Yakima Fisheries Project

Final Environmental Impact Statement

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DOE/EIS-0169 - Final
January 1996

In cooperation with:
Washington Department of Fish & Wildlife and Yakama Indian Nation

BONNEVILLE
POWER ADMINISTRATION

YAKIMA FISHERIES PROJECT

FINAL
ENVIRONMENTAL IMPACT STATEMENT

Bonneville Power Administration

Washington Department of Fish and Wildlife

Yakama Indian Nation

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YAKIMA FISHERIES PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT
Reader's Guide

This document represents the final environmental impact statement (EIS) for the Yakima Fisheries Project. Previous versions of this document were published in 1990 (environmental assessment or EA), in October 1992(Draft EIS), and May 1995 (Revised Draft EIS). Extensive public comments were made on the DEIS, and the document revised into the RDEIS. Further comments were made on the RDEIS, leading to changes and refinements in this Final EIS.

So that the reader who has followed this process may tracks the latest changes, the document has the following characteristics:

- All new language is shown in double-underscored type so that it looks like this. You will also see a vertical line in the margin, to help you find new material.
- Material that has been deleted is not marked. (We could have shown deleted material with a strikethrough option, but it made the document very hard to read.)
- The FEIS contains a complete listing of identified comments, together with responses. Each comment is identified with a code number and by commenter. There is a comment index, so that you may find comments taken from your letter in the text and read the response. (If you made comments but did not identify yourself, these are listed as "Anonymous".) In a number of cases, commenters' observations have led to changes in the document itself (marked as noted above).
- As with the RDEIS, an Index lists major topics in which you may be interested. You may also consult the Table of Contents to help find sections in which you have a particular interest.
- If this is your first opportunity to read an EIS, here are some tips for locating information:
    1. The purpose of an EIS is to disclose impacts that a Federal action may have on the environment and to designate what impacts might be significant. It also proposes mitigation measures to try to reduce or eliminate those impacts.
    2. Chapter 1 presents background on why the project is needed, what kinds of decision will be made, and who will make them.
    3. Chapter 3 presents the affected environment: all the resources in the project area that might be affected by the project actions.
    4. Chapter 4 presents, in detail, all the impacts that might occur, together with possible mitigation measures.
    5. Chapter 2 describes the alternatives (choices for action) and compares the impacts of those alternatives. It is based on the detailed information in Chapter 4. This is the heart of the EIS.

YAKIMA FISHERIES PROJECT
REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT
(DOE/EIS-0169)

Responsible Agency: U.S. Department of Energy, Bonneville Power Administration (BPA).

Title of Proposed Action: Yakima Fisheries Project

Cooperating Agencies: Washington Department of Fish and Wildlife, Yakama Indian Nation

States Involved: Washington

Abstract: BPA proposes to fund several fishery-related activities in the Yakima River Basin. These activities, known as the Yakima Fisheries Project (YFP), would be jointly managed by the State of Washington and the Yakama Indian Nation. The YFP is included in the Northwest Power Planning Council's (Council's) fish and wildlife program. The Council selected the Yakima River system for attention because fisheries resources are severely reduced from historical levels and because there is a significant potential for enhancement of these resources.

BPA's proposed action is to fund (1) information gathering on the implementation of supplementation techniques and on feasibility of reintroducing coho salmon in an environment where native populations have become extinct; (2) research activities based on continuous assessment, feedback and improvement of research design and activities ("adaptive management"); and (3) the construction, operation, and maintenance of facilities for supplementing populations of upper Yakima spring chinook salmon. Supplementation is a strategy for rebuilding fish spawning runs by releasing artificially propagated fish into natural streams to increase natural production.

The project has been considerably revised from the original proposal described in the first draft EIS. Examined in addition to No Action (which would leave present anadromous fisheries resources unchanged in the Basin) are two alternatives for action: (1) supplementation of depressed natural populations of upper Yakima spring chinook and (2) that same supplementation plus a study to determine the feasibility of re-establishing (via stock imported from another basin) naturally spawning population and a significant fall fishery for coho in the Yakima Basin. Alternative 2 has been identified as the preferred action. A central hatchery would be built for either alternative, as well as three sites with six raceways each for acclimation and release of spring chinook smolts.

