomplish common objectives. Based on this, we conclude that insofar as federal agencies put a high priority on improving habitat conditions for fish and wildlife, the objective should be to build on existing institutions and relationships, not to duplicate or supplant them.

Options

The options associated with this issue are defined in detail in the Conservation of Columbia Basin Fish (All-H) paper. Those options have varying levels of federal/non-federal coordination, assessments, and funding.

Approaches

The possible approaches to establishing a better set of federal policies regarding federal and non-federal lands include the following:

- Establish better coordination among assessment and planning methods. Various watershed assessment and planning methods are used to characterize watershed conditions, environmental factors that limit fish and wildlife productivity, and prioritizing opportunities for protection and restoration. These tools are important: they can ensure that watershed protection and restoration efforts are working with common protocols and assumptions, generating data in compatible forms, and headed generally toward consistent objectives. Different tools have been developed and applied differently across the landscape. Is more uniformity needed in these tools? If so, who should take responsibility for achieving it?

- Develop better mechanisms for accomplishing common planning. The Independent Scientific Review Panel has recently advocated an effort that would rely on assessments to evaluate habitat problems and opportunities from a subbasin perspective. The Panel holds that such a perspective will help in evaluating priorities for scarce funding. While the exact shape of this idea has not yet been determined, it may afford an opportunity to integrate habitat planning across federal and nonfederal ownerships. How could such a process serve the purposes of federal land management agencies? How could such a process mesh with the ESA recovery planning process? How could a common planning process be organized so that federal, state, tribal and other interests have appropriate access and participation?

- Establish common data management and information sharing. Over the past ten years, PNW federal and nonfederal agencies have invested enormous effort in collecting and analyzing data on fish and wildlife: the scientific work done by NPPC's Multi-species Framework Project's EDT (Environmental Diagnosis and Treatment) analysis, the NMFS Cumulative

Risk Initiative, the PATH project (Plan for Analyzing and Testing Hypotheses), the System Operations Review, and the Protected Areas data base, to name a few. StreamNet, a regional repository for fish and wildlife data, has done an exceptional job of organizing data and making them widely available. Notwithstanding these efforts, however, agencies have not yet succeeded in creating the "seamless web" of information across the landscape to which the Northwest Forest Plan refers. Should federal agencies put a higher priority on integrating data and analytical methods? Who should do it and how should it be done?

- Establish better mechanisms for coordinating monitoring and evaluation. The All-H paper and Section J in this Habitat Appendix outline performance measures for habitat that are intended to play a key role in evaluating progress. Current monitoring programs developed by different agencies tend to aim at different concerns; none of them necessarily takes in the entire landscape. Accordingly, it can be difficult for any individual agency to measure progress in conserving species that are affected by a variety of other actors. Does the Basin need an integrated capacity to monitor and evaluate habitats and species interactions across the landscape? Do we have performance measures that lend themselves to such monitoring and evaluation? Under whose auspices should monitoring and evaluation be conducted, and how should it be organized?

- Establish better mechanisms for receiving common scientific advice. Different agencies have different expertise. NMFS has expertise on salmon and marine species and their environments. The U.S. Fish and Wildlife Service (FWS) has great expertise in resident species and plants. The U. S. Forest Service (USFS) does significant scientific work associated with national forest lands. State fish and wildlife agencies and Indian tribes have considerable expertise in fish and wildlife biology and restoration. Universities offer a deep pool of expertise in the science of species conservation. Yet often, the scientific advice that informs habitat policy and implementation judgments is fragmentary or conflicting. Are existing scientific bodies already doing what should be done to inform policy makers? Is there a need for a specific group of scientists with expertise in habitat to inform policy and implementation issues and help resolve scientific conflicts?

- Establish coordinated funding. Different agency budget procedures and spending priorities can create problems in fish and wildlife implementation. Agencies that must work jointly on fish and wildlife problems may find that funding practicalities push their efforts out of phase, with resulting delays and inefficiencies. Should federal land management agencies develop a process to ensure that land management agency funding is coordinated? By whom and how should this be accomplished? Under the auspices of an entity with tribal representation, such as the Columbia Basin Forum? Relying on the Northwest Power Act Independent Scientific Review Panel? By other means?

- Establish a forum for policy issues involved in habitat implementation. Issues and disagreements arise in habitat implementation just as in other Hs. The entities working on hydropower issues have a variety of mechanisms by which to discuss and resolve implementation issues—the Technical Management Team, the System Configuration Team, and others. Should there be a similar mechanism for habitat implementation? If so, under whose auspices and how should it be structured?

TRIBUTARY WATER QUANTITY

Issue: Many fish-bearing streams are depleted by water withdrawals, creating problems for fish in tributaries and in the mainstem. Water withdrawals represent intermeshed property interests that are protected by state law, but are not well regulated by state water agencies.

Options

The possible options that can be used to establish a better set of federal tributary water quantity policies include the following:

- Establish a federal target for reduced consumptive water use. Hypothesize a reduction in consumptive water use and based on estimated gains from strategies listed below. For instance, if total consumptive losses in the Northwest are currently in the neighborhood of 13,00,000 acre-feet of water, a 10% reduction would restore 1.3 million acre-feet to the system. Aggressively implement strategies listed below to achieve these targets.

- Announce federal support for state, tribal, and other efforts to restore tributary flows for fish. Rather than an aggressive federal program, announce federal support for state agency, tribal, watershed group and water user steps to restore flows.

- Avoid a broad strategy and focus stream flow restoration in certain areas. Recognizing federal-state-local tensions over water rights, avoid a federally driven program and redouble federal efforts in a limited number of areas.

Approaches

The options above present different levels of federal involvement in resolution of water quantity issues. Regardless of the federal involvement option chosen, the following changes in federal policies are needed:

- Modify federal agency programs to remove disincentives for water uses that hurt streams and to reward practices that help streams. Water reforms can be encouraged through incentive programs that can be geared to reward practices that help streamflows and remove incentives for practices that hurt.

- Allocate sufficient funds to innovative water transactions and other measures that restore flows. Water leasing, purchases, and water efficiencies all require funding. Making a significant impact on tributary water will require significant funding. Such an investment would have to be carefully thought through to avoid undue market distortions.

- Identify watershed approaches to implementation. To provide a foundation for implementation, convene a group of creative government and non-government people to develop a template(s) for implementing water solutions in a watershed context.

- Focus resources on missing administrative and financial infrastructure. Streamflow restoration strategies are difficult to implement because many streams are not gauged, so that water conditions often can only be estimated. Perhaps the weakest area in the region's data systems concerns out-of-stream water use. Detailed water rights information across the states is unavailable in integrated form. Without more information than we have now, it will be difficult to approach tributary water issues systematically. While there are some bright spots—the Oregon Water Resources Department's initiative to make data available on the internet, for example—generally it is difficult to ascertain where and when particular problems for fish and wildlife arise in the region's rivers. Should there be a high priority on gathering and integrating these data? Who should take responsibility for it and how should it be done?

TRIBUTARY WATER QUALITY

Issue: How can solutions to water quality and fish habitat problems be integrated so that both ESA and CWA objectives are achieved?

Background

Water quality problems are prevalent in the basin, as evidenced by the extent of water-quality-limited water bodies (i.e., rivers, streams, lakes) resulting from point and nonpoint source pollution (see Maps 3 and 4 in the All-H paper). Stream and riparian zone conditions necessary to achieve water quality standards result in a number of beneficial physical habitat and water quality characteristics. Healthy riparian zones, in addition to providing shade to keep the water cool, also promote streambank stability, provide buffers to assimilate pollutants in overland runoff, hold cool groundwater for release during periods of low stream flow, and can add physical habitat (e.g., large woody debris) to the stream system. Therefore, if stream restoration and recovery can be achieved as a result of meeting the water quality standards, the benefits to salmonids are greater than simply attaining cool water. Stream restoration will also result in providing habitat characteristics necessary to support healthy salmonid populations and the ecosystems in which they live.

The three states of Idaho, Oregon, and Washington all have court-developed schedules for developing Total Maximum Daily Loads (TMDL) for each impaired waterbody on their CWA section 303(d) lists. TMDLs allocate allowable pollutant loads among different pollution sources so that appropriate control actions can be taken, water quality standards achieved, and human health and aquatic resources protected. The states are using a basin-wide approach to TMDL development.

Currently, regulatory provisions do not allow for Federal implementation of TMDLs. The new Section 303(d) regulations, currently under review, propose that an implementation plan, identifying how the pollutant load reductions will be achieved, accompany each TMDL. In addition, the new regulations propose an increased emphasis on the protection of threatened and endangered species in TMDL development and implementation and on T&E needs (i.e., habitat) as a rationale for listing a waterbody as impaired. The strengthening of the TMDL regulations should make a significant difference in the EPA's and the states' ability to implement this program in a manner that also helps meet ESA objectives.

Federal and state agencies, Tribes, and local governments can all work together on TMDL development and implementation.

Options

The possible options that may be used to establish a better set of tributary water quality policies include the following:

- An active Federal role in reviewing and approving TMDLs. This option's appeal is that it provides for more accountability and reliability. The problem is that it creates a higher and perhaps unwanted level of Federal oversight in the implementation of a state-delegated program. In addition, the Federal regulatory agencies that would be conducting the reviews (e.g., EPA, NMFS, FWS) do not have the staff to conduct reviews for the thousands of TMDLs that will be generated as a result of the state's section 303(d) lists.

- Encourage high standards in state programs for reviewing and approving TMDLs. This option's appeal is that it provides for more accountability and reliability. The problem with this option is that: (1) the state water quality agencies may have limited resources to do much more than a "cook book" approach to TMDL development, and (2) TMDL development is currently at a formative stage for pollutants such as temperature and sediment, so the scale of what constitutes a "high standard" is going to shift as we learn more about the development and implementation process.

- Focus on pilot watersheds or subbasins for integrated nonfederal/federal stepdown assessment, TMDL implementation planning, integrated priority setting, and funding. This option could be successful if the pilot watershed(s) chosen is in alignment with the court-appointed schedule for TMDL development, and if the TMDL(s) were developed under the assumption that a phased approach with adaptive management would be included in the implementation plan. The problem with this option is that the states and EPA may not have the luxury of conducting a pilot or series of pilots and waiting for results, given the tight time line the states are under to develop TMDLs.

- Focus Federal water quality efforts in Federal programs. Focus Federal efforts using their authorities and monies (grant and loan dollars) to assist the states and tribes to develop and implement TMDLs. For example, (1) the USDA brings to bear research and incentives to be built into agriculture loans and other assistance programs; (2) EPA annually grants money to the states via their performance partnership grants that can be directed to TMDL development (this money includes Clean Water Act section 319 funds, which totals approximately 4 million dollars per state) and (3) for urban water quality efforts, Habitat Conservation Plans (HCPs) are developed with metropolitan areas for storm and sewer water discharge and tax incentives to point source industries. The development of a Unified Federal Policy for the implementation of the CWA Plan is one example of an umbrella process to organize the Federal family around protecting water quality. The problem with this option is that it will require that each Federal agency be able to clearly articulate its authorities and funding sources in a manner that allows for integration.

Approaches

There are a number of ways that CWA and ESA implementation could overlap and provide efficiencies. Implementation could overlap in subbasin and watershed assessment, planning, and actions. Overlap could also be provided in objectives, standards, performance measures, and prioritization criteria. It will take substantial effort to identify the potential overlaps and the implementation mechanisms for achieving them. The ultimate goal for these overlaps would be to maximize the efficiencies and the certainty of regional and local efforts. Efficiencies can be maximized if efforts achieve multiple objectives. Certainty that efforts are meeting CWA and ESA objectives can be provided if local efforts use consistent guidance for assessment, planning and implementation.

Federal, state and tribal policy and technical discussions on these overlaps need to begin right away. Ultimately, a strategy for overlapping CWA and ESA implementation needs to be developed. This will be a complex process. Further approaches should be developed in an inter-governmental forum.

FEDERAL ROLE IN AGRICULTURAL LANDS

Issue: How can agricultural land users be encouraged to improve soil and water conservation in a manner that protects and restores aquatic habitat?

Background

Agriculture and rangeland use typically is not subjected to the regulations and ordinances associated with other land uses. However, the literature and many Federal and state conservation programs clearly confirm that agricultural land use patterns need to be changed in order to adequately protect and restore aquatic habitats. What steps can the Federal government take to encourage and support sustainable agriculture that is complementary to habitat recovery objectives?

NMFS recently completed section 7 consultation with the USDA Farm Services Administration (FSA), in cooperation with the NRCS on the Conservation Reserve Enhancement Program (CREP) implementation in Oregon. (This program is also undergoing consultation in the State of Washington and, prospectively, in Idaho.) The USDA CREP is designed to address water quality degradation that is a direct or indirect result of agricultural activities on private lands along freshwater streams. In Oregon, on a statewide basis, about 20 percent of the freshwater salmon streams on private lands pass through agricultural land use areas. Oregon's request for a CREP as described in "Oregon's Riparian Enhancement Initiative" (September 1998) confirmed that patterns of aquatic ecosystem degradation due to agricultural production practices must be reversed to secure the long-term survival and recovery of listed salmonids.

Increasing the regulation and enforcement of agricultural land use practices is one potential option that the state and local governments should explore. For the Federal role, while ESA and CWA enforcement are potential tools, the Federal agencies view those tools as a "default" if conservation and appropriate regulations at the state and local levels are not pursued and implemented. The following conservation recommendations, excerpted from the NMFS 1999

biological opinion on the Farm Service's administration of the Oregon CREP, provide some incentive options that the Federal government should explore.

Options and Approaches

- Conduct a sustainable agriculture analysis. FSA, in coordination with other USDA agencies and programs, should continue and expand efforts to provide information and technical assistance that will allow agricultural producers and other interested parties to evaluate alternative conservation systems necessary to recover declining aquatic species and their habitats, and costs associated with those systems, in a timely manner.

  However, short-term land retirement programs such as CREP are costly and cannot fully address the need for more sustainable agricultural practices that fully integrate environmental, economic and social needs. The CREP Co-op Agreement concerning USDA's commitment to the Oregon CREP included provisions for development of land and water conservation plans to meet identified species recovery needs by establishing permanent vegetative cover or other comparable practices.

  Most producers are motivated to choose management options that maximize profits. However, because impacts on declining species are not reflected in market signals, conflicts arise between production and species needs. Giving producers information about government programs and conservation systems that not only meet the requirements of the Act but can be relied on to produce consistent, acceptable crop yields is very likely to increase their acceptance of conservation practices as part of their overall farm or ranch management system. Thus, developing such information for Oregon's many distinct growing areas is an urgent and high-priority need.

  USDA has the capacity to develop innovative research and technology transfer tools that will provide agricultural producers in Oregon with the tools they need to protect and restore aquatic ecosystems, while achieving more cost-efficient production and increased profitability. For example, the Solutions to Environmental and Economic Problems (STEEP) project conducted in the Pacific Northwest began in 1975 to develop and accelerate adoption of wheat production practices that control soil erosion; it became a national model for unified regional research and information transfer. A similar program is now needed to solve problems related to the environmental and socioeconomic impacts of alternative conservation systems necessary to restore riparian and aquatic habitats and increase salmonid survival. Three specific information and technical assistance needs are as follows:

  1. Development of geographic and sector specific conservation systems to meet the needs of listed species while ensuring agricultural productivity.
  2. Analyses of socioeconomic barriers to the adoption of conservation systems, such as conflicts between conservation and production goals, agricultural traditions, and producer assumptions about cost and risk aversion.
  3. Development of a market-based strategy to deliver new riparian and aquatic conservation systems to Oregon's diverse agricultural sectors.

- Implement additional conservation incentives. FSA, in coordination with other USDA agencies and programs, should continue to expand efforts to make adoption of alternative riparian and aquatic conservation systems necessary to recover declining aquatic species and their habitats more cost-effective for agricultural producers.

  The Oregon CREP provides a substantial incentive for enrollment of certain acreage under the program. After these short-term contracts expire, however, the future use of enrolled acres will depend primarily on economics of related factors. Among other considerations will be the compatibility of permanent vegetative cover with existing use of adjacent land; the desirability and cost of conversion from crop to other land uses such as grazing, forestry, or urbanization; geographic isolation of various tracts; and the availability of other incentives to continue conservation systems. "Oregon's Riparian Enhancement Initiative" noted that, without CREP, significant mitigation of existing agricultural impacts on salmonids is unlikely.

  CREP and other conservation provisions of the Federal Agricultural Improvement and Reform Act of 1996 (the 1996 Farm Bill) were specifically designed to address high priority conservation needs. Administration of those programs by FSA, NRCS, and other partners make a vital contribution to national environmental goals. However, authorization and funding for those programs will expire in 2002. Moreover, Farm Bill programs specifically targeted for conservation represent only a small fraction of the total number of agricultural programs available to producers. Many other agricultural programs administered by FSA and other USDA agencies (such as marketing, commodity, and loan programs) may also have a significant direct or indirect effect on the likelihood of producers adopting conservation ecosystems that would improve the survival of listed salmonids.

  In view of the need for additional incentives to continue and expand existing conservation program benefits and achieve permanent adoption of sustainable agricultural practices and conservation systems, it is important that FSA, in coordination with other USDA agencies, investigate opportunities to include conservation incentives as part of other agricultural programs. Examples of expanded incentive opportunities include enhanced program benefits, premiums, purchasing preference, or promotional assistance for beneficiaries who adopt appropriate conservation systems; targeted research, education, or demonstration programs; and other "debt for nature" ideas. Alternatively, USDA should develop conservation-based eligibility criteria for its agricultural programs. Examples of FSA and other USDA programs to include in this investigation are as follows:

  1. FSA programs to provide farm and commodity loans, dairy price support, domestic and foreign food assistance, catastrophic crop insurance and crop disaster assistance, emergency assistance for farmers in declared disaster areas, and farm ownership.
  2. Foreign Agricultural Service programs to provide incentives for eligible promotions and develop foreign markets for agricultural commodities.
  3. Risk Management Agency programs to provide crop insurance and other risk management assistance.
  4. Agricultural Marketing Service programs to provide marketing incentives through Marketing, Promotion, and Information Boards.

5. NRCS programs to provide conservation technical assistance, carry out the Conservation Farm Option pilot and other conservation provisions of the 1996 Farm Bill, reach out to socially disadvantaged farmers and ranchers, farmland protection and reduced flood risk.

E. IMMEDIATE FEDERAL ACTIONS

IMMEDIATE ACTIONS CRITERIA

For the most part, governments should commit scarce resources only to those projects that have been identified as important through an assessment that follows science-based procedures. That process for planning projects is described under Multi-scale Analysis, Planning and Implementation (Section F) in this Appendix. Some actions, however, are so clearly necessary or beneficial that they do not require an in-depth assessment. This section is organized by what is needed to contribute to the All-H paper's habitat objectives.

Immediate actions that address the All-H paper's first objective (no further degradation) include the following:

1. **review existing federal, state and local laws and regulations** protecting aquatic habitats, particularly those regulating non-federal forestry, agriculture and urban development;
2. evaluate whether the suite of existing provisions avoids further harm to aquatic habitat;
3. implement those provisions that protect water quality and water quantity;
4. enforce existing laws and regulations that protect aquatic habitats; and
5. adopt additional laws and regulations necessary to protect aquatic habitats.

Some examples of immediate actions to avoid further habitat degradation are as follows:

- **ensure full compliance with total maximum daily load (TMDL)** schedules and priorities;
- develop TMDL implementation plans that are consistent with the needs of threatened and endangered species; achieve better coordinated state, local and federal outreach on the U.S. Department of Agriculture's (USDA) Conservation Reserve and Enhancement Program (CREP) program;
- achieve better state enforcement of laws requiring water diversions to be screened; and
- achieve better use of authorities to ensure adequate tributary instream flows.

Protecting and improving instream flows is an immediate priority. Tributary stream flow problems are pervasive in the basin. While existing state moratoria should remain in place to avoid further depletion, federal land management agencies should ensure that water conveyances across federal land do not deplete streams of flows needed for fish. The U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation (USBR) should ensure that any diversion structures they permit or authorize do not deplete streams of water needed for fish. States and federal agencies should set up adequate gauges, meters, and other mechanisms for enforcing water use. Pilot programs should be undertaken to demonstrate innovative solutions for tributary water needs and instream flows to provide for aquatic species.

Determining how best to protect and restore estuary habitat is also an immediate priority. Science analyses indicate that survival improvements in the estuary could significantly improve survival of the species overall. It is urgent that the estuary be surveyed and assessed. Based on these surveys, an experimental adaptive management plan of restoration actions should be undertaken promptly to expedite our understanding of how to improve estuary survival.

Immediate actions that address the second and third Habitat objectives in the All-H paper (protect high-quality habitats and restore degraded habitats on a priority basis) are typically more site-specific. Both site-level actions and future actions can contribute to meeting these objectives. Such actions should be ongoing or be fully implemented in not more than 3 years. These actions should continue or be implemented without additional assessment or planning, *provided that* they meet one of the following criteria:

1. The action should secure existing high-quality habitats that include not only currently productive habitats, but also high-quality habitats that could be productive with increased fish returns.
2. The action should address imminent risks to species survival.
3. The action should result in substantial benefits to species survival (assuming sufficient escapement) in not more than 5 years after implementation.
4. The project is planned according to a science-based assessment and action plan, at least at the watershed scale (6^{th} Code hydrologic unit code [HUC]) for the affected area.

These criteria are specified in order to direct federal and state agencies, tribes, and other partners to continue to accomplish projects that address imminent risks while they are, in the next three to five years, completing the watershed based assessment and planning that will lead to actions that address long-term recovery of aquatic habitats. Below are examples of projects from the existing programs of several federal agencies that meet the imminent risk criteria[3]:

- purchase leases or conservation easements in the Columbia River Estuary (Bonneville Power Administration [Bonneville]),
- relocate the Rice Island colony of Caspian terns to East Sand Island (U.S. Fish and Wildlife Service [FWS], Corps, National Marine Fisheries Service [NMFS]),
- enhance Yakima River water supply (USBR),
- modify Cougar Dam to improve temperatures in the McKenzie River (Corps) (Note: implementation may take 4 years, but benefits are immediate following implementation.),
- carry out Buck Hollow Creek land treatment, sediment ponds, etc. in the Deschutes River subbasin, and
- carry out NMFS Irrigation Diversion Screening Program.

These examples do not represent a complete list of the actions that meet the immediate action criteria that occur under various federal agencies or programs. Several other categories of

3 Examples are not provided for state and local programs.

actions that are part of agencies' ongoing programs may fit the criteria. It is anticipated that, collectively, these actions will continue to represent accomplishment (for further details on accomplishments, see the Federal Authorities Section (A) in this Appendix. Individual agencies are in the best position to evaluate their programs and determine which actions fit the criteria. State, local, and federal agencies and tribes are encouraged to prioritize actions that meet these criteria. The following categories are examples of actions that may meet the criteria:

- road treatments (reduction of sediment inputs or risk of failure),
- water purchases and leases where existing diversions present a barrier or result in unsuitable habitat for one or more life stages,
- fish screens and ladders,
- culvert and bridge replacement where they are a barrier to migration,
- water diversion consolidation,
- push-up dam removal or replacement,
- wetland restoration to improve water quality, and
- removal of low-head dams (e.g., Condit Dam).

Note: This list of categories should serve as possible examples only; other types of projects could fit the criteria.

SAMPLE PROJECTS

Below are examples of immediate federal projects that meet the imminent risk criteria. These descriptions should assist the federal agencies in evaluating which projects should proceed while assessments and plans are being completed.

A. Purchase Leases or Conservation Easements in the River Estuary

Bonneville is undertaking the following project to benefit the Columbia River Estuary.

- Actively seek out opportunities to purchase, lease, or develop conservation easements to restore inter-tidal marshes and swamps. The long-term goal is to help restore 3,000 acres of inter-tidal marshes and swamps in the estuary (50 percent of the marshes lost since 1948).
- Assist in the re-establishment of flow in the west side of Youngs Bay by creating openings (culverts, bridges) in the Astoria-Warrenton Bridge causeway. The action will create flow and habitat conditions similar to those historically present.
- Support actions to reduce the number of Caspian Terns, gulls, and cormorants nesting on Rice Island.

Cost to Bonneville would be $1 to $4 million a year for 3 years. Actions could be implemented this year and completed in 4 years.

B. Caspian Tern Predation on Salmonids in the Columbia River Estuary

The Corps, NMFS, and the FWS are working cooperatively to develop a management strategy for reducing Caspian tern predation on juvenile salmonids in the Columbia River Estuary during fiscal year 2000. The FWS primary objectives for this strategy are as follows:

- Reduce Caspian tern predation on out-migrating smolts in the Columbia River Estuary.
- Provide suitable habitat to accommodate the population of Caspian terns currently nesting in Oregon and Washington.
- Manage the distribution and dispersal of Columbia River estuary terns to: (a.) provide adequate nesting habitat for the population; (b.) minimize impacts on other fish stocks of concern; (c.) encourage tern consumption of marine forage fish as their primary prey base.

During 1999, nesting habitat for Caspian terns was created on East Sand Island, nearer the mouth of the Columbia River. This habitat needs to be maintained in FY 2000 in order to encourage relocation of terns from Rice Island to East Sand Island, thereby reducing the level of predation on juvenile salmonids. Estimates based on current research results are that this relocation will reduce avian predation in the estuary by nearly 40 percent. Also, East Sand Island provides the best available setting for managing and directing the dispersal of terns to other areas outside the estuary.

C. Yakima River Basin Water Enhancement Project

This project was authorized as Title XII of the Yavapai-Prescott Indian Tribe Water Rights Settlement Act of 1994, P.L. 103-434, and October 31, 1994.

The basin conservation program has two main purposes: to improve management of the Yakima River water supply and (thus) to improve streamflow conditions in the Yakima River basin. The program addresses three major elements: instream spawning and rearing habitat, tributary corridor migration, and water temperature issues. These elements are to be implemented based on the completion of feasibility studies, National Environmental Policy Act (NEPA) and permitting requirements, and public involvement requirements. The elements are subject to the availability of appropriated and cost-share funds. Project cooperators include the Yakama Nation, state of Washington, irrigation districts, and local governments. A savings and contingencies section affirms the water rights, treaty rights, and jurisdictions of the United States, the Yakama Nation, state and local agencies, and other public or private entities.

Discrete sections of the title authorize the development of a Yakima River basin conservation program, including the following:

- the development of water conservation plans, feasibility study of water conservation measures, implementation of those measures, and post implementation monitoring and evaluation;
- improvements to the Wapato Irrigation Project including irrigation demonstration projects; and

- a water supply enhancement program for fish and wildlife and irrigation in Yakima basin tributaries.

Other sections include electrification of Chandler Pumping Plant, augmentation of Kachess Reservoir stored water, and modifications to Cle Elum Dam and Reservoir. All these actions have aspects that could benefit resident and anadromous fish.

D. Cougar Dam Modification in the McKenzie River

The Corps, with several partners (NMFS, FWS, the U.S. Forest Service [USFS], Oregon Water Resource Department, and Oregon Department of Fish and Wildlife), is undertaking modifications to Cougar Dam to benefit water temperature in the McKenzie River Willamette Basin. The final construction designs are underway; construction will extend from 2000 to 2005. The dam modification will improve water temperatures below the dam and increase survival of key salmonid species such as spring chinook, winter steelhead, and bull trout. The project is expected to cost approximately $43.2 million dollars.

E. Buck Hollow Creek in the Deschutes River

The NRCS is undertaking the Buck Hollow Creek enhancement project under their Small Watershed Program (SWP). The SWP works through local government sponsors and helps participants solve natural resource and related economic problems on a watershed basis. Projects include watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres. Both technical and financial assistance is available.

Buck Hollow Creek is one of the best examples of a locally derived project that includes private landowners working to improve aquatic habitats. The project includes a number of land treatments to reduce soil erosion, sediment ponds, and plantings, among other treatments that will enhance the aquatic habitats in Buck Hollow Creek to benefit native salmonid species including steelhead and Chinook salmon. This project will be monitored to determine the merit of the project action and to help design similar future projects.

F. The Mitchell Act: Irrigation Diversion Screening Program

The Mitchell Act (Public Law 75-502, of May 11, 1938; and amended August 8, 1946, Public Law 79-676) authorized NMFS to construct and install devices in the basin to improve feeding and spawning conditions for fish, to protect migratory fish from irrigation projects, and to facilitate free migration of fish over obstructions.

The Mitchell Act gives NMFS the authority to take immediate action, if funding is available.

The Mitchell Act screening program operates in the basin tributaries above Bonneville Dam. It does not include any mainstem Columbia River diversions or tributaries below Bonneville Dam. It is applied primarily in northeastern Oregon and the Snake River basin in Idaho, as well as

other portions of Oregon and Washington. Washington involvement has been limited because the state water law that places the requirement for screening on the irrigator is being enforced. However, this limited involvement may change in the future, as new Endangered Species Act (ESA) listings increase the pressure to screen unscreened diversions and to bring screens up to current standards.

For the past several years, the annual budget for screening has been approximately $3,400,000. A Report to Congress (March 1995) stated that all major diversions are to be upgraded to current criteria by 2000; all minor diversions, by 2002. Since the available funding ($3,400,000) has been less than the estimated need (approximately $6,000,000 per year), the time line has slipped considerably. The state fisheries agencies are constructing and replacing as many screens as possible using available funds, but no new estimate for completion has been developed.

F. MULTI-SCALE ANALYSIS, PLANNING, AND IMPLEMENTATION

INTRODUCTION

Federal and state agencies within the Columbia River Basin (basin) generally agree that habitat recovery actions will be more successful if planned in a watershed context.

Several federal agencies are currently using watershed-based assessment to plan some of their resource management actions. These include the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) land management activities, Bonneville Power Administration (Bonneville) funding allocations, 303d-listed streams, total maximum daily load (TMDL) development, and a National Resources Conservation Service (NRCS) watershed planning process when assistance is requested by local groups through Soil and Water Conservation Districts. In addition, state agencies, tribes, and local governments and groups have been undertaking similar watershed efforts. These various agencies and groups, however, are often not coordinated, and their assessments and plans can have differing objectives.

Significant measurable progress in implementing meaningful recovery actions can be made only if the various state and federal agencies, tribes, and local governments operating in the basin coordinate their watershed assessments and planning efforts. This coordination would include the following:

- development of common assessment and planning protocols;
- development of compatible implementation schedules for the development of assessments, plans, and actions; and
- sharing data and technical resources.

There are several roadblocks to achieving this level of coordination, but it is likely that there remains enough flexibility in each agency's programs to achieve a significant level of coordination. **The federal and state agencies, and the tribes, should meet to investigate the flexibility in each agency's programs, and to determine the best approach to achieving a significant level of assessment and planning coordination by the end of fiscal year 2000**.

Engagement of private landowners and managers in watershed assessment and planning efforts is critical to successful implementation of meaningful recovery actions on nonfederal lands. At the site scale, development of voluntary farm plans or conservation plans that include actions to improve and protect water quality and fish habitats should be encouraged through incentive programs and assurance of adequate and timely technical assistance.

Consultation with regulatory agencies would be required to ensure that locally developed plans meet recovery plan criteria or Clean Water Act (CWA) goals. The development of TMDLs for 303d-listed streams is one process that addresses habitat problems on private lands. Implementation action to achieve TMDL allocations is still problematic, although new TMDL guidance ties load allocations to the development of water quality management plans (64 FR 46012, August 23, 1999). Regulatory and enforcement mechanisms through state water quality

laws should be used strategically to dissuade disregard for the laws and to encourage voluntary programs.

Several assessments and plans have already been completed at various scales within the basin (e.g., Columbia Basin Fish and Wildlife Authority [CBFWA]'s subbasin plans, Grande Ronde watershed plan). The conceptual framework for identifying habitat actions described here assumes that these existing assessments and plans would be used. However, the National Marine Fisheries Service (NMFS) is undertaking Endangered Species Act (ESA) recovery planning for evolutionarily significant units (ESUs) within the basin. Once recovery criteria are established, existing watershed plans can be reviewed to ensure the planned actions are sufficient to meet the recovery criteria.

The following outlines a conceptual framework for identifying habitat actions that is based on multi-scale analysis and planning. *This document does not reflect any final decisions by NMFS or the Federal Caucus. Instead, this Appendix section is intended to stimulate discussion among agencies and groups, and to facilitate coordination of assessments and plans.* In general, designing conservation and restoration actions involves three phases:

- an *assessment phase* that is mainly technical and directed at determining existing resource conditions;
- a *planning phase* that synthesizes technical information and outlines opportunities to improve or maintain processes, functions, and positive trends in conditions; along with socio-economic information to decide what actions to take; and
- *an implementation phase* that uses assessments and plans to take specific actions.

The following outline uses this three-phased approach.

OUTLINE OF A MULTI-SCALE ANALYSIS PROCESS

Multi-scale analyses allow for setting broad-scale content, strategies, and priorities that are then refined through a series of finer-scaled analyses to develop actions. The finer-scale analyses depend on local, more refined data to develop site-specific conservation and restoration actions. Those actions are more likely to be successful if they are designed in the context of broad-scale information (such as inherent production potential, watershed sensitivity, or disturbance regime) that can limit project outcomes. Multi-scale analyses are an iterative process where large-scale analyses both guide finer-scale analyses and integrate their results.

Multi-scale Analyses scales:

1. Columbia River Basin: 3rd-field hydrologic unit codes (HUC) equals 67,081,900 hectares
2. ESUs/Provinces: groups of 4th-field HUC average 1,000,000 hectares
3. Subbasin: 4th-field HUC averages 200,000 hectares
4. Watershed: 5th-field HUC ranges from 20 – 40,000 hectares
5. Subwatershed: 6th-field HUC ranges from 5 – 15,000 hectares

5. Stream Reach: (project scale analysis) Length equals 10 – 100 times the average channel width

Feedback Loop to Broader Scale Analyses: Multi-scale analyses are meant to be iterative: re-analysis occurs as new information becomes available, or as ecological conditions, management, or social needs change. Ideally, an area would move through the assessment processes from broad to fine scales; however, it is likely that some fine-scale assessments will be completed before the broader scales are completed. In such cases, finer-scale information can be used to improve the accuracy of broader-scale assessments. Information from all scales can improve assessments at any particular scale. This multi-scale approach to assessment and planning will provide a means to monitor success at the site, watershed, subbasin, and provincial scales to determine whether adaptive management changes are warranted. Monitoring is also needed to provide accountability to the public.

Columbia River Basin

The basin 3rd-field HUC's average 67,081,900 hectares.

Assessment Phase. Several basin-scale assessments have been completed for large areas within the basin. The USFS and BLM completed an assessment of conditions within the basin west of the crest of the Cascade Mountains, in conjunction with the Northwest Forest Plan (NFP) (FEMAT 1993). The two agencies are completing an assessment of the portions of the basin east of the Cascade Mountains, through their Interior Columbia Basin Ecosystem Management Project (ICBEMP). The Northwest Power Planning Council (NPPC) is completing an assessment of the entire basin through their Ecosystem Diagnosis and Treatment (EDT) analysis being carried out to assist in the development of alternatives for their Framework process.

Planning Phase. The NFP, ICBEMP, and the Framework alternatives are planning documents that address the basin. These planning documents outline broad-scale goals, objectives, and strategies that must be refined through finer-scale assessments and plans.

Implementation Phase. Basin level plans for various portions of federal lands are currently being implemented according to the provision of the NFP, PACFISH, and INFISH (and the NMFS and FWS biological opinions on these documents). The ICBEMP and the Framework alternatives are expected to enter their implementation phases in FY 2000.

ESU/Provincial scale

ESU/Provincial scale represents groups of 4th-field HUC that averages 1,000,000 hectares.

Assessment Phase. The NMFS has listed 12 species under the ESA in the Columbia River Basin. These areas vary in size, but are on the order of 1,000,000 hectares. The NMFS recovery planning responsibilities for ESA-listed anadromous salmonids will be carried out through establishment of technical and planning recovery teams at the ESU level. The technical recovery teams will assess viability at the ESU level, establish recovery criteria for viable salmon population (VSP), and identify currently and historically productive habitats. Membership on

the technical recovery teams is open to anyone who is qualified; it is expected that team members will come from federal and state agencies, tribes, and the private sector.

The U.S. Fish and Wildlife Service has listed a number of aquatic species. Some of these species have recovery plans; others have plans in progress. The FWS uses a similar recovery planning process.

A primary component of ESU-scale analysis, for NMFS, is the characterization of the population structure of all ESA-listed anadromous species. An ESU is usually composed of multiple populations. The NMFS recovery planning process will identify which of those populations must be at self-sustaining levels for ESU recovery; it will also establish recovery population levels for each of the critical populations. (The recovery population standard is termed VSP.) The identification of critical populations for ESU recovery is based on an analysis of population abundance, productivity, genetic integrity, and population structure. An assessment at the ESU scale should also provide a general characterization of conditions (topographic, geologic, meterologic, hydrologic, etc.), and the identification of information needed to conduct analyses at finer spatial scale. Analysis results will define a minimum set of issues, maps, and other relevant data that will guide the more detailed subsequent analyses in the multi-scale process.

Subbasins within the province should be categorized under two headings:

- those that are most critical for securing high-quality habitats,
- those that are most sensitive to further disturbance and that may therefore need specialized measures to prevent further degradation, and prioritized subbasins for recovery actions.

Agencies and other organizations can consider these categories to target their programs and efforts to benefit salmonids. The primary outputs of a provincial analysis are as follows:

- population recovery criteria,
- identification of the information required to conduct analyses at finer spatial scales,
- a coarse-scale characterization of the physical conditions within the province,
- a coarse-scale subbasin categorization leading to prioritized efforts at finer scales, and
- initial identification of the causes of fish survival problems.

Planning Phase. The planning aspect of the recovery process focuses on identifying the measures and actions necessary to achieve the recovery goals identified by the Technical Recovery Teams. While this phase of recovery planning has not yet been fully defined, the process will likely include the following:

- inventorying all state, tribal, and local conservation plans or planning efforts, as well as all existing Habitat Conservation Plans and 4(d) rule components in each planning area;
- evaluating these existing conservation plans and efforts to assess how well they address identified factors for decline and/or limiting factors, and the extent to which they collectively achieve the identified recovery goals;

- identifying and evaluating any additional and/or alternative measures or actions which are necessary to achieve the identified recovery goals;
- prioritizing the required recovery measures and actions and identifying the entity or entities responsible for implementing the measures and actions; and
- estimating the costs and time necessary to carry out the identified recovery measures and actions.

In addition, the process will include state, tribal, local government, and other stakeholder involvement to integrate other resource concerns (e.g., resident species concerns, control of erosion from agricultural lands, reduction of fire risk on forested lands). The identification of other resource concerns is essential to resolve points of potential conflict and potential mutual benefit; and to ensure that an ecologically and biologically sound approach to conservation and recovery are used.

Implementation Phase. Implementation at the provincial scale focuses on establishment of population and habitat recovery criteria by NMFS and the U.S. Fish and Wildlife Service (FWS).

Subbasin or Mid-scale review

Subbasin or mid-scale review represents a 4th-field HUC that averages 200,000 hectares.

Tributaries

The USFS and BLM are planning to use this scale to characterize resource status, risk, and opportunity, and to prioritize conservation and restoration activities on federally managed lands. The Northwest Power Planning Council's (NPPC) funding recommendations for anadromous species recovery projects is likely to be based on analysis at this scale. Other agencies (e.g., states, tribes, NRCS, Soil and Water Conservation Districts) also use this scale to **target and schedule** their activities (e.g., TMDL development, USDA environmental quality incentive programs, Washington state's TFW program).

Assessment Phase. Subbasin review aims to characterize ecosystem conditions and processes, and to identify the existing risks to resources from natural and human disturbances. Ecosystem status and risks are then related to management approaches and priorities for the subbasin. Management approaches define the primary land use activities occurring within the watersheds that comprise the subbasin. The management approaches should consider capacity of the watershed to absorb disturbance and the sensitivity of resources to disturbance. The basic components of the review include characterization of the major land use activities, their distribution and relative intensity across the watersheds in the subbasin, and identification of the status of and any existing risk to ecosystem processes and components.

Planning Phase. This information is used to establish appropriate integrated priorities for aquatic, riparian, terrestrial, recreational, and watershed management at the subbasin scale. Stakeholder involvement is also critically important at the subbasin scale; most likely to be interested would be tribes and existing regional groups such as provincial advisory councils (PACs), regional advisory councils (RACs), Soil and Water Conservation Districts, larger-scale watershed councils, or regional user group organizations. Funding sources should be

coordinated and targeted toward priority watershed areas. Agency programs and authorities should be used to target watersheds that will receive funding to develop watershed restoration plans. Federal and state natural resource agencies should prepare to provide interdisciplinary technical assistance to targeted watershed recovery planning efforts. At the subbasin scale, a marketing and outreach program should be designed and implemented to help bring to targeted watersheds management plan groups the information that is relevant to anadromous and resident species and water quality recovery goals.

Implementation Phase. The primary outputs of a subbasin review are as follows:

1. Identification of conservation watersheds based on the most recent best available population and habitat status and watershed connectivity information that is available. This process includes identification of current population stronghold[4] watersheds and watershed connectivity based on population status.
2. Characterization of the dominant land uses and their distribution and intensity across the watersheds in the subbasin.
3. General characterization of the existing risks to ecosystem health, the range of options available for reducing risk, a description of risk the treatment options pose, and recommendations for reducing or avoiding risk.
4. Prioritization of watersheds for conservation and restoration through a numerical ranking system, based on each watershed's importance for the recovery of the species.
5. Development of criteria to focus federal land management efforts on watersheds most important to species recovery. On nonfederal lands, criteria would be used to encourage voluntary locally led efforts within critical watersheds.
6. Prioritization of future analysis needs at finer scales to ensure recovery goals are achieved.
7. Identification of performance measures to ensure that watershed-scale assessments and plans are completed in priority areas, and conditions are improving over time.

Mainstem

Mainstem habitat is addressed primarily in the Hydro Appendix and in the hydro section of the All-H paper. However, certain aspects of mainstem habitat protection and restoration do not relate directly to hydropower operation: important habitat aspects such as shallow water habitats, side channels and sloughs, wetlands, and aquatic plants in shallow water that use the assessment, planning and implementation framework. There may be a number of opportunities to improve the habitat diversity, complexity, and productivity of mainstem habitats. These opportunities need to be explored in the mainstem reaches of the Columbia, Snake, and Willamette rivers below dams that create complete migration barriers (e.g., Hells Canyon and Chief Joseph).

Assessment Phase. Little is known about how salmonids use and respond to changes in the mainstem and estuary habitats. Historically, fall chinook populations produced very large

[4]Strongholds include the following: 1) Important high quality watersheds that currently support clean water; 2) Support habitats associated with strong species populations; 3) Support habitats associated with core population of threatened or endangered species or those needed to refound extirpated populations; 4) Support habitats for narrow endemic or fringe populations.

numbers. Restoring potential hot spots of productivity in the mainstem could play an important role, not only in salmon recovery generally, but also in meeting tribal and other harvest objectives. Very little is known about where and what actions to prioritize to improve mainstem habitat; thus, the first step for mainstem habitat is to a survey the habitat. At the Basin scale, an interdisciplinary science team should develop a protocol and sequence for mainstem habitat surveys and studies (for the Columbia, Snake and Willamette rivers) below migration barrier dams.

Planning Phase. Based on the surveys and assessments, an implementation plan should be developed with which to test promising approaches to mainstem habitat improvements, while maximizing opportunities to learn. Plans should identify actions that maximize opportunities to learn about the best locations and means for improving habitat

Implementation Phase. Agencies and tribes should implement an adaptive management program of mainstem habitat improvements. Select actions should be implemented. Monitoring and evaluation must be developed and implemented for each action, because feedback on these actions will be critical for learning how to treat mainstem issues.

Watershed Scale

Watershed scale represents a 5th-field HUC that ranges from 20 – 40,000 hectares.

The watershed scale has the widest array of agency and groups that will be conducting assessment and developing plans:

- the states will be developing some TMDLs at this scale;
- the NRCS (in conjunction with its conservation partners) coordinates and integrates many of its programs at this scale;
- the USFS and BLM use watersheds analysis to assess conditions of sensitive resources at this scale, and aggregate projects at this scale for ESA-section 7 consultations.

Agreements should be developed among federal and state agencies, Soil and Water Conservation Districts, watershed councils, tribes, and other local groups to develop watershed management plans. Technical assistance planned at the subbasin scale is provided by federal and state agencies at the watershed scales. These assessments and plans should be funded by cooperating federal, state, tribal, and private groups.

Assessment Phase. Watershed-scale analysis should provide a comprehensive ecosystem assessment that integrates the physical, biological, and social processes within the watershed. Several agencies and groups have outlined procedures for conducting analysis at this scale (e.g., Federal Guide for Watershed Analysis, 1995; Washington's Forest Practices Act Board Manual; Washington Department of Ecology watersheds assessment; and so on).

An evaluation of the existing analyses and coordination of common elements and implementation schedules would be most beneficial at the watershed scale. The primary technical outputs include examples such as the following:

1. Synthesis and interpretation of existing resource condition information using appropriate modeling or analyses approaches.
2. Identification of risks to populations and their habitats through identifying trends in the physical characteristics or water quality in the subbasin that could jeopardize existing populations or adversely affect any restoration or enhancement strategies.
3. Development of short- and long-term management strategies that maintain, protect and enhance current stronghold watersheds.
4. Development of short- and long-term management risk reduction strategies that restore watersheds to increase the number, size and connectivity among stronghold watersheds.
5. Specific performance measures that are related to watershed-scale objectives that address the sub-watershed and reach scales.

Planning Phase. Information from the assessment phase is used to establish appropriate integrated priorities for aquatic, riparian, terrestrial, recreational, and watershed management at the sub-watershed scale. Stakeholder involvement is very important at the subbasin scale, and most likely to be parties with direct interests in the watershed because they live, recreate, work, and/or have an existing user right or permit there. Tribes, watershed councils, landowners, and local user groups are examples of parties who would be interested in planning at the watershed level. Their interests and desires should be incorporated into the management of the watersheds within the capabilities and sensitivities of the ecosystems.

Implementation Phase. The primary outputs include the following:

1. Watershed management plans that contain recommended goals, objectives, and actions, and that identify who is responsible for implementing the action, and how much the actions will cost.
2. Numerical ranking system used to prioritize conservation and restoration based on each area's importance to the recovery of the species and return of the watershed to a stronghold condition.
3. Recommended timing, sequencing, and general location for each management recommendation.
4. Anticipated rates and times for achieving the management objectives for each management recommendation.
5. Risk management plan that describes existing risks to ecosystem health, the treatment options for reducing risk, a description of risk the treatment options pose, and recommendations for reducing or avoiding risk.
6. Monitoring plan that describes the "how to" for reporting on specific performance measures.

Subwatershed and Site Analysis

Those involved in sub-watershed scale assessments include the following: NMFS, FWS, USFS, BLM, tribes, or any other landowner responsible for the implementation of projects. The NRCS

provides technical and financial assistance to individual landowners or land managers at this scale to develop and implement conservation plans. The primary purpose of subwatershed and reach-scale analysis is site-specific planning that will lead to project implementation. Assessments and plans at the subwatershed scale provide the methods, techniques, and mitigation measures needed to complete projects that achieve goals and objectives established during broader-scale analyses.