Major issues examined in the Revised Draft EIS include potential impacts of the project on genetic and ecological resources of existing fish populations, on water quality and quantity, on threatened and endangered species listed under the Endangered Species Act, and on the recreational fishery. Only minor differences in environmental consequences were found between Alternatives 1 and 2. Potentially high impacts on wild, native, and non-target fish populations under both alternatives would be mitigated through careful adherence to the adaptive management process outlined in the EIS.

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Additional copies of the EIS may also be obtained by calling BPA's toll-free document request line: 1-800-622-4520. For information on DOE NEPA activities please contact: Carol M. Borgstrom, Director, Office of NEPA Oversight, EH-25, U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585, (800) 472-2756.

YAKIMA FISHERIES PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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APPENDICES

A **Comments on Revised Draft EIS and Responses**

B **1995 Planning Status Report: Volume 3 - Yakima Spring Chinook Salmon; Volume 5 - Yakima Coho Salmon**

C **Glossary of Species' Scientific Names**

D **Biological Assessments and Endangered Species Consultation**

E **Harvest Management**

1. PURPOSE OF AND NEED FOR ACTION

1.1 Proposed Action

The Bonneville Power Administration (BPA) proposes to fund the Yakima Fisheries Project (YFP) to undertake fishery research and mitigation activities in the Yakima River Basin. The State of Washington and the Yakama Indian Nation (YIN) would jointly direct the project.

In cooperation with BPA, the project managers propose to construct, operate and maintain anadromous[1] fish production facilities in order to conduct research activities designed to increase knowledge of supplementation techniques. These techniques would be applied to rebuild naturally spawning anadromous fish stocks historically present in the Yakima River Basin and, ultimately, to rebuild those throughout the Columbia River Basin.

The protection, mitigation, and enhancement of fish and wildlife resources of the Columbia River and its tributaries is one of the goals of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act). That Act requires that the Northwest Power Planning Council (Council) develop both a **program** to protect and rebuild Columbia Basin fish and wildlife resources (the Columbia River Basin Fish and Wildlife Program; NPPC, 1994) and a 20-year **plan** for meeting the region's electrical energy needs (the Northwest Conservation and Electric Power Plan). The Act also requires that BPA fund protection, mitigation, and enhancement activities consistent with the Council's Fish and Wildlife Program, the Power Plan, and other purposes of the Northwest Power Act. The Yakima-Klickitat Fisheries Project (YKFP) is one of the projects included in the Fish and Wildlife Program; the YFP is the first phase of the YKFP.

Although the YFP may eventually involve the supplementation of all stocks of anadromous fish known to have occurred in the Yakima Basin, at this time only two action alternatives have been proposed, in addition to the No Action alternative:

- **Alternative 1** would supplement depressed naturally spawning populations of upper Yakima spring chinook;
- **Alternative 2** would include all actions under Alternative 1; in addition, it would add a study to determine the feasibility of re-establishing a naturally spawning population and a significant fall fishery for coho in the Yakima Basin.

Coho are now virtually eliminated from the basin. Under Alternative 2, a feasibility study would be conducted using smolts currently being imported from another basin under the

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1 Words underscored at their first appearance in the text are defined in the **Glossary**.

Columbia River Fish Management Plan (CRFMP).[2] **The Policy Group for the Yakima Fisheries Project has identified Alternative 2 as the preferred alternative.** (See Section 1.5 for background on defining the scope of the project.)

1.2 Need and Purposes

The project responds directly to a **need for knowledge of viable means to rebuild and maintain naturally spawning anadromous fish stocks.** In proposing the YFP, BPA and the project managers seek knowledge about how resource managers can use the strategy of supplementation in their efforts to protect and mitigate for impacts on stocks of anadromous fish in the Yakima River Basin. As described below, traditional methods may be less viable than originally thought.