Assessment Phase. Assessments at the sub-watershed scale are those needed to implement projects. This step follows National Environmental Policy Act (NEPA) guidelines if federal funding is used. If projects are undertaken on private land without federal assistance, activities could be planned under programs such as a habitat conservation plan (HCP), individual conservation plan or farm plans. At the subwatershed scale, where site-specific project are designed, the assessment focus changes from determining what kinds of actions (and in what general locations) are needed to determining what direct, indirect, and cumulative affects the site-specific actions will have on the area's resources. Here, the information from broader scales on priorities, causes of problems, bio-physical capabilities, and sensitivities should be used to justify the purpose and need for the action. There should be a clear link between objectives at broader scales to project actions. The effects of the actions are placed in context provided by synthesis of assessment information from broader scales. The specific criteria that will maintain properly functioning conditions should be developed for implementation at the subwatershed scale. Assessments should focus on the following:

1. In subwatersheds identified as having currently or potentially high fish production potential, determine the distribution of stream reach conditions across the sub-watershed appropriate to maintain high levels of fish production.
2. In all subwatersheds, identify reach level standards/criteria that must be met to ensure properly functioning habitat and water quality conditions are maintained. Properly functioning condition is the sustained presence of natural habitat-forming processes in a watershed (e.g., riparian community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation (NMFS, 1999).

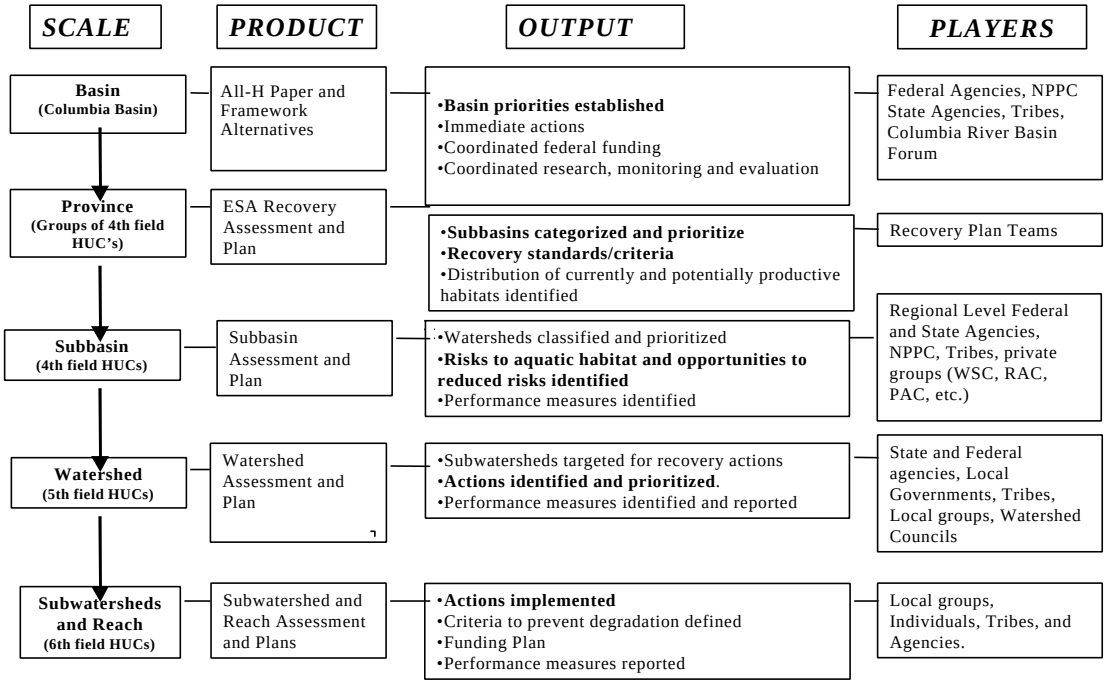
Planning Phase. Primary outputs include project design, location, timing, and mitigation measures. In this final step in the planning process, risk management focuses on treatment options for reducing risks and designing project elements that reduce or avoid risk.

Implementation Phase. Implementation of actions occurs at this scale. Federal or state agencies, tribes, or individual landowners, with appropriate technical and financial assistance, implement habitat conservation and recovery actions such as the following:

1. Land acquisition,
2. Obtaining instream flows,
3. Irrigation canal consolidations,
4. Irrigation canal screening,
5. Prescribed burning,

6. Upland and riparian vegetation planting,
7. Road treatments,
8. Land use management alternatives,
9. Fencing, buffers and other Best Management Practice (BMP), and
10. Monitoring identified performance measures.

Figure F.1 Roadmap to Habitat Recovery



REFERENCES CITED

NMFS. 1999. Habitat Approach. Memorandum for NMFS/NWR staff from Rick Applegate and Donna Darm. August 26, 1999. (Available from NMFS, Portland OR).

G. LIST OF TOOLS FOR IMPLEMENTING SITE/PROJECT STRATEGIES

Columbia River Inter-Tribal Fish Commission. 1994.
A Coarse Screening Process for Evaluation of the Effects of Land Management Activities on Salmon Spawning and Rearing Habitat in ESA Consultations (Rhodes et al., 1994).

Columbia River Inter-Tribal Fish Commission. 1999.
Protecting and Restoring Watersheds – A Tribal Approach to Salmon Recovery.

Federal Interagency Stream Restoration Working Group. 1999.
Stream Corridor Restoration: Principles, Processes, and Practices.

Oregon Watershed Enhancement Board. 1999.
Oregon Aquatic Habitat Restoration and Enhancement Guide.

Pacific Fisheries Management Council. 1999.
Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and recommended Conservation Measures for Salmon. Portland, OR.

U.S. Department of Agriculture, Natural Resources Conservation Service.
Field Office Technical Guide. (Available at NRCS field office locations)

U.S. Department of Agriculture, Natural Resources Conservation Service.
Streambank and shoreline protection. *In:* Engineering Field Handbook, Part 650, Chapter 16.

U.S. Department of Energy, Bonneville Power Administration. 1997
Watershed Management Program. Final Environmental Impact Statement. DOE/EIS-0265. Portland, OR.

U.S. Environmental Protection Agency. 1993.
Guidance specifying management measures for sources of non-point pollution in coastal waters. USEPA. Office of Water. Washington, D.C. No. EPA840-B-92-002

Washington Department of Fisheries and Wildlife. 1999.
Restoring the Watershed: A citizen's guide to riparian restoration in western Washington.

H. SUMMARY OF EXISTING WATERSHED GUIDANCE DOCUMENTS

Bureau of Land Management. 1998.
Riparian Area Management. TR1737-15.

Conservation Technology Information Center. 1999.
Building Your Watershed.

Environmental Protection Agency. 1992.
The Watershed Protection Approach. EPA840-S-93-001.

Federal Interagency Stream Restoration Working Group. 1999.
Stream Corridor Restoration: Principles, Processes, and Practices.

Oregon Department of Environmental Quality, Water Quality Division. 1997.
Guidance for Developing Water Quality Management Plans That Will Function As TMDLs for Nonpoint sources.

Oregon Watershed Enhancement Board. July 1999.
Oregon Watershed Assessment Manual.

Terrene Institute. 1993.
Clean Water in Your Watershed: A Citizens Guide to Watershed Protection.

The Oregon CRMP Task Group. 1998.
Coordinated Resource Management Planning Notebook.

USDA Natural Conservation Service. 1999.
National Planning Procedures Handbook.

USDA Natural Conservation Service. 1998.
Areawide Conservation Planning Primer.

Washington Department of Ecology. 1995.
Guidance for Conducting Water Quality Assessments and Watershed Characterizations under the Nonpoint Rule.

I. PRIORITIZATION CRITERIA FOR THE COLUMBIA RIVER BASIN

Aquatic restoration in the Columbia River Basin (basin) is being planned, funded, and implemented by a number of federal and state agencies, tribes, local governments and stakeholder groups. To be effective, these important efforts should be complementary and coordinated. One mechanism to improve coordination (short of restructuring existing processes and agency authorities) would be to develop coordinated priority criteria. A number of groups recognize the need for and have developed priority criteria (Bradbury et al., 1995; Frissell, 1997, NWPPC, 1999; USFS, 1999). The experience of these groups should be used to develop coordinated criteria for the region. Such criteria are needed to ensure that collective restoration efforts in the basin amount to the greatest, most cost-effective benefits.

The catalyst for aquatic restoration in a given subbasin or watershed may come from various sources. One important source is Endangered Species Act (ESA) requirements for ensuring the persistence of native species. The following approach outlines those ESA components that should be included in priority criteria for aquatic habitat restoration. This approach is intended as a starting point for regional dialogue and regional development of priority criteria for habitat actions. Ultimately, habitat priority criteria should be integrated with priority criteria in the other sectors affecting ESA-listed anadromous salmonids (i.e., hatcheries, harvest, and hydro) and with other mandates such as the Clean Water Act (CWA).

The following approach addresses multiple scales (Basin, province/evolutionarily significant unit [ESU], subbasin, watershed, etc.) and defines the components that priority criteria should address at each scale. The criteria would be developed during the multi-scaled assessment and planning process. The components of the criteria change as the scale changes, as follows:

- At the **basin scale, provincial areas are prioritized** for reviews based mainly on degree of threat to ESA-listed species survival.
- At the **provincial/ESU scale, subbasins are categorized** and prioritized based mainly on existing and potential habitat productivity.
- At the **watershed scale, subwatersheds are targeted for project planning** based mainly on the need to and feasibility of addressing the causes of identified problems.
- At the **site scale, actions are prioritized** for implementation based on a logical sequencing of treatments (i.e., expanding or connecting to high-quality habitats or productive areas, resolving sources of bank instability before/or instead of applying direct bank treatments). Figure I.1, found on page 83, illustrates this approach to habitat restoration prioritization.

The purposes of coordinating criteria development are as follows:

1. To provide objective and consistent criteria for allocating resources to actions that have a high likelihood of benefiting ESA-listed species.
2. To assure that individual actions integrate into a synergistic set of actions.

3. To assure that actions are planned and implemented by priority, to address imminent risks to ESA-listed species, prevent further habitat and water quality degradation, protect high-quality habitats, and recover habitats.
4. To integrate existing watershed objectives and strategies identified by various agencies or groups (such as established watershed councils) working on restoration in the basin with ESA recovery objectives and strategies.

EXISTING GUIDANCE ON ESA PRIORITIZATION

ESA-listed species recovery plan guidelines (48 FR 43103, September 21, 1983; and National Oceanic and Atmospheric Administration (NOAA) recovery planning guidelines 1992) provide the following direction in developing restoration priority criteria:

- **Four-factor System.** The direction outlines a four-factor system for determining what actions should be implemented for the recovery of species:

  Factor 1: The species with the highest degree of threat have the highest priority for preparing and implementing recovery plans.

  Factor 2: Priority would go to species with the greatest potential for success. Recovery potential is based on how well biological and ecological limiting factors and threats to the species' existence are understood and how much management is needed.

  Factor 3: Taxa (a taxonomic group) that are most genetically distinct should receive priority within any given category of degree of threat.

  Factor 4: Priority is given to those species that are or may be in conflict with construction or other development projects or other form of economic activity.

- **Task Priority.** A task priority is used to rank tasks (actions). The task priorities are as follows:

  Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

  Priority 2: An action that must be taken to prevent a significant decline in species population /habitat quality, or some other significant negative impact short of extinction.

  Priority 3: All other actions necessary to provide for full recovery of the species

COLUMBIA BASIN-SCALE HABITAT PRIORITY CRITERIA

Development of a final set of basin-scale priority criteria will depend on integration of habitat priority criteria with priority criteria in the other sectors (i.e., hatcheries, harvest and hydro) and with other mandates such as the CWA.

At the basin scale, the following are important components in establishing habitat restoration priority criteria:

1. The four-factor system outlined in the *Federal Register* should be used to **rank and schedule** provinces for ESA recovery planning, and to focus ESA-listed salmonid recovery efforts led by the various state, federal, tribal, and private groups working in the basin.

2. The task priority criteria outlined in the *Federal Register* should be used to prioritize immediate actions that are proposed without the context of a subbasin plan. These task priority criteria are used in the All-H paper as criteria for immediate actions. The All-H's immediate action criteria identify actions that (1) are needed to reduce imminent risk; and (2) will secure high-quality or productive habitats; or will result in immediate (within 5 years of implementation) and certain improvement in fish survival. The following criteria are in descending order of priority:

    a. an action addressing protection of an endangered ESU will receive higher priority than an action that targets a threatened ESU;

    b. an action addressing protection or rebuilding of both endangered and threatened ESUs will have a higher priority than an action that addresses only one or the other;

    c. protection of habitat for naturally reproducing, indigenous populations over habitat for artificially supplemented populations (where they are not considered part of the ESU); and

    d. securing and protecting habitats (priority over restoring or enhancing habitats).

Who: National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (FWS) officials, federal and state agencies and tribes.

PROVINCE / ESU-SCALE HABITAT PRIORITY CRITERIA

Objective, measurable population and habitat criteria will be developed for ESA-listed ESUs in the basin as part of the ESA recovery planning process. Once ESUs meet these delisting criteria, they will be removed from the Endangered Species list. Delisting criteria establish measurable indices for overall ESU recovery. Delisting (or recovery) criteria for populations will be based on concepts related to maintaining viable salmon populations (abundance, productivity, genetic integrity, and population structure). For habitats, recovery criteria will be based on a distribution and classification of current or potential productive capacity.

In an ideal situation, the restoration priority criteria would be used to determine priority locations and actions needed to reach the delisting/recovery criteria. Unfortunately, the establishment of delisting/recovery criteria for all ESUs may take up to five years. However, agencies and groups can still effectively prioritize actions and begin implementing projects using a multi-scaled assessment and planning process (described in Section F). Then, when the population and habitat recovery criteria are developed, planned actions can be reviewed for consistency with the

delisting criteria and adjusted according to any new information provided by the delisting criteria/recovery planning process.

Components for habitat priority criteria at the provincial/ESU scale include: the following

1. Subbasins within the province should be categorized and prioritized for assessment and planning, based on the four-factor system, tribal trust obligations, and State priorities for the total daily maximum loads (TMDLs).
2. The subbasin categorization should also include policy/social criteria such as the maturity of present subbasin/watershed partnerships.
3. Once recovery planning has identified the population and habitat delisting/recovery criteria (by identifying populations key to maintaining or establishing ESU viability, and the habitats that are currently or potentially productive and important for these populations), this information should be used to target priority action areas.

Who: NMFS, FWS, and regional level representatives from federal and state agencies, tribes, and the private sector.

SUBBASIN SCALE HABITAT PRIORITY CRITERIA

At the subbasin scale, the state and federal agencies, tribes, and local watershed councils should develop restoration priority criteria that address ecological and socio-economic issues. They should use the restoration priority criteria to prioritize watershed assessment, watershed planning, and actions. Federal and State agencies should use the priority criteria to target their programs and outreach efforts. The outreach efforts should include providing watershed councils and other private groups with information and technical support that would allow them to develop priorities based on the criteria such as those listed below.

Components for priority criteria at the subbasin scale include the following:

1. Watersheds with conditions that may pose imminent risk to populations.
2. Watersheds with high existing or potential productive capacity for ESA-listed species.
3. Watersheds that connect to or build upon high-quality habitats for anadromous or resident species.
4. Risks to the conditions of aquatic ecosystem components and processes from land ownership and use patterns.
5. Status/efforts of existing partnerships, local councils.

Who: Watershed councils, tribes, counties, soil and water conservation districts, federal regulatory and land management agencies.

WATERSHED SCALE HABITAT PRIORITY CRITERIA

The priority criteria from the broader scales will identify the priority watersheds for restoration of ESA-listed species and their habitats. Again, the priority should be a product of criteria that

integrate other sectors affecting ESA-listed anadromous salmonids (i.e., hatcheries, harvest and hydro) and with other mandates such as the Clean Water Act. Once federal and state agencies, tribes, or private landowners are focused on a particular watershed, they can then begin to identify long-term recovery actions and the sequence for implementing them. In watersheds with mixed ownerships, agencies should use criteria developed at this scale to target available technical and financial resources to facilitate locally led efforts to develop watershed-scale plans. In addition, agencies would have the opportunity to target and schedule their resources to facilitate implementation of completed watershed-scale plans. Federal and state agencies, and tribes, would also focus on these priority watershed and integrate their efforts with non-federal ownerships.

Components for habitat priority criteria at the watershed scale include the following:

1. present and historic range of watershed conditions;
2. documented association of historically productive life-history strategies (i.e., historic times and locations of spawning, rearing, and migration), with specific types and distribution of historic habitat;
3. existing and potentially productive habitat for species of concern, particularly habitat supporting historically productive life-history components of those species;
4. existing risks to ecosystem condition due to natural and human-induced disturbance processes;
5. the opportunity for reducing risk or improving conditions based on the following:
    a. identification of areas that would benefit most from rest from human disturbance, rather than active restoration;
    b. identification of areas needed to provide connectivity among productive or potentially productive habitats;
    c. identification and treatment of causes of problems rather than symptoms to the extent possible (i.e., this criterion should not paralyze recovery efforts);
    d. identification and treatment of water quantity problems;
    e. identification and treatment of water quality problems; and
    f. identification and treatment of habitat quality and complexity.

Who: Watershed councils, tribes, counties, soil and water conservation districts, Federal and state natural resource management agencies, with technical assistance and review by regulatory agencies.

SUB-WATERSHED/REACH SCALE HABITAT PRIORITY CRITERIA

At this scale, risks, opportunities and desired results (for CWA, ESA, local objectives) will have been identified through multi-scale assessment and planning. At the sub-watershed scale, the need is to develop a sequence of actions and specific projects that can be implemented on the ground. These actions and projects should collectively add up to what is needed to achieve the local objectives, including the local area's role in meeting the recovery/delisting criteria. Land managers and owners who voluntarily implement habitat recovery actions based on these criteria

would receive some form of assurances from the regulatory agencies. Federal land management agencies would identify and implement projects on federal lands, while coordinating their watershed effort with non-federal efforts.
Recent summaries of the effectiveness of restoration actions (NRC, 1996; ISG, 1999) indicate that restoration would be more successful if founded on treating whole watersheds, using the natural regenerative processes of the ecosystem, and targeting the source of problems rather than symptoms. The following is provided as guidance for choosing effective restoration actions:

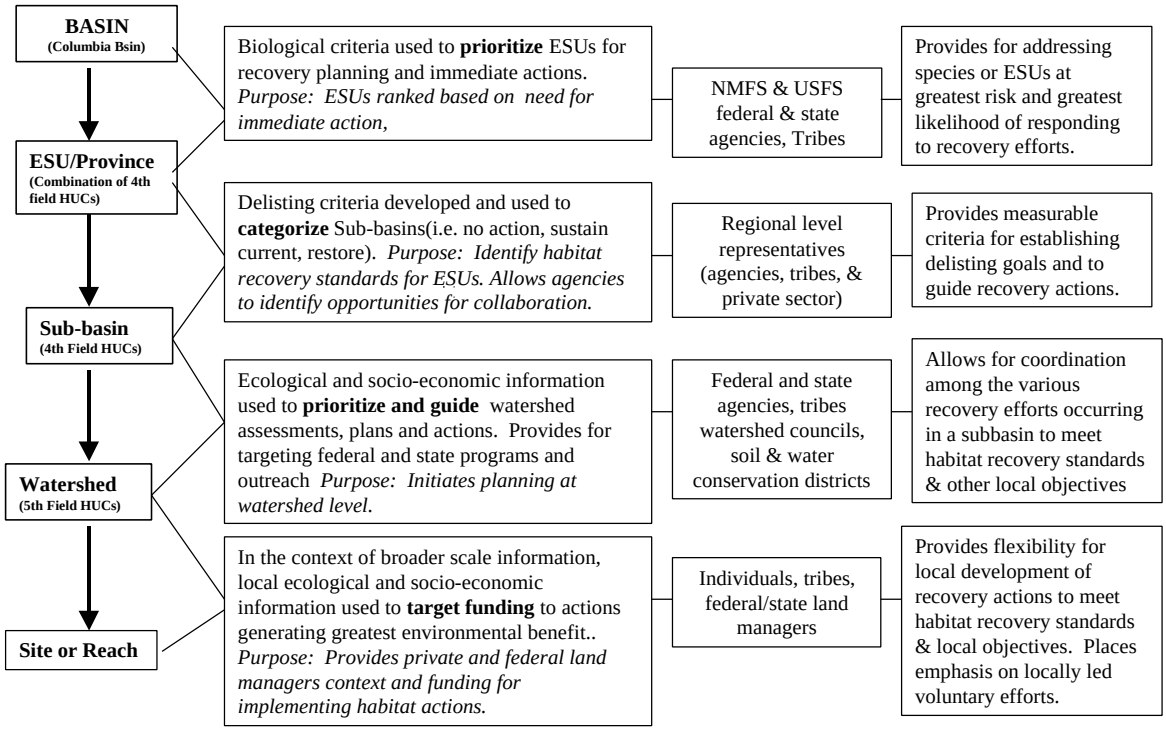
1. Use passive regeneration to improve habitat quality in locations where natural recovery can occur in the desired time frame.
2. Use active remediation to improve habitat quality in locations where passive regeneration is not feasible and where salmon can benefit from the actions. Active remediation is an effort to use natural (preferably) or artificial means to temporarily or permanently fill an ecological void caused by habitat degradation. Examples include actions ranging from planting willows to channel re-meandering.
3. Treating instream habitat conditions (high sediment levels) that are the symptoms of larger watershed problems (high road density or widespread bank alteration) can result in further habitat degradation of habitat conditions; therefore, when using active restoration techniques, schedule activities to address the sources of problems first.
4. Use monitoring and adaptive management to ensure that project objectives are met.

Who: Land management agencies, resource management agencies, tribes, conservation organizations, and individual landowners and managers with technical assistance and review by regulatory agencies as requested.

The following page shows a "roadmap" for prioritizing actions at the levels, as discussed above. Key terms are as follows:

- **Prioritization Criteria** - biological, social, political, or economic information that focuses habitat restoration efforts in geographic areas by individuals where success of meeting ESA recovery goals are the greatest.
- **Delisting Criteria** - objective, measurable criteria which, when met, would result in a determination in accordance with ESA § 4(b), that the species be removed from the endangered species list.
- **Prioritize** - to rank geographic areas from most to least important for habitat recovery.
- **Categorize** - to aggregate areas into broad groups with similar habitat recovery goals and objectives (e.g. areas where current populations need to be protected, areas with potential to restore to historic levels, etc.).
- **Guide** - to allocate resources to habitat recovery to watershed planning efforts meeting habitat recovery goals and objectives.
- **Target** - to provide implementation funding to those actions that generate the greatest habitat benefit per dollar expended.

Figure I.1: ROADMAP FOR PRIORITIZING ACTIONS



REFERENCES

Bradbury, B., W. Nehlsen, T.E. Nikelsen, K.M. S. Moore, R.M. Hughes, D. Heller, J. Nicholas, D. L. Bottom, W. E. Weaver, R.L. Beschta. 1995. Handbook for Prioritizing watershed Protection and Restoration to Aid Recovery of Native Salmon.

Frissell, C. A. 1997. Ecological Principles. Pp. 96-115 *in* J. E. Williams, C.A. Wood, and M. P. Dombeck, eds. Watershed Restoration: principles and practices. American Fisheries Society. Bethesda, MD.

ISG (Independent Scientific Group). 1999. Return to the River: Scientific Issues in the Restoration of Salmonid Fishes in the Columbia River. Fisheries: 24 (3):10-9.

NRC (National Research Council). 1996. Upstream: salmon and society in the Pacific Northwest. Report of the Committee on Protection and Management of Pacific Northwest Anadromous Salmonids for the National Research council of the National Academy of Sciences. Nation Academy Press, Washington, DC.

NWPPC (Northwest Power Planning Council). 1999. Fiscal Year 2000 Annual Implementation Work Plan funding recommendation Draft 4 of the "Rolling Memorandum.

Memorandum from the NWPPC Fish and Wildlife Staff to the Council members, September 9, 1999.

USFS 1999. Unpublished report. An interim watershed restoration strategy. A commitment made as part of the Biological Opinion for chinook salmon and steelhead. USDA Forest Service Pacific Northwest Region, Portland, OR.

J. PERFORMANCE MEASURES AND STANDARDS

The following is a conceptual beginning to performance measures and standards for inclusion in the All-H paper and recovery planning for the Columbia River Basin. It attempts to outline an approach. This document includes a number of concepts currently in experimental and developmental stages (e.g., the VSP, H-VSP, and PFC concepts). The ultimate utility of these concepts to guide performance measure/standards is still under development. This discussion has been drafted to illustrate the general framework and components for performance measures/standards, and to generate an organized discussion of this topic. The goal for this section is to link recovery activities to recovery objectives and analysis and monitoring processes. Please provide comments that indicate whether this general approach is useful and whether the outlined components are those that will, when more fully developed, be useful.

THE ROLE OF PERFORMANCE MEASURES AND STANDARDS

Performance measures are those direct measures or estimates of biological or ecological attributes that indicate the degree to which management activities are achieving specific goals. Alternately, performance standards are quantitative values associated with specific levels of performance. Conceptually, performance measures provide the link between broad goals and objectives and those activities needed to achieve specific biological or ecological standards. In the context of recovery planning, the broad objective is to recover anadromous salmonids. An overall goal in that recovery objective may be to achieve conformity with the water quality standards of the Clean Water Act (CWA) throughout the basin. The performance measure associated with this goal could be the cumulative number of Total Maximum Daily Loads (TMDLs) developed and implemented by each of the states in basin. Performance standards tiered to this measure would include specific water quality parameter values.

In the context of recovering anadromous fish species, performance measures are used to evaluate progress towards attainment of specific numerical population and habitat performance standards of abundance or condition. An important source of core performance standards will be those criteria necessary for delisting as identified by the recovery teams. Individual performance standards could include the total number of viable populations necessary to recover each evolutionarily significant unit (ESU) and, for the water quality example above, specific state water quality standards assessed at the subwatershed or reach scale.

Designing meaningful performance measures and standards for salmonid recovery is a complex task. Recovery of anadromous salmonids requires the identification of necessary population and habitat criteria and comparable standards over the full ESU. -Population and habitat performance measures and standards must be integrated spatially, but must also fortify allied measures and standards at individual and multiple spatial scales (e.g., basin, ESU, subbasin, watershed, subwatershed, and reach). Within this multi-scale context, appropriate habitat performance measures and standards should reflect the spatial scale being addressed. In most cases, performance measure specificity will vary inversely with spatial scale. A multi-scale

framework provides an efficient, logical mechanism for establishing and linking the performance measures and standards needed to achieve the recovery of anadromous salmonids.

Performance measures and standards should be developed at all scales of analysis and planning — including basin-wide, provincial, watershed, subwatershed, and reach. Currently, basin-wide performance measures are being developed independently to satisfy the goals and objectives of regional planning efforts and regulatory programs (i.e., Northwest Forest Plan monitoring plan, Interior Columbia Basin Ecosystem Management Project [ICBEMP] objectives and standards, TMDL development criteria). In most cases, attendant performance standards remain to be developed. The section on **Coordination** (below) describes these basin-wide habitat goals and their relationship to allied performance measures and standards. Here, basin-wide performance measures and standards are presented, along with a description of the types of performance measures that will be developed through recovery planning and other processes.

In general, two types of performance measures and standards (ecological and managerial) will be described at each spatial scale:

- Ecological performance measures and standards are based on the population biology and habitat ecology of ESA-listed species. These measures and standards relate to the concept of viable salmon population (VSP) and the properly functioning habitat (watershed, riparian, and stream) conditions necessary to support viable salmon populations (H-VSP). These measures and standards evaluate progress toward, or define, VSP and H-VSP recovery criteria.
- Managerial performance measures and standards are used to assess the implementation of actions and programs (e.g., action or program completed - yes/no).

PERFORMANCE MEASURES, STANDARDS, AND RECOVERY PLANNING IN THE COLUMBIA RIVER BASIN

Recovery planning entails the establishment of objective, measurable standards or criteria which, when met, will result in a determination that the species can be removed from listing. Implicit within the recovery planning process is the identification, development, and implementation of programs and activities necessary to achieve those recovery criteria. Performance measures provide a system of continuous evaluation of the effectiveness of those actions and programs in moving toward and achieving those criteria.

The recovery of anadromous fish ESUs requires a hierarchical spatial framework whereby ecological and managerial considerations and limitations at each spatial level provide the contextual and logical basis for conservation activities at subsequent lower levels. Consequently, performance measures and standards used to evaluate progress towards species recovery are defined at multiple levels:

- At the scale of the basin, the performance measures will be general and related to implementation of priority programs, activities, and near-term actions that will reduce immediate threats to ESUs.
- Province-wide or ESU-level performance measures and standards provide a basis for assessing progress against broad recovery goals and objectives at the large spatial scales

encompassed by the ESUs. ESUs are usually composed of multiple populations. The ESU analysis informing development of recovery criteria will identify those populations within the ESU considered critical for recovery, and the amount and distribution of high-quality habitats needed to support critical populations. At this level, recovery activities will be related to VSP and H-VSP, and performance measures will be identified within the context of the VSP and H-VSP criteria.

- Finer-scale watershed-level or population-level performance measure and standards evaluate progress toward specific numeric standards linked to recovery criteria for individual watersheds and subwatersheds. At the watershed scale, population numerical criteria will identify the number of fish required for a population to be considered viable (VSP). Commensurate specific freshwater habitat (H-VSP) numeric standards will reflect aquatic, riparian, and upland ecosystem conditions necessary to recover and conserve the populations and the ESU at the levels identified by the recovery criteria.

Performance measures at all spatial scales, as well as the additional numeric standards attendant to the finer spatial scales, require the contextual basis of the recovery planning analysis and process for development. However, examples of relevant performance measures and standards are provided below.

Basin-scale Performance Measures and Standards

The basin measures and standards provide a context in which to evaluate the overall success of combined recovery efforts. The large spatial scale compels these measures to be programmatic in scope, general in nature, and often structured as aggregate summaries of ongoing actions across all finer spatial scales. Consequently, performance measures at this scale may have a managerial bias, with many ecological performance measures increasingly applicable only at finer spatial scales. Examples of potential basin-scale performance measures include the following:

Ecological

Examples might include the following:

- Show an improving trend (>10 percent per decade) in the number of watersheds within the basin with high-quality aquatic habitat, as measured by an appropriate metric by 2005; continue to shift watersheds toward improved condition until a distribution consistent with VSP and H-VSP criteria is achieved.

- Decrease the CWA, 303(d) water-quality-limited stream segments within each state within the basin. The rate of decrease of 303(d) stream reaches should match state schedules for implementing TMDLs (see Attachment J.1, Tables J.A1-J.A3).

Managerial

Examples might include the following:

- Recovery plans for all ESUs within the basin listed as endangered, fully developed by 2002.

- Recovery plans for all ESUs within the basin listed as threatened, fully developed by 2005.

- Meet state schedules for the implementation of TMLDs to address CWA, 303(d)-listed streams.

ESU/Provincial-scale Performance Measures and Standards

ESUs are composed of groups of subbasin (groups of 4th field HUCs); therefore, ESU level population and habitat measures and standards are developed at the provincial scale. Measures and standards at this scale are much more specific than basin-wide level measures and standards. The VSP analysis will help set ESU-level recovery goals and criteria by exploring the value of key population level parameters, and then relating the viability of individual populations to the viability of the ESU as a whole. As preliminary information for the recovery team, the National Marine Fisheries Service (NMFS) Northwest Science Center has developed the data requirements, data analysis, and interpretation process that uses VSP concepts to set recovery criteria (Bilby et al. 1999; NMFS 1999). An example of the H-VSP process for the Snake River Spring/Summer Chinook ESU has been provided by the NMFS Northwest Science Center and is included in Section K.

Ecological

Examples might include the following:

- Identification of the watersheds and populations key to the recovery of the ESU.
- Establishment of broad habitat standards based on overall subbasin sensitivity and predominant land use activities (e.g., water quality standards for toxic chemicals, temperature, percent of the subbasin where instream flow requirements have been secured).

Managerial

An example might be the following:

- Completion of subbasin plans identifying priorities for watershed analyses and identifying categories of likely management actions.

Watershed-scale Performance Measures and Standards

Watershed-level performance measures and standards include numerical population criteria for those watersheds identified as key to ESU recovery, and associated habitat conditions sufficient to support those populations at the desired levels. The population criteria are developed through the recovery planning process. Habitat standards (H-VSP) at the watershed, subwatershed, and reach level will be established by relating population productivity and physical attributes of the basin (topography, distribution of channel and valley types, hydrological characteristics and geology) and disturbance (land use, degree of channel alteration, riparian condition). Recovery teams will then use the relationship between habitat quality classes and potential population productivity to relate current habitat conditions to existing population levels. The results will form a basis for determining the change in habitat conditions necessary to achieve H-VSP and, consequently, the habitat's contribution to VSP for that population.

Changes in current protection and restoration strategies required to achieve habitat conditions sufficient to support VSP levels will be used to establish standards for watershed conditions. Reach-level numerical standards will be based on watershed and riparian processes that maintain instream habitat and riparian conditions; they will be derived through watershed analysis. Local units will develop performance measures for land management activities that relate to riparian and watershed processes, within the context of the biophysical sensitivities and the existing natural and anthropogenic disturbances. It is important to integrate information and analysis at the subbasin, watershed, and reach levels in the development of performance measures and standards because certain types of activities in some watersheds may be compatible with high-quality habitat, but the same actions might significantly degrade habitat in another location. Interrelationships of the measures and standards at each scale are summarized in Tables J.1 and J.2 for ecological and managerial performance metrics, respectively.

Ecological

Examples might include the following:

- Sufficient number and appropriate distribution of subwatersheds with high-quality, productive habitat to support populations at the VSP level.
- Meet or exceed annual rate of population increase necessary to achieve VSP.
- Subwatersheds capable of achieving their productive potential, i.e.,:

  a. Land uses compatible with the maintenance of productive salmon habitat.

  b. Best Management Practices (BMPs) for these land uses that protect stream and riparian structure and function.

- Conditions in the migration corridor (mainstem river channels) that do not impede access to and from spawning and rearing areas.

Managerial

Examples might include the following:

- Number of subwatersheds and watershed level analyses completed.
- Number of recovery activities prioritized by subwatersheds and watershed level analyses completed annually.

Subwatershed Performance Measures and Standards

Subwatershed-scale habitat measures and standards focus on the processes responsible for habitat creation and maintenance. The specific criteria would be developed through a watershed analysis or other broad-scale analytical process. These standards should address concerns about cumulative effects.

Ecological

Examples of measures and standards would include the following:

- Amount and timing of sediment and water delivered to channels comparable to what would be expected under unmanaged conditions.
- Disturbance type, frequency, and intensity comparable to what would be expected under unmanaged conditions.
- Distribution of riparian conditions (age, species composition) expected under a natural disturbance regime.
- Unimpeded access to all tributaries historically occupied by salmon and to floodplain and other off-channel habitats.
- Spawning escapement levels sufficient to maintain appropriate nutrient levels.
- Sufficient summer flow levels (i.e., minimum flows).

Managerial

Examples of measures might include the following:

- Were mitigation measures described during watershed analysis used to plan projects within the subwatershed?
- Number of actions completed.

Reach Scale Performance Measures and Standards

Performance measures and standards at this level are very specific and dictated by the sensitivity of a site to a planned land use action. Generally, these standards should not be channel characteristics, but rather criteria closely associated with the management action (e.g., standards expressing desired riparian zone characteristics rather than amount of wood in the channel). Some of the numerical standards in the properly functioning conditions (PFC) matrix are appropriate for application at this level, as are the Desired Future Condition standards developed for the Washington Forest Practices revisions.

Ecological

Examples include the following:

- Riparian conditions sufficient to protect water temperature, bank integrity, wood input etc.
- Percent of riparian area with conditions sufficient to protect water temperature, bank integrity, wood input etc.
- Road construction and maintenance standards that minimize sediment generation and transport to streams.
- Standards for the use of riprap or other features that limit floodplain-channel interactions.

Managerial

An example might be the following:

- Were the mitigation measures that were described for the project implemented?

Ideally, the performance measures and standards outlined here would be specific to the current condition of a subwatershed, its sensitivity to different types of land use, and its potential to contribute to stock productivity. The degree to which this ideal can be achieved depends on the ability to coordinate the data collection, on analyses at various scales, and on cooperation among differing landowners within subbasins.

COORDINATION OF PERFORMANCE MEASURES/STANDARDS

Land management across the basin is currently advised by numerous regulatory processes that try to evaluate current vs. desired habitat conditions at individual or multiple spatial scales. In general, broader-scale management frameworks are biased toward forest practices and are better established for federally managed lands. For example, the ICBEMP objectives and standards provide processes for addressing habitat at all spatial scales through subbasin planning and ecosystem analysis at the watershed scale (EAWS). Less heuristic but still multi-scalar approaches are possible through broader application of TMDL criteria that can address water quality concerns at the subwatershed and reach level, and continued implementation of ESA Habitat Conservation Plans (HCPs) with protocols and processes for subwatershed and finer scale habitat evaluation.

In contrast, state forest practice laws generally address habitat protection at the reach level. However, the Washington watershed analysis process provides a mechanism to address concerns at a subwatershed level. Agricultural Best Management Practices (BMPs) and many of the regulatory mechanisms governing development address aquatic habitat only at the reach scale. Additional performance measures/standards being used or developed by programs are variable in their focus on spatial scales (i.e., ESA section 7 analysis and section 10 permits, CBFWA project selection analysis, and state-sponsored watershed restoration efforts).

Existing performance measures and standards were developed for different purposes and so are not exactly the same. However, ideally they should be complimentary and coordinated to form a congruous set of performance measures and standards among the state, local, and federal agencies, tribes, and private landowners. Achieving this ideal will depend on the ability of these groups to coordinate their goals and analytical methods. An important opportunity for the Region would be to describe the role, the potential for coordination, and the points of consistency among the major sources of performance measures/standards for the basin. This evaluation should include, at a minimum, the following programs: CWA (states and tribal TMDL), ICBEMP, state Forest Best Management Practices (BMPs), state Agricultural BMPs, HCP agreements, CBFWA, ESA section 7 consultation, and ESA section 10 consultation.

Table J.1: Examples of ecological performance measures and standards at each scale.

Type	Level	Measures or Standards
Population	Basin	Number of ESUs making progress against recovery goals.
	ESU (subbasins)	Identification of the populations within the ESU that must achieve VSP level for recovery.
	Population (watersheds)	VSP determination based on analysis of abundance, productivity, integrity and population structure.
Habitat	Basin	Proportion of subbasins/watersheds where progress is being made against habitat performance measures/standards.
	ESU (subbasin)	Habitat conditions within the watersheds identified as critical to support population levels at VSP.
	Watersheds	Sufficient subwatersheds with high-quality habitat conditions to maintain VSP population target.
	Subwatersheds	Distribution of reach-level habitat conditions across the subwatershed appropriate to maintain high levels of salmon production.
	Reach	Reach level standards needed to maintain subwatershed conditions. Properly functioning conditions (PFC) defined by standards that reflect the processes responsible for the creation and maintenance of habitat (e.g., water delivery to channels, sediment generation, delivery of wood and other organic matter).

Table J.2: Examples of managerial performance measures at each scale.

Level	Measures or Standards
Basin	Number of ESUs with completed recovery plans.
ESU (subbasins)	Number of subbasin plans completed.
Population (watersheds)	Number of identified recovery plan activities completed.
Subwatersheds	Were mitigation measures described during watershed analysis used to plan projects within the subwatershed?
Reach	Were the mitigation measures that were described for the project implemented?

Literature Cited

National Marine Fisheries Service. 1999. Viable Salmonid Populations. Draft August 31, 1999. Northwest Fisheries Science Center. NOAA/NMFS, Seattle WA.

Bilby, R., G. Pess, B. Feist, and T. Beechie. 1999. Freshwater habitat and salmon recovery: relating land use actions to fish populations response. Draft August 31, 1999. Northwest Fisheries Science Center. NOAA/NMFS. Seattle, WA.

ATTACHMENT J.1. State Total Maximum Daily Load (TMDL) Schedules

Table J.A1. TMDL Schedule – Washington, Columbia River Watershed – Anadromous, October 19, 1999.

Year	Location	Year	Location
1999	Entiat Yakima, Upper	**2004**	Little Klickitat Tucannon Methow Okanogan Wenatchee Elochoman Grays River Kalama Lewis, EF Lower Snake Columbia
2000	Wind	**2009**	Cowlitz
2001	Walla Walla		

Table J.A2. TMDL Schedule – Oregon, Columbia River Watershed – Anadromous and Non-anadromous , October 19, 1999.

Year	Location	Year	Location
1999	Upper Grande Ronde Tualatin	**2004**	Lower Crooked Upper John Day Beaver South Fork
2000	Wallowa Umatilla	**2005**	Powder Burnt Lower John Day
2001	Imnaha Lower Grande Ronde Willow Middle Columbia Hood Upper Quinn	**2006**	Middle Owyhee Crooked Rattlesnake Jordan Lower Owyhee Trout Lower Deschutes
2002	Alvord Lake Upper Deschutes Little Deschutes	**2007**	Lower Col. Sandy
2003	North Fork John Day Middle Fork John Day Upper Malheur Willow Bully Lower Malheur		

Year	Location	Year	Location
2003 (con't)	Warner Lakes Clackamas North Santiam South Santiam Middle Willamette Upper Willamette Middle Fork Willamette Coast Fork Willamette McKenzie		

Table J.A3 TMDL Schedule – Idaho, Columbia River Watershed, Anadromous and Non-Anadromous, October 19, 1999.

Year	Location	Year	Location
1998	17050114: Lower Boise River 17050121: Middle Fork Payette 17040202: Upper Henrys 17060204: Lemhi Winchester Lake 17040208: Portneuf	**2002**	17050103: Middle Snake/Succor 17050120: S.F. Payette 17010304: St. Joe 17040201: Idaho Falls 17040205: Willow 17060304: M.F. Clearwater 17060308: Lower N.F. Clearwater 16010204: Lower Bear/Malad 17040210: Raft 17040211: Goose
1999	17050105: East Little Owyhee 17050107: Middle Owyhee 17050122: Lower Payette 17010214: Pend Oreille Lake 17010303: Coeur d'Alene River 17040203: Lower Henrys 17040204: Teton 17040217: Little Lost Jim Ford Creek Cottonwood Creek 17060303: Lochsa 17040207: Blackfoot 17040209: Lake Walcott 17040212: Upper Snake/Rock	**2003**	17050123: N.F. Payette 17050124: Weiser 17010301: Upper Coeur d'Alene 17040218: Big Lost 17060108: Palouse 17060306: Lower Clearwater 17040206: American Falls 17040220: Camas 17040221: Little Wood
2000	17050111: N.F./M.F. Boise 17050113: S.F. Boise 17060208: S.F. Salmon 17010215: Priest Lake 17010305: Upper Spokane 17010304: St. Joe River 17040104: Palisades 17060203: Middle Salmon/Panther 17060207: Mid Salmon/Chamberlain 17060302: Lower Selway	**2004**	17050108: Jordan 17050210: Little Salmon 17010104: Lower Kootenai 17010213: Lower Clark Fork 17040214: Beaver/Camas 17040215: Medicine Lodge 1040216: Birch 17060209: Lower Salmon 16010203: Little Bear/Logan 17040105: Salt

Year	Location	Year	Location
2000 (con't)	17060307: Upper N.F. Clearwater 16010102: Central Bear 16010201: Bear Lake 17050102: Bruneau	**2004 (con't)**	17050101: C.J. Strike Reservoir
2001	17050194: Upper Owyhee 17050115: Middle Snake/Payette 17050201: Brownlee Reservoir 17010302: S.F. Coeur d'Alene 17060201: Upper Salmon 17060202: Pahsimeroi 17060305: S.F. Clearwater 16010202: Middle Bear 17040219: Big Wood	**2005**	17050112: Boise/Mores 17010105: Moyie 17010306: Hangman 17060205: Upper M.F. Salmon 17060206: Lower M.F. Salmon 17060101: Hells Canyon 17060103: Lower Snake/Asotin 17040213: Salmon Falls

K. FRESHWATER HABITAT AND SALMON RECOVERY: RELATING LAND USE ACTIONS TO FISH POPULATION RESPONSE

The methods for this analytical protocol research are scheduled to be issued for peer review in March 2000. The results of assessments for Salmon River spring/summer chinook and for Willamette River chinook and steelhead will be completed in April or early May 2000.

The usefulness of any approach for assessing the role of freshwater habitat in the recovery of Pacific Northwest salmon populations is enhanced if it includes two properties.

- First, if habitat conditions are defined in a way that can be associated with salmon population response.
- Second, if proposed human actions can be associated with effects on habitat conditions.

With these two properties, potential impacts of human activities on salmon can be quantified.

However, developing an approach to freshwater habitat assessment that meets these criteria is complicated by (1) the high degree of spatial and temporal variability in productive capacity and (2) the variation of habitat requirements both by species and through time for a species. We are attempting to deal with these problems by defining habitat characteristics (natural and human-affected) at coarse spatial scales that reflect the availability and condition of the full range of specific habitat types that a species requires to complete the freshwater phase of its life history. Defining habitat at this scale and in this way addresses seasonal or life-history variations in habitat requirements.

RELATING HABITAT CONDITION TO POPULATION PERFORMANCE

The relationship between freshwater habitat condition and productivity of fish populations has traditionally been examined at very fine spatial scales (individual habitat units or short stream reaches) over short periods of time (1 to 5 years). Much of this research has tried to associate an environmental condition with a life-stage specific response by the fish, such as the effect of fine sediment on incubation survival. This type of research is important to an understanding of the ways various factors affect salmon populations and provides a basis for evaluating the potential impacts of land-use actions.

However, it generally has not been possible to use these site-specific, life-history specific relationships to estimate productivity of salmon populations at larger spatial scales (i.e., watershed or regional). This is primarily because there is a high degree of reach-to-reach variation in salmon production, often caused by factors other than physical habitat condition. In addition, reach level habitat relationships cannot address the spatial and temporal heterogeneity in conditions that occur naturally in streams and rivers and promote overall system productivity. To integrate the cumulative effect of multiple risk factors on survival and productivity of a salmon population throughout its freshwater residency, the habitat-population relationship must be examined at large spatial and long temporal scales.

Examination of time series of redd counts in the Salmon River (tributary to the Snake River) indicates that specific subunits of watersheds (subwatersheds) consistently support large numbers of fish while others contain very few spawning salmon (Figure K.1). As the fish from all subwatersheds at each of these sites are subjected to comparable conditions in the migration corridor, estuary, and ocean, differences in population level among subwatersheds are most likely related to freshwater habitat conditions. The subwatersheds for which fish population data are available have been divided into population size classes (high, medium, low) based on the proportion of the total population supported by each subwatershed (Figure K.2). An average population level and estimate of spatial and temporal variability is assigned to each population size class by averaging spawner or redd counts across all sites within each class for all years of record.

Figure K.1: Salmon River, Idaho Spring and Summer Chinook spatial distribution and abundance (1960 to 1973). Values represent proportion of total redds at all index reaches at each site, normalized for index reach length.

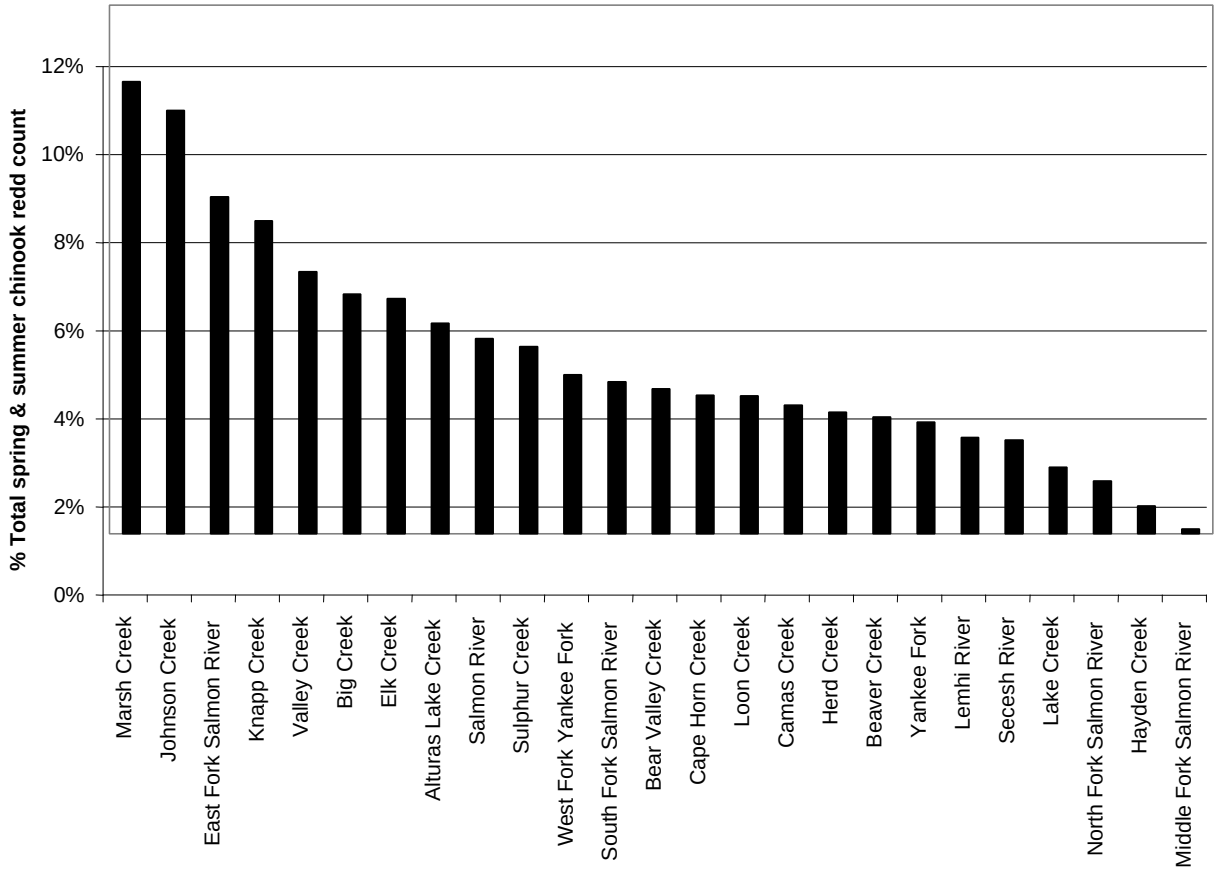


Figure K.2: Salmon River spring and summer chinook population size classes by HUC6 drainage influence area

Habitat conditions are associated with population size classes by determining the features that are common to the subwatersheds in each class. Information from this analysis, currently being conducted for the Salmon River, information is available in geographic information system (GIS) coverages or other databases, although the comprehensiveness of the data varies by

parameter and geographically. Parameters include physical attributes of each subwatershed and the pattern and type of land use. Examples of physical habitat characteristics include topography, distribution of channel and valley types, hydrologic regime, occurrence and extent of wetlands and geology. Land use parameters include proportion of the area subjected to various types of human activity (e.g., forestry, agriculture, urban development), degree of channel or floodplain alteration, and condition of the riparian vegetation. Once the habitat characteristics are associated with salmon population size classes, sites for which no fish data are available can be assigned to classes based on their physical attributes and land use pattern. Once all subwatersheds have been assigned to a population size class, estimating productive potential for the entire watershed is accomplished by summing population levels across all the subwatersheds. This approach also enables prediction of population response to future alterations in habitat quality. The population response predictions can then be used in the risk-assessment models that the National Marine Fisheries Service's (NMFS) Northwest Fisheries Science Center NWFSC will use to examine salmon population performance through its entire life history (CRI modeling effort).

Preliminary results for the Salmon River suggest that several landform variables are key distinguishing characteristics of the population size classes. These include subwatershed relief, bedrock geology, and prevalence of shrub and meadow dominated riparian areas. Land use impacts on water temperature were also an important determinant of subwatershed population size class.

EVALUATING THE EFFECTS OF LAND USE ACTIONS ON HABITAT CONDITION

Many human actions have the potential to affect habitat quality. The impact of these actions on productive potential depends upon the type and extent of the proposed action, the sensitivity of the subwatershed to that activity, and the relative contribution the subwatershed makes to overall watershed production. A great deal of research over the last thirty years has been directed at better understanding the response of aquatic ecosystems to various human impacts. As with research on habitat–population relationships, much of this work has been conducted at relatively fine spatial and temporal scales. However, over the last decade a number of procedures have been developed that examine the cumulative impacts of human activities on the condition of aquatic systems. These processes are generally referred to as watershed assessments or watershed analyses.

Generally, watershed assessment approaches acknowledge that the condition of habitat in streams and rivers is largely a product of interactions with the surrounding terrestrial ecosystem. Water, sediment, biological materials (e.g., wood, leaf litter) and nutrients are provided by these terrestrial-aquatic interactions. Thus, predicting the response of stream habitat to a human action is often best accomplished by examining the effect this action will have on the delivery of these products to the stream. For example, road construction on unstable slopes may dramatically increase sediment delivery to a channel, altering channel characteristics in the affected subwatershed. Removal of riparian vegetation will change the rate of input and type of wood and other organic material delivered to the stream, altering both channel form and trophic dynamics. Understanding how these delivery processes are affected by management activities and the likely impact that alteration of these processes will have on the habitat parameters that

are closely associated with population levels provides a straightforward procedure for associating human activities with population response.

Predicting changes in subwatershed-level habitat conditions due to site-specific land management actions requires knowledge of the relative sensitivity of that location to the proposed action. In some subwatersheds, certain activities may be compatible with the maintenance of high-quality habitat. However, the same actions might significantly degrade habitat in another location. The subbasin analysis process and the Ecosystem Analysis at the Watershed Scale (EAWS) included in the ICBEMP will provide this type of information for federal lands. A comparable analysis protocol for non-federal lands is required to complete the coverage for all critical areas in the basin. Continued improvement in these assessment methods will improve our ability to predict changes in habitat condition and assess population response.

APPLICATION OF THE HABITAT ASSESSMENT PRODUCTS

The ability to relate human activities to changes in habitat condition and population response of salmon will help guide efforts towards salmon protection and recovery. This approach to habitat assessment provides a basis for evaluating regional land use plans and habitat conservation plans, prioritizing habitat restoration actions, and evaluating specific land use actions. Understanding the spatial distribution of salmon production in a watershed provides a means to prioritize areas for protection or restoration, based on their relative contribution to system productivity. For example, future land use activities with a high potential to affect salmon habitat could be directed away from those subwatersheds that have a high productive potential. This approach will enable subwatersheds where productive potential is currently impaired by past human actions to be identified. Restoration activities could be prioritized to first address those impaired subwatersheds with the appropriate underlying physical attributes to support high levels of production. These areas represent locations where restoration activities are likely to have the greatest impact on salmon productivity.

This method also allows habitat characteristics to be directly related to recovery goals for salmon. Recovery goals will be established at the evolutionarily significant unit (ESU) and watershed levels. Associating subwatershed habitat condition with population levels enables the current productive capacity for freshwater habitat in a watershed to be estimated. Assessing the potential effect alterations in subwatershed habitat condition may have on productivity of the watershed as a whole provides a method of developing alternatives for achieving the freshwater habitat conditions required to achieve the recovery population goal for the watershed.

L. ESTIMATING THE COST OF PROTECTING, MAINTAINING, AND IMPROVING SALMON AND STEELHEAD HABITAT IN THE COLUMBIA RIVER BASIN

Estimating the cost of something as complex as protecting, maintaining, and improving salmon and steelhead habitat in the Columbia River Basin is fraught with uncertainty. The long list of data gaps that contribute to that uncertainty include the following:

1. The ecological complexity contained within 32 subbasins and mainstem habitat must be addressed.
2. The causes of habitat problems, not just the symptoms, must be addressed. This requires a watershed perspective (ridge-top to ridge-top and from the headwaters to the mouth).
3. An accurate description of what specific actions are needed in every subbasin, watershed or reach is lacking.
4. Subbasins and activities within subbasins must be prioritized and the work schedule that may take as long as 15 to 20 years must be estimated.
5. The needs of the landowners and local governments of a watershed or subbasin must be balanced with habitat improvements for fish and wildlife.

Regardless of the difficulty, the Region needs to at least consider and provide a preliminary estimate of the cost of habitat actions necessary to recover anadromous fish and other aquatic species

A number of programs provide significant funding to implement habitat protection and restoration activities that benefit fish and wildlife in the basin (see Habitat Appendix Section A). Each program either directly benefits fish and wildlife or arguably benefits fish and wildlife, although it may not be the specific purpose of the program. Examples of programs aimed at providing direct benefit to fish and wildlife are the Northwest Power Planning Council's (NPPC) Fish and Wildlife Program (FWP) (currently about $15 million per year to habitat improvement), EPA's Clean Water Act 319 funding (1999 funding was about $9.2 million to 3 states), NMFS Screening Program ($3.4 million to Columbia Basin), the Natural Resources Conservation Service (NRCS) Conservation Reserve Enhancement Program (CREP) ($250 million per state available), and other State programs (about $15 million). An example of a program that provides substantial funding that indirectly benefits fish and wildlife is the NRCS's Conservation Reserve Program. This program is aimed primarily at reducing soil erosion but, in so doing, affects achievement of certain fish and wildlife watershed enhancement objectives.

The Conservation of Columbia Basin Fish ("All-H") paper calls for meeting three habitat objectives:

1. Prevent further degradation of habitat conditions and water quality;
2. Protect (secure) existing high-quality habitat;
3. Restore degraded habitats on a priority basis.

This cost estimate is provided for the cost of the latter two objectives—protect (secure) and restore. This is because to achieve these objectives, proactive site-specific actions need to be funded. This cost estimate is only for the direct cost of implementing programs to secure and

restore habitat. There may be indirect costs that are not reflected here. For example, the purchase of instream flow rights might have benefits and economic costs, depending on how it is implemented. It may result in land being fallowed, which could reduce crop production, or it could result in irrigation efficiencies. Such indirect costs, which would range widely depending on the action and the watershed, have not been estimated.

The costs of preventing further degradation of habitats (the first objective) are not estimated because the costs of meeting this objective will typically be associated with implementing state, federal, tribal, and local laws and regulations affecting land and water use. This could include both direct and indirect costs and benefits to governments implementing land and water use programs.

Implementation of an extensive, regionally coordinated habitat program may be broken down into six major components. They are:

- Watershed Planning and Assessment
- Subbasin Planning and Assessment
- Subbasin and Regional Coordination
- Implementation of Priority Actions
- Accountability (Monitoring, Evaluation, and Reporting)
- Operation and Maintenance.

Costs for each of these can be estimated or assigned based on historical data or professional judgment of those working in the habitat field. Costs in each category are based on the treatment of 33 subbasins (4^{th} Field hydrologic unit codes [HUCs]) containing anadromous fish in the basin (32 subbasins plus the mainstem Columbia, which is treated as a separate subbasin). These subbasins contain about 1300 watersheds (6^{th} field HUCs). Certainly, all subbasins and watersheds are not equal: some are in need of extensive reparation while some are relatively healthy. Many have ongoing recovery programs, but none are considered complete. For purposes of estimating costs, average costs for Watershed and Subbasin Assessment and planning is multiplied by the total number of subbasins or watersheds to be treated. Costs are estimated for 15 years, with some adjustment for start-up needs and capability building.

A relationship exists between some of the six categories, which can significantly affect the total annual cost estimates. For example, the amount of money allocated to "Accountability" and "Operation and Maintenance" is a function of the funding allocated to "Implementation of Priority Actions," i.e., they are both calculated as a percentage of the total implementation cost. The costs set out under "Implementation of Priority Actions" will be affected by progress in the previous three categories that establish the needs (Assessment and Planning) and the mechanics (Coordination) to effectively implement activities to address the needs.

The costs shown on Table L.1, page 107, should be considered to be funding needs for habitat activities that plan for, coordinate, or directly improve habitat conditions for fish and wildlife. These needs may be partially met through current funding programs such as the FWP in the first

few years. However, in outyears, a substantial portion will be "in addition to" current program expenditures. The habitat investments under the FWP, though not the only funds being invested in the subbasins, provide insight.

Insufficient information is available at this time to accurately determine all the feasible opportunities and costs to secure and restore habitat in all the subbasins of the Columbia River. This can be determined with more certainty, based on future subbasin assessments and plans. However, it is reasonable to make some preliminary and general cost estimates using experiences in implementing the FWP. Since 1984, but especially during the last decade, the FWP has directed significant funding toward protection and restoration of anadromous fish habitat throughout the Basin. Funding for habitat under this program represents neither the amount requested nor the need for funding, both of which are significantly higher than was funded. Some basins received more than others because the planning and implementation infrastructure and local coordination were further along.

There are examples of subbasin habitat activities, and records of their costs, that have been accomplished under the FWP. A ten-year data set from the Bonneville Power Administration (Bonneville) was used to determine dollars spent in 23 subbasins on activities typically classified as habitat improvement projects or related activities. The Bonneville data were used because they were readily available and represented the range of habitat improvement projects that had been implemented in 23 watersheds in the basin. These historical data are of use in estimating potential costs over the next 15 years.

In the Grand Ronde model watershed, for example, expenditures have averaged $827,000 per year over the last 11 years. These costs include planning, coordination and implementation. Those working in the Grand Ronde Basin have developed a detailed plan of what needs to be accomplished, and have estimated how much those actions would cost. They estimate that it would take an additional $60 million, or an average of $4 million per year over 15 years, to fully treat the basin. Other similar examples may be found. Yakima River habitat activities have consumed $30.7 million over the last 10 years—about $3 million per year—but much remains to be done. The Umatilla and Salmon River subbasins have received an average of $1.9 and $1.4 million per year, respectively, under the Bonneville Program, far less than requested to meet priority needs.

Based on these examples, it appears that, on average, $3.0 million per year per subbasin is a reasonable approximation from a basin-wide perspective. It appears that a total investment of over $3.0 billion would be required to adequately address habitat needs in the Columbia River Basin through 2015. This figure includes an "adder" (at the end of the calculation) of $120 million per year to represent the ongoing CREP program funding. Again, it is important to remember that not all subbasins are the same, and that some have greater needs than others. Actual needs and opportunities can only be determined after subbasin assessment and planning. It is likely that this is an overly conservative estimate for some subbasins. Actual needs and opportunities by watershed and subbasin will be developed during watershed and subbasin planning and assessment.

Table L.1 also shows how each of the components and estimated total and annual average cost for each of the six categories of habitat activities. Two cost columns are shown. The first, entitled "Base Case" contains estimates based on the best available information and professional judgement. The second column entitled "Alternate Case" is intended for comparison purposes under a different set of assumptions. The reader may, by requesting an electronic copy of the spreadsheet, insert his/her own estimates into the second column. The component and individual costs will then be automatically calculated. The following bullets will assist the reader in understanding the assumptions and calculations.

- The cost of a regionally coordinated habitat program can be estimated by breaking the program into its significant components and estimating costs for each over time.
- Accurate costs for the categories of Implementation, Monitoring and Evaluation, and Operation and Maintenance cannot be developed until assessments and subbasin plans are at least initially completed.
- Average costs for Watershed and Subbasin Planning and Assessment and Coordination are generally known and can be more accurately estimated
- Cost estimates assumes a watershed approach—not just riparian and instream work
- Significant funds currently available through agricultural programs such as Conservation Reserve Enhancement Program (CREP) are included in the calculation of total need ($120 million per year) and are assumed to have their administrative and O&M costs embedded within the program.
- Estimates are for a total watershed approach and do not consider the distinction between public and private lands or their relative needs.
- Implementation Costs (No. 4 below) are considered reasonable based on examples of past expenditures, but likely fall significantly short of the total need in the basin.
- Funding sources are neither assumed nor specified; however, it is anticipated that current funds will continue to be made available.
- The total cost is for the period of analysis for 15 years. However, periods up to 30 years can be selected and calculated.
- The yearly average will be most affected by (1) the length of time to complete watershed planning and assessment, and (2) the increase in the O&M component over time. They tend to be off-setting: that is, planning and assessment costs decrease while O&M builds.

1. Watershed Planning and Assessment

- The Independent Scientific Review Panel, Northwest Power Planning Council, and others are calling for watershed assessments.
- The definition of an adequate assessment and plan is being discussed within the region (species distribution and abundance, water quality data needs, limiting factors, mitigation opportunities, opportunities, etc). Cost will be affected by the outcome.
- The number of watersheds requiring significant assessment is unknown so an estimate is provided.
- Some watersheds already have substantial assessment information.

- Planning and assessment are considered to be a one-time cost, with any additional needs being funded through implementation or monitoring and evaluation.

2. Subbasin Planning and Assessment

- There are 32 anadromous subbasins plus the mainstem – 33 subbasin units total.
- Many, or perhaps all, will need to have a coordinated plan developed that is based on watershed assessments and that includes goals and objectives.
- Each subbasin will need an "Implementation Plan" that prioritizes and relates activities, estimates time and costs, establishes monitoring and evaluation (M&E) and O&M costs, and estimates potential benefits.

3. Subbasin and Regional Coordination

- Assumes each subbasin will require local coordination to work with the public, local governments, funding entities, agencies and tribes etc.
- Assumes a regional coordination mechanism is necessary to coordinate across subbasins and among sovereigns.

4. Implementation of Priority Actions

- Amount of funding is a reasonable amount per subbasin that reflects past expenditures and identified needs. The amount entered is multiplied by 33 subbasins, realizing some will need more and some less per year.
- Funds are for project implementation in each subbasin according to the subbasin Plans.
- Assumes sufficient technical and other resources available to effectively use funding.
- Total cost calculation assumes funding ramps up to the full amount in three years. The total for the first two years equals that of the third and subsequent years.
- O&M is assumed to be imbedded within currently funded programs such as CREP and is not part of the O&M calculation.

5. Accountability

- Includes, monitoring of results of habitat activities, analysis and evaluation, reporting and revising subbasin plans (adaptive management), as appropriate.
- All projects may not require M&E.
- M&E cost estimates are derived as a percentage of average project implementation costs (No. 4).
- The cost is taken as a percentage of the value used in "Implementation" (No. 4 above).

6. Operation and Maintenance

- O&M costs are taken as a percentage of average project implementation costs (No. 4).
- The calculation assumes no O&M occurs until the second year of a project; then it is assumed to continue for the life of the project (number of years selected) at a constant percentage.

- Not all projects require O&M.
- The average O&M cost misrepresents the actual cost, except during the middle portion of the time period selected. This is because O&M increases each year as new projects requiring O&M are initiated.

Table L.1: Total Cost of Scenarios (in $M)

TOTAL COST OF SCENARIOS + $120M CREP FUNDS	**$3,620,249**	**$2,393,899**
AVERAGE ANNUAL COST OF BASE AND TRIAL SCENARIOS	**$241,350**	**$159,593**
HABITAT RESTORATION ACTIVITY	**BASE CASE**	**ALTERNATE**
1. WATERSHED PLANNING AND ASSESSMENT		
Years to use in analysis (up to 30)	15	15
Number of anadromous fish watersheds	1300	1300
Average cost per watershed for watershed assessment	$200	$100
Per cent of watersheds requiring assessment	60%	30%
Average per cent of assessment already completed	25%	50%
Years to complete assessments	5	15
WATERSHED ASSESSMENT COST	**$117,000**	**$19,500**
AVERAGE COST PER YEAR	**$23,400**	**$1,300**
2. SUBBASIN PLANNING AND ASSESSMENT		
Number of subbasins being treated	33	32
Average cost per subbasin to complete subbasin assessments, goals, and objectives	$300	$100
Average cost per subbasin to complete subbasin implementation plan	$1,000	$500
Years to complete subbasin planning and assessment	5	15
PLANNING AND ASSESMENT COST	**$42,900**	**$19,200**
AVERAGE COST PER YEAR	**$8,580**	**$1,280**
3. SUBBASIN AND REGIONAL COORDINATION		
Number of subbasins needing local coordination	33	16
Average cost per subbasin for a coordinator and facilities	$100	$100
Cost for Regional (central) coordination	$800	0
COORDINATION COST	**$61,500**	**$24,000**

TOTAL COST OF SCENARIOS + $120M CREP FUNDS	**$3,620,249**	**$2,393,899**
AVERAGE ANNUAL COST OF BASE AND TRIAL SCENARIOS	**$241,350**	**$159,593**
HABITAT RESTORATION ACTIVITY	**BASE CASE**	**ALTERNATE**
AVERAGE COST PER YEAR	**$4,100**	**$1,600**
4. IMPLEMENTATION OF PRIORITY ACTIONS		
Average amount of funds per year dedicated to each subbasin to implement priority actions (represents a reasonable estimate). Assumes a 3-year ramp-up, where the first two years equal the third and subsequent years.	$3,000	$1,000
PROJECT IMPLEMENTATION COST	**$1,386,000**	**$448,000**
AVERAGE COST PER YEAR	**$92,400**	**$29,867**
5. ACCOUNTABILITY		
Average per cent of implementation cost for monitoring, evaluation, updating subbasin plans, and reporting (adaptive management)	20%	10%
Percent of projects requiring monitoring and evaluation	50%	25%
MONITORING AND EVALUATION COST	**$138,600**	**$11,200**
AVERAGE COST PER YEAR	**$61,875**	**$747**
6. OPERATION AND MAINTENANCE		
Percent of projects requiring O&M	20%	20%
Average annual cost of O&M as a percentage of initial project cost	15%	8%
OPERATION AND MAINTENANCE COSTS	**$74,249**	**$71,999**
AVERAGE O&M COST PER YEAR	**$4,950**	**$4,800**

Table L.2: Habitat Component

HABITAT COMPONENT	% OF TOTAL COST	
	BASE	ALT.
1. WATERSHED PLANNING AND ASSESSMENT	3.2%	0.8%
2. SUBBASIN PLANNING AND ASSESSMENT	1.2%	0.8%
3. COORDINATION	1.7%	1.0%
4. IMPLEMENTATION OF PRIORITY ACTIONS	88.0%	93.9%
5. ACCOUNTABILITY	3.8%	0.5%
6. OPERATION AND MAINTENANCE	2.1%	3.0%
	100.0%	100.0%

M. REFERENCES FOR THE EXISTING CONDITIONS OF FRESHWATER AND ESTUARINE HABITAT

An Annotated Bibliography

To make the Habitat section of the All H paper brief and readable, many of the citations used to develop the paper were omitted from the main body of the document. Instead the references are presented here. The subjects of the references are presented below, in the same order as their appearance in the habitat section of the All H paper. Complete reference citations are found beginning page 126 of this annotated bibliography.

I. GENERAL CONDITIONS

House *et al.* 1996. Lands managed by the Bureau of Land Management within the Willamette, Columbia, Snake, and Salmon basins were found to have 12 percent of riparian acres in optimal condition, while 65 percent are in minimal condition. In these same basins, only 32 percent of stream channel miles are considered in optimal condition, with 40 percent in fair and 28 percent in minimal condition.

McIntosh *et al.* 1994a, b. Managed and unmanaged watersheds in eastern Oregon and Washington were compared; the results indicate that the frequency of large pools within managed watersheds (i.e., watersheds that are predominantly multiple-use) decreased by 28 percent over the past 50 years. During the same time period, large pool frequency within unmanaged watershed (i.e., wilderness area and roadless watersheds minimally affected by human disturbance) increased by 77 percent. The frequency of large woody debris and debris complexes is about 50 percent greater in unmanaged streams than in managed streams. Considering these results, the authors concluded that streams in managed watersheds of eastern Oregon and Washington are in a highly degraded state relative to unmanaged systems (especially with respect to fine sediment, shade, and habitat complexity).

NRC. 1996. In Washington, Oregon, Idaho, and California, the breeding range of Pacific salmon has declined by about 40 percent in the last 100 years; many of the populations that remain are severely depressed.

Quigley and Arbelbide 1997; McIntosh *et al.*1994a, b; NMFS 1996. These publications summarize the general condition of Columbia River Basin streams and degradation to these systems by various land management activities.

Spence *et al.* 1996. Agricultural practices, including farming and grazing, have detrimentally affected aquatic systems within the Columbia River Basin. Although the proportion of land within the Columbia River Basin dedicated to farming is relatively small (12 percent dry cropland, and an additional 4 percent in irrigated agriculture), this land use can have a disproportionate impact on aquatic ecosystem function. On the other hand, grazing occurs on a substantial portion (41 percent) of the land base in Washington, Oregon, and

Idaho. Grazing on federal and non-federal land is nearly evenly divided. There is a considerable history of degraded rangeland conditions. Recent reports indicate that, while upland conditions may be improving, riparian conditions are still only fair-to-poor. Restoration of riparian rangelands is feasible and could occur in a few years with reductions or elimination of riparian grazing.

II. WATER QUALITY

Stober *et al*. 1979, NPPC 1986. Changes in water quality can cause ecosystem alterations that affect many biological components of aquatic systems, including vegetation within streams as well as the composition, abundance, and distribution of macroinvertebrates and fishes. These changes can affect the spawning, survival, food supply, and the health of salmon.

A. Temperature

Reservoirs and Dams

Quigley and Arbelbide. 1997. Impounding free-flowing waters results in long-term changes in downstream water temperatures.

Irrigation

Dauble. 1994. In areas of irrigated agriculture, temperature increases during the summer may be exacerbated by heated return flows.

NPPC. 1986. In general, problems associated with return flows of surface water from irrigation projects include increased water temperature; salinity; pathogens; decreased dissolved oxygen; increased toxicant concentrations from pesticides and fertilizers; and increased sedimentation.

Timber Harvest Activities

Beschta *et al*. 1987; Beschta *et al*. 1995. The removal of riparian canopy reduces shading and increases the amount of solar radiation reaching the streams. The result is higher maximum stream temperatures and increased daily stream temperature fluctuations.

Chamberlin *et al*. 1991. Increases in temperature due to removal of streamside vegetation normally increases in direct proportion to increased sunlight reaching the stream. To predict the likely effects of forest harvesting on the direction and magnitude of stream temperature changes, a careful analysis of the energy balance, including the groundwater impacts, is needed.

MacDonald *et al*. 1991. In many areas in the Pacific Northwest, forest cover provides shade. Reductions in forest cover along streams can increase solar radiation reaching them, thereby increasing summer stream temperatures. Forest cover reduction can also decrease minimum nighttime temperatures due to increased radiant heat loss. Besides acute lethal effects, increased temperatures may also cause sub-lethal (behavioral) or indirect effects (rate of chemical reactions such as the equilibrium between ammonium and unionized).

Rhodes *et al*. 1994. Widespread reduction in riparian vegetation has occurred in the Snake River basin due to land management, including logging, roading, mining, and grazing. Salmonid production potential and rearing capacity has been reduced in these streams due to elevated stream temperatures associated with riparian vegetation removal.

Farming and Grazing

Doppelt *et al*. 1993. Agriculture and urban development are the most pervasive sources of non-point sources of pollution on private lands. In the second Resource Conservation Act appraisal of non-federal lands, the U.S. Department of Agriculture (USDA) reported that agricultural non-point source pollution is degrading 29 percent of all streams.

Spence *et al.* 1996. Agriculture can negatively affect stream temperatures by the removal of riparian forests and shrubs, which reduces shading and increases wind speeds. Bare soils may retain greater heat energy than vegetated soils, thus increasing conductive transfer of heat to water.

B. Sediment, Excess Nutrients/Low Level of Dissolved Oxygen, Toxins and pH

Reservoirs and Dams

Quigley and Arbelbide. 1997. Impoundment changes the volume of water flow and reduces capability to route sediments.

Spence *et al.* 1996. Impoundments change sediment transport and storage. Elevated fall water temperatures from impoundments can result in disease outbreaks in adult salmon that cause high pre-spawning mortality. Impoundments also can change the quantity and timing of streamflow. Changes in flow quantity alters stream velocity which affects the composition and abundance of both insect and fish populations. Changed flow velocities may also delay downstream migration of salmon smolts and result in salmon mortality.

Above the dams, slow-moving water has lower dissolved oxygen levels than faster, turbulent waters, a factor that may stress fish.

Drawdowns reduce available habitat area and concentrate organisms, potentially increasing predation and transmission of disease.

Drawdown of impoundments during winter may facilitate freezing, which diminishes light penetration and photosynthesis, potentially causing fish kills through anoxia.

Behind dams, suspended sediments settle to the bottoms of reservoirs, depriving downstream reaches of needed sediment inputs, leading to the loss of high-quality spawning gravels (as substrate becomes dominated by cobble unsuitable for spawning), as well as to changes in channel morphology.

Irrigation

Omernik 1977; Waldichuk. 1993. Nutrients (e.g., phosphates, nitrates), insecticides, and herbicides are typically elevated in streams draining agricultural areas, reducing water quality and affecting fish and other aquatic organisms.

Spence *et al.* 1996. Irrigation withdrawals change sediment transport and storage. In streams that support irrigation, siltation and turbidity increase, because irrigation return waters usually carries with it high sediment loads. Water diversions also can change the quantity and timing of streamflow. Changes in flow quantity alters stream velocity, which affects the composition and abundance of both insect and fish populations. Changed flow velocities may also delay downstream migration of salmon smolts and result in salmon mortality.

Road Construction

Brown and Krygier. 1971. In small streams, clear-cut logging may produce only small changes in stream sediment concentrations. However, greater changes in stream sediment concentration were associated with the road building done to support logging and slash burning after logging.

Dunne and Leopold 1978; Furniss *et al.* 1991; Weaver and Hagans 1996; Weaver *et al.* 1998. Road construction increases landslide frequency.

Furniss *et al.* 1991; Gibbons and Salo 1973; Meehan 1991; Weaver *et al.* 1987. The physical impact of roads detrimentally affects watershed integrity.

Road construction contributes sediments to streams.

Furniss *et al.* 1991; Harr *et al.* 1975; Quigley and Arbelbide 1997. Road construction affects sediment and hydrologic regimes.

Furniss *et al.* 1991. Road construction contributes to water quality degradation. On a per-unit basis, mass wasting events associated with forest roads produce 26-34 times the volume of sediment as undisturbed forests.

Quigley and Arbelbide. 1997. Road construction concentrates impacts from other land use activities and road-related loss of watershed integrity has a detrimental effect on fish and fish habitats; these effects are inevitable, large in magnitude, and long in duration.

Timber Harvest Activities

Cederholm and Reid. 1987. Salmonid mortality in Clearwater River, Washington, is due primarily to an increase in the sediment load and changes in the riparian ecosystem that reduced winter storm refuges. Landslides and surface erosion from heavily used logging road caused increases in stream sediments, while winter refuge capacities were reduced due to stream blockages and destruction of refuge habitat.

Chamberlin *et al*. 1991. Timber management affects hydrologic and sediment transport processes and therefore has associated affects on the amount and quality of flowing water, gravel substrates, cover, and food supplies required by all salmonid species.

Everest *et al*. 1987. Erosion following timber harvest and road building can increase fine sediment in the streambed, and can inundate pools and other habitats with sediment. Although important, forest practices aimed at individual ecosystem components (like sediment) have not prevented degradation of streams. A more holistic approach provided by a staff of specialists who are trained to consider the overall integrity of streams and streamside zones is needed to maintain productive, healthy aquatic/riparian ecosystems.

Marcus *et al*. 1990. Forest harvest and reforestation practices affect salmonids by altering erosional patterns, deposition of sediment, streamflows, fish migrations, structural habitat cover, water temperatures, nutrient cycles, and potentials for exposure to toxicants. Salmon populations have evolved under conditions of fluctuating patterns and have developed adaptations that increase their probability of survival. However, the magnitude and frequency of these pattern changes often increase following logging activities. These changes can result in increased stress on salmonid populations and lead to long-term population declines.

NMFS. 1996. Timber harvest activities result in simplification of stream channel habitat through sedimentation, channelization, and loss of riparian vegetation and large woody debris.

Platts *et al*. 1989. In the South Fork Salmon River, Idaho, annual measurements in fine sediment were taken from 1965 to 1985. Logging and roading occurring in the watershed between 1950 and 1965, combined with large storms in 1964 and 1965, resulted in a large increase in the amount of instream fine sediment. A logging moratorium in 1965, in combination with natural regeneration and watersheds restoration efforts, led to decreased sediment delivery and instream fine sediments. However, further recovery to pre-logging conditions will be contingent on further watershed recovery and floods capable of transporting sediments downstream.

Quigley and Arbelbide. 1997. The level of watershed disturbance is mainly a function of the effect of the use of heavy equipment in timber harvest and road construction and the natural site conditions. Natural site conditions that can increase negative watersheds effects due to timber harvest include steep slopes and erodable soils influenced by high climatic stress. In general, slopes that have been logged contribute sediment to streams as a function of the amount of bare compacted soil that is exposed to rainfall and runoff. Sediment delivery rate is controlled by slope steepness and stream channel proximity.

Spence *et al.* 1996. Site disturbance and road construction typically increase sediment delivered to streams through mass wasting and surface erosion.

Swanston. 1991. Surface erosion on sites that are forested occurs mainly in response to intense rainstorms or excess surface flows over bare soil due to logging, grazing, landslides, etc.

Sheet erosion and rill and gully erosion can increase as a result of the loss of soil infiltration capacity due to soil compaction by logging or the use of other heavy equipment.

Farming and Grazing

Dunne and Leopold 1978; MacDonald *et al.* 1991; Meehan 1991; NMFS 1996; Platts 1991. Increased channel sedimentation is caused by livestock overgrazing with detrimental effects on pool depth, spawning gravels, channel stability and morphology.

Quigley and Arbelbide 1997; Meehan and Platts 1978; Thurow 1991. Increased rate and erosive force of surface runoff is caused by livestock overgrazing.

Quigley and Arbelbide 1997; Meehan and Platts 1978; Thurow 1991. Reduction in soil structure is caused by livestock overgrazing.

Quigley and Arbelbide 1997; Meehan and Platts 1978; NMFS 1996; Thurow 1991. Soil compaction is caused by livestock overgrazing.

Quigley and Arbelbide 1997; Spence *et al.* 1996. Farming has been associated with the following adverse impact to stream and riparian environments: loss of native vegetation, bank instability, loss of floodplain function (due in part to encroachment), removal of large woody debris sources, changes in sediment supply, changes in hydrology, increases in water temperature resulting, channel modification, habitat simplification and changes in nutrient supply.

Spence *et al.* 1996. Agricultural land use can contribute substantial quantities of sediments to streams.

In areas where biocides are applied at recommended concentrations and rates, and where there is a sufficient riparian buffer, the toxic effects to aquatic life may be minimal.

Agricultural practices may also include stream channelization, large woody debris removal, installation of rip-rap and revetments along stream banks, and removal of riparian vegetation.

Taylor *et al.* 1989; Thurow 1991. Bacterial contamination is caused by livestock overgrazing.

Dredging Activities

Kennish. 1997. Dredged spoils removed from areas proximate to industrial and urban centers can be contaminated with heavy metals, organochlorine compounds, polyaromatic hydrocarbons, petroleum hydrocarbons, and other substances.

Mining Activities

Nelson *et al.* 1991. Erosion from surface mining and spoils may be one of the greatest threats to salmonid habitats in the western US.

Sodium cyanide solution used in heap leach mining is contained in settling ponds from where they might contaminate groundwater and surface waters.

NMFS. 1996. Past mining activities routinely resulted in the removal of spawning gravels from streams, channelization of streams from dredging activities, and leaching of toxic effluents into streams.

OWRRI. 1995. Commercial mining is likely to involve activities at a larger scale, with much disturbance and movement of the stream channel involved.

Quigley and Arbelbide. 1997. Mining activities can affect aquatic systems through addition of large quantities of sediments and contaminated solutions, acidification of surface waters, acceleration of erosion, increased bank and streambed instability, destruction of riparian vegetation, and changes in channel formation and stability.

Spence *et al.* 1996. Although hydraulic mining is not common today, past activities have left a legacy of altered stream channels, and abandoned sites and tailings piles can continue to cause serious sediment and chemical contamination problems.

West *et al.* 1995. Water pollution by heavy metals and acid is also often associated with mineral mining operations, as ores rich in sulfides are commonly mined for gold, silver, copper, iron, zinc, and lead. When stormwater comes in contact with sulfide ores, sulfuric acid is commonly produced.

Urbanization

Arkoosh *et al.* 1998. Urbanized areas also alter the rate and intensity of runoff into streams and waterways. Urban runoff can cause immunosuppression by organic contaminants.

EPA. 1993. Construction activities can also have detrimental effects on salmon habitat through the runoff of large quantities of sediment, as well as of nutrients, heavy metals, pesticides, and runoff of petroleum products and oils from roads and parking lots. Also associated with urbanization are sediment, nutrients, and chemicals from yards, as well as discharges from municipal sewage treatment plants and industrial facilities.

NMFS. 1996. Urbanization has led to degraded aquatic habitats by channelizing streams, constructing floodplain drainage and allowing encroachment on to the floodplain, damaging riparian areas, releasing point and non-point pollution, and using flood control techniques that alter natural stream channels and flow patterns. Urbanization is also associated with land drainage systems that concentrate runoff, increase downstream flood risk, and create a flashy discharge pattern.

Phillips. 1984. In urban areas, construction in and adjacent to waterways can involve dredging and/or filling activities, bank stabilization (see other sections), removal of shoreline vegetation, waterway crossings for pipelines and conduits, removal of riparian vegetation, channel re-alignment, and the construction of docks and piers. These alterations can destroy salmon habitat directly or indirectly by interrupting sediment

supply that creates spawning and rearing habitat for prey species (e.g., sand lance, surf smelt, herring), by increasing turbidity levels and diminishing light penetration to eelgrass and other vegetation, by altering hydrology and flow characteristics, by raising water temperature, and by re-suspending pollutants.

III. WATER QUANTITY

Chamberlin *et al.* 1991. Outlines the influence of timber management on hydrologic and sediment transport processes and the associated affects on the amount and quality of flowing water, gravel substrates, cover, and food supplies required by all salmonid species.

Jackson and Kimerling. 1993. In the Columbia River Basin, the vast majority of surface water withdrawals are made to facilitate agricultural irrigation.

NPPC. 1986. Low flows can concentrate fish, rendering juveniles more vulnerable to predation.

NRC 1996, Spence *et al.* 1996. Altering the connection between surface and groundwater can affect water temperatures, instream flows, and nutrient availability. These factors can affect egg development, the timing of fry emergence, fry survival, aquatic diversity and salmon growth.

NRC. 1996. Roads may affect groundwater and surface water by intercepting and re-routing water that might otherwise drain to springs and streams. This increases the density of drainage channels within a watershed and results in water being routed more quickly into the streams.

Phillips. 1984. Activities associated with urbanization (e.g., building construction, utility installation, road and bridge building, storm water discharge) can significantly alter the land surface, soil, vegetation, and hydrology, and adversely affect salmon habitat through loss or modification.

Platts. 1991. Livestock grazing can affect the riparian environment by changing, reducing, or eliminating vegetation, and actually eliminating riparian areas through channel widening, channel aggrading, or lowering of the water table.

Rauzi and Hanson. 1966. Soil compaction by livestock trampling can result in a reduction in water infiltration by 40-90 percent.

Spence *et al*. 1996. Soil and vegetation changes on agricultural lands lead to lower infiltration rates, which results in runoff that is greater and more rapid. On croplands, reduced infiltration and more rapid runoff may also result in lower summer base flows, higher stream temperatures, and fewer permanent streams. When wetlands are tiled and drained for agricultural purposes springs, seeps and headwater streams often dry up.

USEPA. 1993. The combination of buildings, rooftops, sidewalks, parking lots, roads, gutters, storm drains, and drainage ditches, quickly divert rainwater and snow melt to receiving

streams, resulting in an increased volume of runoff from each storm, increased peak discharges, decreased discharge time for runoff to reach the stream, and increased frequency and severity of flooding.

Volkman. 1997. Summarizes the contribution of water development to the decline of anadromous salmonids in the Columbia River basin. The report discusses the federal agencies' role in water management in relation to salmon recovery efforts and the role played by federal agencies who manage water in salmon recovery efforts; it makes some suggestions for future direction in water policy to manage dilemmas such as anadromous salmonid restoration.

IV. MIGRATION BLOCKAGES

Bisson *et al.* 1987. Biological properties of debris-created structures can include blockages to fish migration, protection from predators and high streamflow, and maintenance of organic matter processing sites within the benthic community.

Quigley and Arbelbide 1997; NMFS 1996; NRC 1996. There is a reduced accessibility of historical habitat due to water manipulation and use.

Raymond. 1979. In general, reservoirs and water diversions (see section on irrigation water withdrawal) reduce water velocities and change current patterns, resulting in increased migration times.

Spence *et al.* 1996. Effects of these irrigation withdrawals and impoundments on aquatic systems include creating impediments or blockages to migration (for both adults and juveniles), diverting juveniles into irrigation ditches, or damage to juveniles as a result of impingement on poorly designed fish exclusion screens.

V. USE/OWNERSHIP PATTERNS

Federal and nonfederal lands

Doppelt *et al*. 1993. "Although most of the federal-land riverine systems are seriously degraded, nearly all of the remaining relatively healthy headwaters, biotic refuges, benchmark streams, riparian areas, and biological hot spots are found on federal lands. This is especially true in the western United States and in Alaska, where watersheds in the headwaters within federal roadless areas effectively constitute most of the remaining refugia for native riverine biodiversity whose populations are at-risk or declining." [Page 10]

Frissell, C. A. 1993. "New policies are needed to facilitate restoration of low-elevation floodplains, wetlands, and other critical riverine habitats. Many such habitats are in private ownership and a floodplain restoration policy will involve complex social and political dynamics. Fiscal resources could be devoted largely to education, development of creative, relatively non-intrusive regulatory policies, and provision of financial incentives for floodplain and wetland disinvestment." [Page 19]

Upstream reaches are currently serving as "*de facto*" refuges for native salmonids, because many downstream reaches have been degraded by management activities (logging, agriculture, channelization, urbanization and introduced species) and no longer support native populations. However, because headwater streams are more vulnerable to natural catastrophes (e.g., landslides, fires, and debris flow), it is unlikely that headwater refugia can reliably sustain native populations over the long-term.

Henjum *et al.* 1994. "Many of the anadromous and resident fishes at risk in Washington and Oregon spend much of their life history in aquatic habitats located in or directly downstream of federal forestlands. Sound conservation practices on federal lands alone cannot guarantee the continued viability of the many eastside populations at risk, but further degradation of aquatic ecosystems on these lands will certainly increase the likelihood of future extinctions." [Page 121]

NRC. 1996. Over the last century, private land management activities have degraded aquatic habitat. The result has been loss of natural production capacity. Part of the problem is that uniform and consistently applied habitat conservation strategies are not practiced across the Columbia River basin. Such widely applied strategies are needed because the basin scale is most relevant to the metapopulation structure of anadromous salmonids.

Soil conservation programs are currently designed to control erosion off cropland and do not necessarily address water or fish habitat quality and lands adjacent to croplands. In urban areas, greenways along rivers are for human recreation, not to contribute to the maintenance of functional river systems. Flood detention basins in urban areas are poor replacements for natural backwaters and floodplain pools of a natural river.

The NRC recommends " . . . developing a more equitable and more uniform system of habitat-protection requirements on private ownerships across all land uses, establishing joint planning groups or entire river basins (or subbasins), where private landowners can participate in land-use policy decisions, investigating various incentives for landowners to practice improved environmental stewardship, and expanding programs that involve the public in monitoring and habitat-conservation projects." [Page 222]

Quigley and Arbelbide. 1997. Many subbasins in the Columbia River basin appear to be composed of a patchwork of productive and degraded watersheds. The highest quality habitats are often located in higher elevation systems associated with cold forest types. Subwatersheds occurring in the mid- and lower elevations also contain important aquatic habitats, but these are more strongly influenced by habitat loss, degradation, and watershed disturbance associated with timber harvest, grazing, and more extensive roading.

The report summarizes results from an evaluation of the relationships between aquatic and terrestrial ecosystems, using models that linked landscape features and management activities to stream channel measures and fish populations. The results indicate that pool frequency and large pool frequency were highest on forested lands predominantly owned by the U.S. Forest Service (USFS) and managed as wilderness or moderate use areas.

Lowest values for parameters related to pools were found on Bureau of Land Management (BLM) and privately owned rangelands. In the Central Idaho Mountains, where instream fine sediments were measured, privately owned forests and agricultural lands showed the highest level of surface fines. The next highest levels of surface fines were found on high-use USFS lands.

Habitat Productivity in Valley Bottoms

ISG. 1999. The central tenet of the conceptual foundation presented in this document is the importance of a complex and dynamic continuum of habitats in the Columbia River system. Diverse habitat segments found in the floodplain and gravel-cobble stream reaches are particularly important to salmonids because they provide the connected, necessary habitats for spawning and rearing. Historically, alluvial reaches were probably the most productive in the Columbia basin, and are also centers of human activities.

Sedell *et al*. 1990. The presence and juxtaposition of unaffected stream reaches is important for recovery of aquatic biota following disturbance. Maintaining adequate refugia is complicated by the fact that streams are open, directional systems. Protection of a refugia requires control over the entire upstream network and surrounding watershed. It is unlikely that such protection will be given to very many large streams, yet it is these that support the greatest diversity of fishes.

Standford, J. A., and J. V. Ward. 1992. Aggraded floodplains and upwelling groundwaters historically were key production areas for anadromous salmonids and bull trout in the Columbia River system (James Sedell, USFS, pers. comm., 1992).

Spence *et al.* 1996. Some of the most productive waters occur on non-federal lands; therefore, an integral part of regional salmon recovery must include conservation of non-federal lands. Historically, many of the low-gradient river reaches and estuaries included the most productive salmonid habitats. It is essential to restore these biologically important waters to recover salmonids to levels that can sustain fishing pressure. To achieve connectivity between relatively intact refugia on federal lands, ecologically healthy corridors must be maintained or restored on non-federal lands.

VI. COLUMBIA RIVER ESTUARY

NMFS. 1999. Sediments in estuaries downstream from agricultural areas may also contain herbicide and pesticide residues.

Lower Columbia River Estuary Program. 1999. The document describes existing conditions in the Columbia River estuary and outlines a plan for improving conditions within it. The management plan identifies seven issues: biological integrity, impacts of human activity and growth, habitat loss and modification, conventional pollutants, toxic contaminants, institutional constraints, and public awareness and stewardship. The document also includes 43 actions that are based on scientific studies and address the 7 issues; they were developed with considerable input from interested citizens.

Phillips. 1984. Dredging not only removes plants and reduces water clarity, but can also change the entire physical, biological, and chemical structure of the ecosystem.

Dredging also can reverse the normal oxidation/reduction potential of the sediments of an eelgrass system, which can reverse the entire nutrient-flow mechanics of the ecosystem.

Sherwood *et al.* 1990. Estuaries downstream from impoundments have also been converted into a less-energetic microdetritus-based ecosystem with higher organic sedimentation rates. Detritus and nutrient residence has increased; vertical mixing has decreased, likely increasing primary productivity in the water column, and enhancing conditions for detritivorous, epibenthic, and pelagic copepods.

VII. CURRENT MANAGEMENT

CRITFC. 1995. In this, the second of a two-volume restoration plan (Wy-Kan-Ush-Mi Wa-Kish-Wit),the Nez Perce, Umatilla, Warm Springs, and Yakama Nation tribes propose a Columbia River basin (basin) anadromous fish restoration plan that include specific plans for 23 subbasins. The 23 plans are a refinement of the 1990 plans completed by the fishery agencies in the basin and the tribes that define habitat and production problems and propose remedies. To offer the best scientific information available on the 23 subbasins, the restoration plan combines the cultural and geographic knowledge of the tribes with the life cycle survival framework, scientific hypotheses, and recommendations from Volume one of Wy-Kan-Ush-Mi Wa-Kish-Wit. The plans are not intended to be prescriptive; rather, they are intended to engage the region in the challenge of salmon restoration through cooperative efforts at the watershed and regional level.

FEMAT. 1993. In 1993, federal court action halted timber harvest and other land management activities on USFS- and BLM-administered land within the range of the northern spotted owl, which created a regional crisis. The Clinton Administration commissioned the Forest Ecosystem Management Assessment Team (FEMAT) to develop and evaluate options to manage and resolve the crisis. The options consisted of the construction of a network of late-successional reserves and an interim and long-term strategy to protect aquatic and riparian environments and the threatened and “at risk” species that depend on these habitats. The aquatic strategy consists of: a network of key watersheds to protect “at risk” fish stocks or basins with outstanding water quality; riparian reserves that maintain ecological function and water quality; a watershed analysis procedure that helps to plan further protection and restoration within a basin; and restoration to prevent further degradation and improve the recovery rate of degraded habitats.

ICBEMP. 1997a,b. As part of the Clinton Administration’s plan for ecosystem management in the Pacific Northwest, the USFS and BLM jointly established the Interior Columbia River Basin Ecosystem Management Project (ICBEMP). The project produced two draft environmental impact statements (DEIS), covering seven alternative management strategies for federal lands in the interior Columbia River basin east of the Cascade crest and portions of the Klamath and Great Basins within Oregon. The alternatives developed began with the project's purpose and need statements: “to provide a coordinated

approach to a scientifically sound, ecosystem-based management strategy," and to "restore and maintain long-term ecosystem health and ecological integrity and to support the economic and/or social needs of people, cultures, and communities, by providing predictable and sustainable levels of goods and services from Forest Service and BLM-administered lands." [Page S1 to S2 (in both a, & b)]

INFISH. 1995. This USFS Record of Decision and Finding of No Significant Impact applies to 22 National Forest in eastern Oregon and Washington, Idaho, western Montana, and portions of Nevada (project area). The document describes a strategy to provide interim direction to protect habitat and resident fish populations outside anadromous habitats within the project area. The strategy consists of riparian management objectives, standards and guidelines, and monitoring requirements. The preferred alternative (Alternative D) amends management direction established in the Regional Guides and all existing land and resource management plans within the project area.

NWP. 1994. This Record of Decision (ROD) amended the planning documents of 19 National Forests and 7 BLM districts. The selected alternative (Alternative 9) was one of 10 alternatives developed and assessed by FEMAT. Alternative 9 includes well-distributed reserves that protect old forest and the species that depend on this habitat type; locates late-successional reserves in key watersheds; includes a riparian protection strategy that has four components (key watersheds, riparian reserves, watershed analysis, and watershed restoration); and designates adaptive management areas to encourage testing of technical and social approaches to achieving social, economic, and ecological objectives. Riparian reserves (and the other land allocations) were accompanied by a set of standards and guidelines to prohibit or regulate activities in riparian reserves that retard or prevent the attainment of aquatic conservation strategy objectives.

PACFISH. 1995. This document is the Record of Decision, Environmental Assessment, and Finding of No Significant Impact by the USFS and BLM for the management of anadromous fish-producing watersheds on federal lands in eastern Oregon and Washington, Idaho, and portions of California. The amendment was to be in place for 18 months while longer-term strategies were being developed through two geographically specific EISs. The preferred alternative (Alternative 4) provides supplemental management direction for Land Use Plans or regional guides and forest plans to add new riparian goals, interim riparian management objectives, and standards and guidelines for new and proposed projects to protect the condition and function of riparian habitat conservation areas (RHCA). The standards and guidelines were designed to provide safeguards against activity effects that pose an unacceptable risk to RHCAs. A key watersheds network is also provided, along with development and trial application of a protocol for watershed analysis.

VIII. STRATEGIES

[Prevent further degradation of tributary and estuary habitat conditions and water quality; Protect existing high quality habitats; Restore degraded habitats on a priority basis.]

Bradbury *et al*. 1995. This document outlines an approach for restoration prioritization that is intended to provide native fishes and ecosystems with the most ecological benefits and a priority for anadromous salmonids. The approach addresses watersheds rather than individual species. The advantage of using an ecosystem approach is that it is intended to recognize problems before they are beyond repair, which leads to a more effective protection and restoration strategy. An ecosystem approach focuses on process and elements that degrade ecosystem function and avoids restoration that addresses symptoms rather than sources of problems.

Frissell. 1997. Past restoration efforts have been hindered by lack of attention and understanding of ecological context and ecosystem processes involved in habitat degradation. The lack of an ecological context has perpetrated a long-standing and unnecessary dichotomy between habitat restoration and habitat conservation that undermines recovery efforts. "Restoration priorities should begin by identifying and securing existing watershed refugia and downstream critical habitats that function as convergence nodes for existing populations and life histories of key species. The next priority for recovery of habitat reaches adjacent to watershed refugia and nodal habitats. Finally, the long-term restoration of downstream, lowland habitats is necessary to reestablish historical levels of productivity and secure the future of native species." [Page 114]

ISG. 1999. The document suggests that successful salmon restoration will be guided by the concept of the "salmon life history ecosystem." [Page 10] Rebuilding more abundant, productive and stable salmon population is dependent on increasing natural ecosystem processes and functions. The increase in normative ecosystem conditions that are needed to recover salmon include: "restoration of habitat for all life history stages (including migration), reduction of mortality sources (including harvesters), planning hydropower mitigation measures in the context of the normative river concept, and empirical evaluation of mitigation for effectiveness in reaching fish restoration objectives." [Page10]

Restoration must also be a function of salmon population and life history diversity, not just production. "Reserves that protect remaining core populations and intact habitats are needed to foster a step-by-step rebuilding of salmon abundance and productivity." [Page10]

NRC. 1996. Few increases in aquatic populations have been demonstrated as a result of the large amounts of time and money spent of habitat recovery efforts in the Columbia River basin. This failure can be largely attributed to a failure to match the scale of the recovery project to the scale of the life histories of salmon in a river basin. Projects that are targeted at single habitat components on a small portion of the total drainage, and that do not take into consideration the processes and management practices that maintain habitat conditions conducive to salmon production, are likely to fail.

Habitat management and restoration concepts are defined and differentiated. Restoration is defined as "reestablishment of predisturbance aquatic functions and related physical,

chemical, and biological characteristics. Restoration is different from habitat creation, reclamation, and rehabilitation – it is a holistic process not achieved through isolated manipulation of individual elements." [Page 204]

NPPC. 1999. The Council has adopted a framework and program that is scientifically based on biologically sound objectives. It includes a new program that is: "based on province-level scale, defined goals and strategies; defined principles for artificial production (through Artificial Production Review), explicit criteria described for subbasin plans, a comprehensive, regional monitoring and evaluation program is in place, describes procedures and standards for project review and funding recommendation, including budget allocations, developed consistent with requirements of Power Act, program fulfills ESA requirements where applicable." [Page 4]

Stanford *et al*. 1996. This document recommends a restoration protocol that is based on formalization of the problem at the scale of the catchment; restoration of habitat heterogeneity by letting the river do the work; maximization of passage efficiency; minimization of cultured stocks; minimization of effort to control riverine food webs; and use of adaptive ecosystem management.

USFS. 1999. The document describes an interim strategy for USFS and BLM lands. The strategy is an interim one, because it is related to the implementation of PACFISH, which is intended to be replaced with a long-term strategy described by the Interior Columbia River Ecosystem Management Project. The restoration philosophy it embraces includes a full spectrum of restoration activities on a limited number of watersheds: first securing aquatic species strongholds by addressing threats to long-term habitat and watershed stability; then, extending favorable conditions into adjacent watersheds and then to more poorly represented parts of the subbasin.

Quigley and Arbelbide. 1997. "Long term persistence of aquatic biological diversity will depend on more than current distribution of productive habitats for many systems. It will likely depend on restoring watershed processes that create and maintain habitats across broad networks that will support the species, genetic, and phenotypic diversity necessary to buffer population and communities in variable and changing environments." [Page 1372]

Restoration is assumed to include the maintenance or restoration of aquatic ecosystem integrity and to provide for the long-term persistence of native and desirable non-native fishes. Restoration, then, will require the rebuilding of a network of well-connected, high-quality habitats that supports a diverse assemblage of native species, the full expression of potential life histories and dispersal mechanisms, and the genetic diversity necessary for long-term persistence.

To reach the restoration goal in many areas will require more than a singular focus on a fixed set of high-quality habitats because these are currently too few and are poorly distributed. Restoration must also include "the development of more ecologically

compatible land-use policies . . . required to ensure the long-term productivity of many systems." [Page 1356]

Yount and Niemi. 1990. One of the factors associated with short recovery times of aquatic riverine systems was the availability and accessibility of unaffected upstream and downstream areas and internal refuges that could serve as sources of organisms for recolonization.

IX. COORDINATION

Doppelt *et al*. 1993. This document, in discussing policy problems associated with prevention of degradation of America's riverine systems and riverine-riparian biodiversity, noted that there are no "national policies that mandate coordinated federal, state, and private management and conservation of whole river systems." [Page ix] The paper suggests that policies in the form of several Acts be developed that will create a comprehensive, uniform policy that would be applied to federal lands and that will mandate watersheds-level, ecosystem-based protection and restoration. These Acts would also provide a mechanism to initiate voluntary, non-regulatory local effort to recover riverine systems on private lands.

NRC. 1996. The National Research Council developed this conclusion regarding the management directed by current programs: "The social structures and institutions that have been operating in the Pacific Northwest have proved incapable of ensuring a long-term future for salmon, in large part because they do not operate at the right time and spaces scales. . . . differences among watersheds mean that different approaches are likely to be appropriate and effective in different watersheds, even where the goals are the same. This means that institutions must be able to operate at the scale of watersheds; in addition, a coordinating function is needed to make sure that larger perspectives are considered." [Page 4]

Sedell *et al*. 1990. To protect refugia and to achieve restoration, it is essential that management agencies at all levels of government work toward common goals that are achievable and based on state-of-the-art science of river ecology.

Stanford and Ward. 1992. The document presented the restoration efforts occurring in the Flathead River-Lake ecosystem, Montana. While differences in opinion continue to exist concerning which techniques should be used, the environmental problems of the system have been quantified, articulated, and periodically reassessed to discern how this large catchment is influenced by natural and human disturbance. This understanding was cultivated by the Flathead Basin Commission, a state-legislated commission that coordinated public information and provided oversight. The commission functioned to coordinate agency heads and informed citizens in a manner that stimulated interagency cooperation to fund research, effectively monitor ecosystem indicators, and facilitate discussion of results and proposed management actions in a non-statutory fashion. The commission was instrumental in providing a forum this is effective and empirically based

so that alternative actions to protect and enhance connectivity in this large catchment could be achieved.

Spence *et al*. 1996. "Salmonids are likely to benefit from increased planning at the regional level. To an increasing degree, State and Federal resources management agencies are developing cooperative programs for salmonid conservation and restoration; this coordination of effort is essential for addressing conservation at the watershed, basin, and region level." [Page179]

Preister and Kent. 1997. Successful watershed restoration will often be dependent on "cultural restoration, meaning the good will, stewardship values, and participation by citizens. Hence, restoration programs and policies must reflect local watershed knowledge, create an integration between community and scientific concerns, and develop incentives that favor stewardship behavior." [Page 29]

Turner. 1997. Proper watershed management can only be achieved if it includes the private sector, which has a strong and vested interest. Watershed restoration on a broad scale and that is sustainable will be achieved only when "a knowledgeable and empowered private sector, equipped with technical support from public agencies" is engaged in the process. [Pages 160-161]

WDFW and PNPTC. 1999. The success of the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum Habitat recovery plan will depend largely upon mutual cooperation between various governmental and non-governmental entities. This cooperation is required because no single entity has the authority and mandate for habitat protection; rather, it is spread among a multitude of agencies, including local, state, federal, and tribal governments.

REFERENCE CITATIONS

Arkoosh, M. R., E. Casillas, P. Huffman, E. Clemons, J. Evered, J. E. Stein, and U. Varanasi. 1998. Increased Susceptibility of Juvenile Chinook Salmon from a Contaminated Estuary to *Vibrio anguillarium*. Transaction of the American Fisheries Society 127:360-374.

Beschta, R. L., R. E. Bilby, G. W. Brown, L. B. Holtby, and T. D. Hofstra. 1987. Stream temperature and aquatic habitat: Fisheries and forestry interactions. Pages 191-232 *in* E.O. Salo and T.W. Cundy, editors. Streamside management: Forestry and fishery interactions. University of Washington, College of Forest Research, Seattle, Washington.

Beschta, R. L., J. R. Boyle, C. C. Chambers, W. P. Gibson, S. V. Gregory, J. Grizzel, J. C. Hagar, J. L. Li, W. I. C. McComb, M. L. Reiter, G. H. Taylor, and J. E. Warila. 1995. Cumulative effects of forest practices in Oregon. Oregon State University, Corvallis. Prepared for the Oregon Department of Forestry, Salem, Oregon.

Bisson, P. A., R. A. Bilby, M. D. Bryant, C. A. Dolloff, G. B. Grette, R. A. House, M. L. Murphey, K. V. Koski, and J. R. Sedell. 1987. Large woody debris in forested streams

in the Pacific northwest: Past, present and future. Pages 143-190 *in* E. O. Salo and T. W. Cundy, editors. Streamside management: Forestry and fishery interactions. University of Forest Resources Contribution 57, Seattle, Washington.

Bradbury, B., W. Nehlsen, T. E. Nikelsen, K. M. S. Moore, R. M. Hughes, D. Heller, J. Nicholas, D. L. Bottom, W. E. Weaver, and R. L. Beschta. 1995. Handbook for Prioritizing Watershed Protection and Restoration to Aid Recovery of Native Salmon.

Brown, G. W., and J. T. Krygier. 1970. Effects of clear-cutting on stream temperature. Water Resources Bulletin 6:1133-1139.

Cederholm, C. J., and L. M. Reid. 1987. Impact of forest management on coho salmon (*Oncorhynchus kisutch*) populations of the Clearwater River, Washington: a project summary. Pages 373-398 *in* E. O. Salo and T. W. Cundy, editors. Streamside management: Forestry and fishery interactions. University of Washington, College of Forest Research, Seattle, Washington.

Chamberlin, T. W., R. D. Harr, and F. H. Everest. 1991. Timber harvesting, silviculture, and watershed processes. American Fisheries Society Special Publication 19: 181-206.

CRITFC (Columbia River Inter-Tribal Fish Commission). 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon: Volume II, Subbasin Plans. Columbia River Inter-Tribal Fish Commission, Portland, Oregon.

Dauble, D. 1994. Influence of water practices on fisheries resources in the Yakima River basin. Northwest Science 68:121. Conference information for the 67th annual meeting of the Northwest Scientific Association, Ellensburg, Washington.

Doppelt, B., M. Scurlock, C. Frissell, and J. Karr. 1993. Entering the watershed: a new approach to save America's river ecosystems. Island Press, Washington D.C.

Dunne, T., and L.B. Leopold. 1978. Water in environmental planning. W.B. Freeman and Company. San Francisco, California.

Everest, F. H., R. L. Beschta, J. C. Scrivener, K. B. Koski, J R. Sedell, and C. J. Cederholm. 1987. Fine sediment and salmon production: a paradox. Pages 98-142 *in* E. O. Salo and T. W. Cundy, editors. Streamside management: Forestry and fishery interactions. University of Washington, College of Forest Research, Seattle, Washington.

FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest ecosystem management: an ecological, economic and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Government Printing Office 1993-793-071. U.S. Government Printing Office for the U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, National Park Service; U.S. Department of Commerce, National Oceanic

and Atmospheric Administration and Nation Marine Fisheries Service; and U.S. Environmental Protection Agency.

Frissell, C. A. 1993. A new strategy for watershed restoration and recovery of Pacific salmon in the Pacific Northwest. Prepared for the Pacific Rivers Council, Eugene, Oregon.

Frissell, C. A. 1997. Ecological Principles. Pages 96-115 *in* J. E. Williams, C.A. Wood, and M. P. Dombeck, editors. Watershed Restoration: principles and practices. American Fisheries Society. Bethesda, Maryland.

Furniss, M. J., T. D. Roelofs, and C. S. Yee. 1991. Road construction and maintenance, American Fisheries Society Special Publication 19:297-324.

Gibbons, D. R., and E. O. Salo. 1973. An annotated bibliography of the effects of logging on fish of the western United States and Canada. Gen. Tech. Rpt. PNW-GTR-10. Portland, Oregon.

Harr, R. D., W. C. Harper, J. T. Krygier, and F. S. Hsieh. 1975. Changes in storm hydrographs after road building and clear-cutting in the Oregon coast range. Water Resources Research. 11:436-444.

Henjum, M. G., J. R. Karr, D. L. Bottom, D. A. Perry, J. C. Bednarz, S. G. Wright, S. A. Beckwitt, and E. Beckwitt. 1994. Interim Protection for late-successional forests, fisheries, and watersheds: national east of the Cascade Crest, Oregon and Washington. The Wildlife Society, Bethesda, Maryland.

House, R., A. Thomas, G. Terland, D. Tol, R. Wiley, and J. Williams. 1996. Management of anadromous fish habitat on public lands, including sustainable management concepts, and status and trends in Alaska, coastal and Columbia regions. U.S. Department of Interior, Bureau of Land Management. Boise, Idaho.

ICBEMP: U.S. Department of Agriculture, Forest Service and U.S. Department of Interior Bureau of Land Management. 1997a. Interior Columbia Basin Ecosystem Management Project, Eastside Draft Environmental Impact Statement. (Available from Interior Columbia Basin Ecosystem Management Project, Walla Walla, Washington.)

ICBEMP: U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior Bureau of Land Management. 1997b. Interior Columbia Basin Ecosystem Management Project, Upper Columbia River Basin Draft Environmental Impact Statement. (Available from Interior Columbia Basin Ecosystem Management Project, Walla Walla, Washington.)

INFISH: U.S. Department of Agriculture, Forest Service. 1995. Environmental assessment for the implementation of interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana, and portions of Nevada. U.S. Government Printing Office, Washington D.C.

ISG (Independent Scientific Group). 1999. Return to the River: Scientific Issues in the Restoration of Salmonid Fishes in the Columbia River. Fisheries: 24 (3):10-9.

Kennish, M. 1997. Practical handbook of estuarine and marine pollution. CRC Press, Boca Raton, Florida.

Lower Columbia River Estuary Program. 1999. Comprehensive Conservation and Management Plan. Volume 1: June 1999. Lower Columbia River Estuary Program, Portland, Oregon.

MacDonald, L. H., A. W. Smart, and R. C. Wissmar. 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the Pacific Northwest and Alaska. US Environmental Protection Agency, Water Division, Region 10 EPA/910/9-91-001. NDS Section, WD-139. Seattle, Washington.

Marcus, M. D., M. K. Young, L. E. Noel, and B. A. Mullan. 1990. Salmonid-habitat relationships in the western United States: a review an indexed bibliography. General Technical Report RM-GTR-188. U. S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

McIntosh, B. A., J. R. Sedell, J. E. Smith, R. C. Wissmar, S. E. Clarke, G. H. Reeves, and L. A. Brown. 1994a. Management history of eastside ecosystems: changes in fish habitat over 50 years, 1935 to 1992. U.S. Dept. Ag., Pacific Northwest Research Station, General Technical Report. PNW-GTR-321.

McIntosh, B. A., J. R. Sedell, J. E. Smith, R. C. Wissmar, S. E. Clarke, G. H. Reeves, and L.A. Brown. 1994b. Historical changes in fish habitat for select river basins of eastern Oregon and Washington. Northwest Science. 68:36-53.

Meehan, W. R., and W. S. Platts. 1978. Livestock grazing and the aquatic environment. Journal of Soil and Water Conservation. 33(6):274-278.

Meehan, W. R., ed. 1991. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.

Nelson, R. L. McHenry, M., and W. S. Platts. 1991. Mining. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19:425-457.

NMFS (National Marine Fisheries Service). 1999. Description and identification of essential fish habitat, adverse impacts and recommended conservation measures for salmon. Amendment 14 to the Pacific Coast Salmon Plan, Draft Appendix A. January 1999. Pacific Fisheries Management Council Award Number NA87FC008. Portland, Oregon.

NMFS (National Marine Fisheries Service). 1996. Factors for decline: a supplement to the Notice of Determination for west coast steelhead under the Endangered Species Act. (Available from Environmental Technical Services Division, NMFS Portland, Oregon.)

NPPC (Northwest Power Planning Council). 1986. Compilation of information on salmon and steelhead losses in the Columbia River Basin. Columbia River Basin Fish and Wildlife Program. Portland, Oregon.

NPPC (Northwest Power Planning Council). 1999. Fiscal Year 2000 Annual Implementation Work Plan funding recommendation Draft 4 of the Rolling Memorandum. Memorandum from the NWPPC Fish and Wildlife Staff to the Council members, September 9, 1999.

NRC (National Research Council) 1996. Upstream: salmon and society in the Pacific Northwest. Report of the Committee on Protection and Management of Pacific Northwest Anadromous Salmonids for the National Research council of the National Academy of Sciences. Nation Academy Press, Washington, DC.

NRC (National Research Council). 1989. Irrigation-induced water quality problems: what can be learned from the San Joaquin Valley experience. National Academy Press, Washington, D.C.

NWP (Northwest Forest Plan). 1994. USDA Forest Service; USDI Bureau of Land Management. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl; standards and guidelines. U. S. Government Printing Office, Washington, D.C.

Omernik, J. M. 1977. Nonpoint source-stream nutrient level relationships: A nationwide study. EPA-600/3/77-105. U.S. Environmental Protection Agency. Corvallis, Oregon.

OWRRI (Oregon Water Resources Research Institute). 1995. Gravel Disturbance Impacts on Salmon Habitat and Stream Health, Volume 1. Summary Report. Oregon State University, Corvallis, Oregon. (Available from Oregon Division of State Lands, Salem, Oregon; Also available Vol. II: Technical background report.)

PACFISH: U.S. Department of Agriculture, Forest Service and U.S. Department of Interior, Bureau of Land Management. 1995. Decision notice/decision record, FONSI, ES, Appendices for the interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. Washington DC: U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior Bureau of Land Management.

Phillips, R. 1984. The ecology of eelgrass meadows in the Pacific Northwest: A community profile. U.S. Fish and Wildlife Service. FWS/OBS-84/24.

Platts, W. S., R. J. Torquemada, M. L. McHenry, and C. K. Graham. 1989. Transactions of the American Fisheries Society 118: 274-283.

Platts, W. S. 1991. Livestock grazing. American Fisheries Society Special Publication 19:389-424.

Preister, K., and J. A. Kent. 1997. Social ecology: a new pathway to watershed restoration. Pages 28-48 *in* J. E. Williams, C.A. Wood, and M. P. Dombeck, editors. Watershed Restoration: principles and practices. American Fisheries Society. Bethesda, MD.

Quigley, T. M., and S. J. Arbelbide (technical editors). 1997. An assessment of ecosystem components in the interior Columbia River basin and portions of the Klamath and Great Basins: Volume 3. Gen. Tech. Rep. PNW-GTR-405. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 4 vol. (Quigley T. M., tech. ed.: The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Rauzi, F., and C. L. Hanson. 1966. Water intake and runoff as affected by intensity of grazing. Journal of Range Management. 26:126-129.

Raymond, H. 1979. Effects of dams and impoundment on migrations of juvenile chinook salmon and steelhead from the Snake river, 1966 to 1975. Transactions of the American Fisheries Society 108 (6):505-529.

Rhodes, J. J., D. A. McCullough, and F. A. Espinosa, Jr. 1994. A coarse screening process for evaluation of the effects of land management activities on salmon spawning and rearing habitat in ESA consultations. Technical Report 94-4. Columbia River Inter-Tribal Fish Commission. Portland, Oregon. Prepared under BIA/NMFS contract agreement No. 40ABNF3.

Sedell, J. R., G. H. Reeves, F. R. Hauer, J. A. Stanford, and C. P. Hawkins. 1990. Role of refugia in recovery from disturbances: modern fragmented and disconnected river systems. Environmental Management 14(5):711-724.

Sherwood, C., D. Jay, B. Harvey, P. Hamilton, and C. Simenstad. 1990. Historical changes in the Columbia River estuary. Progress in Oceanography 25:299-352.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. Prepared by Management Technology for the National Marine Fisheries Service. TR-4501-96-6057. (Available from the NMFS Habitat Branch, Portland, Oregon.)

Standford, J. A., and J. V. Ward. 1992. Management of aquatic resources in large catchments: recognizing interactions between ecosystem connectivity and environmental disturbance. Pages 91-124 *in* R. J. Naiman, editor. Watershed management: balancing sustainability and environmental change. Springer-Verlag, New York.

Stanford, J. A., J. V. Ward, W. J. Liss, C. A. Frissell, R. N. Williams, J. A. Lichatowich, and C. C. Coutant. 1996. A general protocol for restoration of regulated rivers. Regulated Rivers Research and Management 12:391-413.

Stober, Q. J., M. R. Criben, R. V. Walker, A. L. Setter, and others . 1979. Columbia River irrigation withdrawal environmental review: Columbia River fishery study. Final report, Contract Number DACW5779-C-0090, Corps, FRI-UW-7919, University of Washington. Seattle, Washington.

Swanston, D. N. 1991. Natural Processes. American Fisheries Society Special Publication 19:139-179.

Taylor, F. R., L. A. Gillman, and J. W. Pedretti. 1989. Impact of cattle on two isolated fish populations in Pahranagat Valley, Nevada. Great Basin Naturalist 49(4): 491-495.

Thurow, T.L. 1991. Hydrology and erosion. *In*: R.K. Heitschmidt and J.W. Stuth, editors. Grazing management: an ecological perspective. Timber Press. Portland, OR.

Turner, W. M. 1997. Achieving private-sector involvement and its implication for resource professionals. Pages 158-178 *in* J. E. Williams, C.A. Wood, and M. P. Dombeck, editors. Watershed Restoration: principles and practices. American Fisheries Society. Bethesda, Maryland.

USEPA (U.S. Environmental Protection Agency). 1993. Guidance specifying management measures for sources of non-point pollution in coastal waters. Office of Water. Washington, D.C. 840-B-92-002.

USFS (U.S. Forest Service). 1999. Unpublished report. An interim watershed restoration strategy. A commitment made as part of the Biological Opinion for chinook salmon and steelhead. USDA Forest Service Pacific Northwest Region, Portland, OR.

Volkman, J. M. 1997. Unpublished report. A river in common: The Columbia, the salmon ecosystem, and water policy. The Western Water Policy Review Advisory Commission. (Available from National Technical Information Service, Springfield, Virginia.)

Waldichuk, M. 1993. Fish habitat and the impact of human activity with particular reference to Pacific salmon. Pages 295-337 *in*: L. S. parsons and W. H. Lear, editors. Perspectives on Canadian marine fisheries management. Canadian Bulletin of Fisheries and Aquatic Sciences 226.

WDFW (Washington Department of Fish and Wildlife) and PNPTC (Point No Point Treaty Council). 1999. Unpublished report. Hood Canal/Eastern Strait of Juan de Fuca Summer Chum Habitat Recovery Plan. (Available from Hood Canal Coordinating Council, Office of Supply Store, 409 W. Railroad Ave., Shelton, WA.)

Weaver, W.E., T.C. Brundage, and D.K. Hagans. 1998. Aerial reconnaissance evaluation of recent storm effects on upland mountainous watersheds of Idaho; wildland response to recent storms and floods in the Clearwater, Lochsa and Boise river watersheds, Idaho. Pacific Rivers Council. Eugene, Oregon.

Weaver, W., D. Hagans, and M. A. Madej. 1987. Managing forest roads to control cumulative erosion and sedimentation effects. *In*: Proceedings, California watershed management conference. Wildland Resources Center Report 11. Berkeley, California.

West, C., L. Galloway, and J. Lyon. 1995. Mines, stormwater pollution, and you. Mineral Policy Center, Washington, D.C.

Yount, J. D., and G. J. Niemi. 1990. Recovery of lotic communities and ecosystems from disturbance – A narrative of case studies. Environmental Management 14(5): 547-569.

HABITAT ALTERATION: TABLE DATA

Table M-1 lists examples of habitat alteration and corresponding potential effects on Pacific salmon. Table M-2 describes most (but not all) of the types of activities which are likely to generate these effects and which may require consultation if undertaken, funded, or permitted by a federal agency in salmon EFH. These tables are found (as tables 3-1 and 3-2) in Section 3.0 of Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (Pacific Fisheries Management Council, 1999). Desired modifications to Table 3-2 text are listed in a footnote to the table.

TABLE M-1. How habitat alteration affects Pacific salmon.[5] (Page 134 of 3)

Ecosystem Feature	Altered Component	Effects on Salmonid Fishes and Their Ecosystems
Water Quality	Increased Temperature	Altered adult migration patterns, accelerated development of eggs and alevins, earlier fry emergence, increased metabolism, behavioral avoidance at high temperatures, increased primary and secondary production, increased susceptibility of both juveniles and adults to certain parasites and diseases, altered competitive interactions between species, mortality at sustained temperatures of >73-84° F, reduced biodiversity.
	Decreased Temperature	Cessation of spawning, increased egg mortalities, susceptibility to disease (USACOE 1991).
	Dissolved Oxygen	Reduced survival of eggs and alevins, smaller size at emergence, increased physiological stress, reduced growth.
	Gas Supersaturation	Increased mortality of migrating salmon.
	Nutrient Loading	Increased primary and secondary production, possible oxygen depletion during extreme algal blooms, lower survival and productivity, increased eutrophication rate of standing waters, certain nutrients (e.g., nonionized ammonia, some metals) possibly toxic to eggs and juveniles at high concentrations.
Sediment	Surface Erosion	Reduced survival of eggs and alevins, reduced primary and secondary productivity, interference with feedings, behavioral avoidance and breakdown of social organization, pool filling.
	Mass Failures and Landslides	Reduced survival of eggs and alevins, reduced primary and secondary productivity, behavioral avoidance, formation of upstream migration barriers, pool filling, addition of new large structure to channels.
Habitat Access	Physical Barriers	Loss of spawning habitat for adults; inability of juveniles to reach overwintering sites or thermal refugia, loss of summer rearing habitat, increased vulnerability to predation.
Channel Structure	Flood Plains	Loss of overwintering habitat, loss of refuge from high flows, loss of inputs of organic matter and large wood, loss of sediment removal capacity.
	Side-Channels	Loss of overwintering habitat, loss of refuge from high flows.
	Pools and Riffles	Shift in the balance of species, loss of deep water cover and adult holding areas, reduced rearing sites for yearling and older juveniles.
	Large Wood	Loss of cover from predators and high flows, reduced sediment and organic matter storage, reduced pool-forming structures, reduced organic substrate for macroinvertebrates, formation of new migration barriers, reduced capacity to trap salmon carcasses.

5 * Freshwater portions of this table are excerpted from Gregory and Bisson (1997) with minor adaptations from that paper. See Gregory and Bisson (1997) for references to original documents on freshwater effects. Also see Spence *et al.* 1996, and NRC 1996 for additional narrative explanation of how alterations in habitat components effect salmon.

Estuarine effects from: Casillas *et al.* 1997, Cohen 1997, Cortright *et al.* 1987, FRI 1981, Lebovitz 1992, Levings and Bouillon 1997, Felsot 1997, Levy 1982, NRC 1996, Luiting *et al.* 1997, Phillips 1984, RAC 1997, Simenstad 1983, 1985, and Simenstad *et al.* 1990.

TABLE M-1. How habitat alteration affects Pacific salmon.[5] (Page 134 of 3)

Ecosystem Feature	Altered Component	Effects on Salmonid Fishes and Their Ecosystems
	Substrate	Reduced survival of eggs and alevins, loss of inter-gravel spaces used for refuge by fry, reduced macroinvertebrate production, reduced biodiversity.
	Hyporheic Zone (biologically active interface between groundwater area and stream bed)	Reduced exchange of nutrients between surface and subsurface waters and between aquatic and terrestrial ecosystems, reduced potential for recolonizing disturbed substrates.
Hydrology	Discharge	Altered timing of discharge related life cycle cue (e.g., migrations), changes in availability of food organisms related to timing of emergence and recovery after disturbance, altered transport of sediment and fine particulate organic matter, reduced prey diversity.
Hydrology (continued)	Peak Flows	Scour-related mortality of eggs and alevins, reduced primary and secondary productivity, long-term depletion of large wood and organic matter, involuntary downstream movement of juveniles during high water flows, accelerated erosion of streambanks.
	Low Flows	Crowding and increased competition for foraging sites, reduced primary and secondary productivity, increased vulnerability to predation, increased fine sediment deposition.
	Rapid Fluctuations	Altered timing of discharge-related life cycle events (e.g., migrations), stranding, redd dewatering, intermittent connections between mainstream and floodplain rearing habitats, reduced primary and secondary productivity.
Riparian Forest	Production of Large Wood	Loss of cover from predators and high flows, reduced sediment and organic matter storage, reduced pool-forming structures, reduced organic substrate for macroinvertebrates.
	Production of Food Organisms and Organic Matter	Reduced production and abundance of certain macroinvertebrates, reduced surface-drifting food items, reduced growth in some seasons.
	Shading	Increased water temperature, increased primary and secondary production, reduced overhead cover, altered foraging efficiency.
	Vegetative Rooting Systems and Streambank Integrity	Loss of cover along channel margins, decreased channel stability, increased streambank erosion, increased landslides.
	Nutrient Modification	Altered nutrient inputs from terrestrial ecosystems, altered primary and secondary production.
Exogenous Material	Chemicals	Reduced survival of eggs and alevins, toxicity to juveniles and adults, increased physiological stress, altered primary and secondary production, reduced biodiversity.
Exogenous Material	Exotic Organisms/Plants	Increased mortality through predation, increased interspecific competition, introduction of diseases, habitat structure alteration.
Estuarine Structure	Tide Flats	Loss of primary and secondary productivity, loss of prey.
	Eel Grass Beds	Loss of cover from predators, loss of primary productivity, loss of prey.
	Marshes (Salt Water, Brackish, and Tidal-	Loss of cover, loss of primary productivity, loss of prey, loss of sediment and nutrient filter.

TABLE M-1. How habitat alteration affects Pacific salmon.[5] (Page 134 of 3)

Ecosystem Feature	Altered Component	Effects on Salmonid Fishes and Their Ecosystems
	Freshwater)	
	Tidal Freshwater Swamps, Including Sloughs	Loss of cover, loss of primary productivity, loss of prey, loss of refuge area during high flows.
	Channels	Loss of cover, loss of refuge from tidal cycles, high flows, loss of sediment/nutrient filter.
	Large Woody Debris	Loss of cover, organic matter storage, habitat complexity.
Estuarine Water Quality	Dissolved Oxygen	Increased physiological stress, reduced growth.
	Nutrients	Increased primary and secondary production, possible oxygen depletion during extreme algal blooms.
	Temperature	Susceptibility to diseases, parasites, behavioral avoidance.
	Exogenous Chemicals	Toxicity to juveniles and adults and their prey, increased stress, lower disease resistance, behavioral alterations.
Estuarine Water Quality (continued)	Exogenous Organisms, Plants	Introduction of diseases, habitat competition, increased predation, changes to habitat structure, nutrient cycling, prey species.
Estuarine Hydrology	Low Freshwater Inflows/Alterations in Timing of Flows	Alterations of juvenile survival, alterations in timing of migrations, altered transport of sediment and organic matter, altered estuarine circulation, loss of cover, increased vulnerability to predators.
Marine Water Quality	Water Quality (Sediment, Nutrients)	Reduced cover, prey effects, reduced feeding efficiency.
	Exogenous Chemicals	Toxicity to juveniles and adults, toxicity to prey, increased stress, susceptibility to disease, altered primary and secondary production.
	Low Freshwater Inflows/Timing Alterations	Reduced cover (e.g., in plumes), altered nutrient input.

TABLE M-2. Actions with the potential likely to adversely affect salmon habitat and habitat components likely to be altered (see Table L-1 for cross reference on how changes in habitat components affect salmon and generally desired habitat conditions).6 (Page 1 of 2)

ACTIONS LIKELY TO EFFECT SALMON EFH	COMPACTION OF SOIL / CREATION OF IMPERVIOUS SURFACES	DISCHARGE OF WASTE - WATER, RUN-OFF	ESTUARINE HABITAT ALTERATION	INTRODUCE/TRANSFER/ CONTROL OF EXOTIC ORGANISMS/PLANTS/ DISEASE	CREATION OF MIGRATION BARRIERS/ HAZARDS	MARINE HABITAT ALTERATION	REMOVAL OF PREY (DIRECT REMOVAL)	REDD DISTURBANCE (DIRECT)
EXAMPLES OF ACTIVITIES THAT MAY INVOLVE THOSE ACTIONS	forestry, agriculture, ranching, road building, construction, urbanization	industrial/food processing, mining, desalinization, aquaculture, forestry, agric. grazing, urbanization, vessel fueling/ repair, dredging, oil/ mineral development	jetty or dock constr., dredging, spoil disposal, waste discharge, vessel oper. (shallow water) ballast water disposal , aquaculture, pipeline install.	aquaculture, bilge water discharge, inter-basin water/fish transfer, fish introduction, boating	dam and irrigation facility constr/operation road building, navigation lock oper., dock installation stream bed mining, tide gate installation/ maintenance	dredge spoil disposal, mineral, oil level/ transport, wastewater discharge, ballast discharge, spill dispersal, incineration,	fishing, dredging, water intakes, water diversions	grazing, fishing, dredging, sand and gravel extraction, reservoir excavation for flood control
HABITAT COMPONENTS								
Steam Water Quality:								
Temperature	X	X			X			
Dissolved Oxygen	X	X		X	X			
Sediment/Turbidity	X	X	X		X			x
Nutrients	X	X	X	X	X			
Contaminants	X	X	X	X	X			
Habitat Access:								
Physical Barriers					X			
Stream Habitat:								
Substrate	X	X	X		X			X
Large Woody Debris	X	X			X			
Pool Frequency	X	X			X			

6 **This table is printed exactly as it appears in section 3.0 of Amendment 14 to the Pacific Coast Salmon Plan. For purposes of this Habitat Appendix, however, the following modifications are noted: Another column titled "Alter Amount of Rates of Woody Debris Input" is added to the columns detailing actions likely to affect salmon EFH. Examples of activities would include grazing. Improper livestock management can reduce or eliminate woody species (e.g., cottonwood, alder) or "coarse wood" (woody shrubs) that function as LWD in streams.**

Also: under "Habitat Components/Stream Flow/Hydrology," "increase in drainage network" should be listed as an "action likely to affect salmon EFH." Besides road building, such things as gullying from poor upland management can increase the drainage network. This is an action affecting habitat, rather than a habitat component. Federal Caucus Habitat Committee, November 17, 1999.

TABLE M-2. Actions with the potential likely to adversely affect salmon habitat and habitat components likely to be altered (see Table L-1 for cross reference on how changes in habitat components affect salmon and generally desired habitat conditions).6 (Page 1 of 2)

ACTIONS LIKELY TO EFFECT SALMON EFH	COMPACTION OF SOIL / CREATION OF IMPERVIOUS SURFACES	DISCHARGE OF WASTE - WATER, RUN-OFF	ESTUARINE HABITAT ALTERATION	INTRODUCE/TRANSFER/ CONTROL OF EXOTIC ORGANISMS/PLANTS/ DISEASE	CREATION OF MIGRATION BARRIERS/ HAZARDS	MARINE HABITAT ALTERATION	REMOVAL OF PREY (DIRECT REMOVAL)	REDD DISTURBANCE (DIRECT)
EXAMPLES OF ACTIVITIES THAT MAY INVOLVE THOSE ACTIONS	forestry, agriculture, ranching, road building, construction, urbanization	industrial/food processing, mining, desalinization, aquaculture, forestry, agric. grazing, urbanization, vessel fueling/ repair, dredging, oil/ mineral development	jetty or dock constr., dredging, spoil disposal, waste discharge, vessel oper. (shallow water) ballast water disposal , aquaculture, pipeline install.	aquaculture, bilge water discharge, inter-basin water/fish transfer, fish introduction, boating	dam and irrigation facility constr/operation road building, navigation lock oper., dock installation stream bed mining, tide gate installation/ maintenance	dredge spoil disposal, mineral, oil level/ transport, wastewater discharge, ballast discharge, spill dispersal, incineration,	fishing, dredging, water intakes, water diversions	grazing, fishing, dredging, sand and gravel extraction, reservoir excavation for flood control
Pool Quality	X	X			X			
Off-Channel Habitat		X	X		X			
Prey	X	X		X	X		X	X
Predators				X	X		X	
Channel Condition & Dynamics:								
Width/Depth Ratio	X	X			X	X		
Streambank/Channel Complexity	X	X			X	X		
Floodplain Connectivity	X	X	X		X			
Stream Flow/ Hydrology:								
Change in Peak/Base Flows	X	X			X			
Increase in Drainage Network	X	X			X			
Estuarine Habitat:								
Extent/cond. of habitat types			X		X	x		
Extent/cond. of eel grass beds			X			x		
Water Quality also disease & contaminants		X	X	X		x		
Water Quantity/ Timing of Fresh water inflow	X				X	x		
Prey			X	X	X	x	X	
Predators			X	X	X	x	X	
Marine Habitat Elements: Water Quality/disease/		X		X		X		

TABLE M-2. Actions with the potential likely to adversely affect salmon habitat and habitat components likely to be altered (see Table L-1 for cross reference on how changes in habitat components affect salmon and generally desired habitat conditions).6 (Page 1 of 2)

ACTIONS LIKELY TO EFFECT SALMON EFH	COMPACTION OF SOIL / CREATION OF IMPERVIOUS SURFACES	DISCHARGE OF WASTE - WATER, RUN-OFF	ESTUARINE HABITAT ALTERATION	INTRODUCE/TRANSFER/ CONTROL OF EXOTIC ORGANISMS/PLANTS/ DISEASE	CREATION OF MIGRATION BARRIERS/ HAZARDS	MARINE HABITAT ALTERATION	REMOVAL OF PREY (DIRECT REMOVAL)	REDD DISTURBANCE (DIRECT)
EXAMPLES OF ACTIVITIES THAT MAY INVOLVE THOSE ACTIONS	forestry, agriculture, ranching, road building, construction, urbanization	industrial/food processing, mining, desalinization, aquaculture, forestry, agric. grazing, urbanization, vessel fueling/ repair, dredging, oil/ mineral development	jetty or dock constr., dredging, spoil disposal, waste discharge, vessel oper. (shallow water) ballast water disposal , aquaculture, pipeline install.	aquaculture, bilge water discharge, inter-basin water/fish transfer, fish introduction, boating	dam and irrigation facility constr/operation road building, navigation lock oper., dock installation stream bed mining, tide gate installation/ maintenance	dredge spoil disposal, mineral, oil level/ transport, wastewater discharge, ballast discharge, spill dispersal, incineration,	fishing, dredging, water intakes, water diversions	grazing, fishing, dredging, sand and gravel extraction, reservoir excavation for flood control
contaminants								
Water Quantity/ Timing-Riverine Plumes	X							
Prey			X			X	X	

HABITAT APPENDICES:
ACRONYMS AND ABBREVIATIONS

BA	Biological Assessment
BAG	Basin advisory groups
basin	Columbia River Basin
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
Bonneville	Bonneville Power Administration
CAA	Clean Air Act
CBFWA	Columbia Basin Fish and Wildlife Authority
Corps	U.S. Army Corps of Engineers
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CTA	Conservation Technical Assistance
CWA	Clean Water Act
CWAP	Clean Water Action Plan
CZMA	Coastal Zone Management Act
EAWS	ecosystem analysis at the watershed scale
EFH	Essential Fish Habitat
EIS	environmental impact statement
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
ESU	evolutionarily significant unit
EWP	Emergency Watershed Protection
FCRPS	Federal Columbia River Power System
FCSA	Feasibility Cost-Sharing Agreement
FIP	Forestry Incentives Program
FMP	Fishery Management Plan
FPMS	Flood Plain Management Services
FSA	Farm Services Agency
FWCA	Fish and Wildlife Coordination Act Federal
FLPMA	Land Policy and Management Act
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information Systems

GWEB	[Oregon] Governor's Watershed Enhancement Board
HCP	habitat conservation plan
HUC	Hydrologic Unit Code
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IIT	Interagency Implementation Team
INFISH	Resident Fish Management Plan and Biological Opinion for Forest and BLM lands
LCREP	Lower Columbia River Estuary Program
LEERDS	lands, easements, rights-of-way, relocations, and disposal areas
LCREP	Lower Columbia River Estuary Program
LRMP	Land and Resources Management Plan
MOA	Memorandum of Agreement
NCSS	National Cooperative Soil Survey Program
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFP	Northwest Forest Plan
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council
NPS	non-point source
NRCS	Natural Resource Conservation Service
NRI	National Resources Inventory
O&C	Oregon and California Lands Acts
O&M	Operations and Maintenance
PAC	provincial advisory council
PACFISH	Anadromous Fish Management Plan and Biological Opinion for Forest and BLM Lands
PAS	Planning Assistance to States
PCA	Project Cooperation Agreement
PFC	properly functioning conditions
PMP	Plant Materials Program
RAC	regional advisory council
RC&D	Resource Conservation & Development Program
RCA	riparian conservation area
SIP	Stewardship Incentive Program
SWP	Small Watershed Program

TMDL	Total Maximum Daily Load
USBR	Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	United States Geological Survey
UWA	unified watershed assessment
VSP	viable salmon population
WAG	Watershed advisory groups
WQS	Water Quality Standards
WRDA	Water Resource Development Act
WRIA	Water Resource Inventory Areas
WRP	Wetlands Reserve Program