Conventional fish hatcheries traditionally have produced large numbers of artificially propagated fish to increase harvest opportunities and, in some cases, to bolster natural production. However, important questions regarding hatchery production have arisen in three areas:

- the survival of hatchery fish after release from the hatchery,
- the impacts of hatchery fish as they compete with wild populations, and
- the effects of hatchery propagation on the long-term genetic fitness of fish stocks.

The YFP is being designed (1) to provide resource managers with knowledge regarding these issues and (2) to identify and apply improved methods for carrying out hatchery production and supplementation of natural production.

Supplementation aims to rebuild natural anadromous fish spawning runs by raising and releasing artificially propagated fish into natural streams and by increasing natural production of both naturally and artificially produced fish. Its goal (as distinct from conventional hatchery practices; see Table 1.1) is to increase the numbers of naturally spawning fish, while maintaining the long-term genetic fitness of the fish population being supplemented and keeping adverse genetic and ecological interactions with non-target species or stocks within acceptable limits. Its ultimate goal is to produce enough naturally spawning fish with a high enough survival rate to be able to phase out artificial propagation.

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2 Coho are currently being acclimated and released below Wapato Dam as part of the *U.S. v. Oregon* Columbia River Fish Management Plan; see Section 1.4. This coho program is intended to provide harvest opportunities for the Yakama Indian Nation and other fishers.

Table 1.1 A Comparison of Current Hatchery Programs and Proposed Supplementation Facilities

	SUPPLEMENTATION	CONVENTIONAL HATCHERY
GOALS	• Increase natural runs while preserving genetic diversity of fish stock.	• Increase fish numbers.
	• Gather information on supplementation techniques.	• Mitigate fish losses.
	• Develop and carry out research activities.	• Increase harvest opportunities.
BROODSTOCK	• Use only naturally spawning fish trapped near spawning areas.	• Use adult fish returning to hatchery.
EARLY REARING	• Structure more closely resembles natural environment.	• Standard ponds consist of a constant or fixed environment.
FEED	• Use of some standard feed plus live feed to encourage natural feeding instincts.	• Use of standard hatchery feed and methods.
RACEWAYS	• More raceways with fewer fish (continual monitoring).	• Established numbers and density of fish in each.
REARING PONDS	• Few, to support acclimation.	• Common, as needed for production.
FISH RELEASE	• Acclimate in ponds and allowed to leave on their own.	• Dropped directly into streams.
ADULT FISH	• Return to natural spawning areas.	• Return to hatchery via fish ladder.

Fishery agencies and Tribes throughout the Pacific Northwest consider supplementation a potentially important viable alternative to conventional hatchery methods for rebuilding salmonid runs.

- The Columbia Basin Fish and Wildlife Authority's Integrated System Plan (CBFWA, 1991) indicates that the fish management agencies and Tribes expect supplementation to provide over half of the total production increases.
- The Council recognizes the value of scientifically supported supplementation programs for the rehabilitation of weak wild and naturally spawning populations (NPPC, 1994).
- The National Marine Fisheries Service (NMFS), in its Proposed Recovery Plan for Snake River Salmon (NMFS, 1995), proposes development of management programs involving artificial propagation and supplementation to support recovery of listed Snake River salmon. These programs would include specific numerical goals and strategies for genetic management, disease management, monitoring and evaluation, reintroduction and supplementation, and facilities management.

Despite this support, no adequately detailed understanding of optimal techniques exists for all situations where supplementation may be applied. Furthermore, none of the existing supplementation projects in the Columbia River Basin have adequate facilities for testing the various rearing strategies being proposed for the YFP. (See Section 2.5.) **The uncertainties about the technique, as well as the importance of supplementation to existing and potential future mitigation plans, make it imperative that supplementation be thoroughly evaluated using a systematic, experimental program. The YFP would be designed to meet both the need for rigorous research and that for responsiveness to changes as the project proceeds.**

The National Research Council (NRC, 1995) has recommended that the goal of hatchery planning, management, and operation should be to assist recovery of wild populations and to increase knowledge about salmon. "Hatcheries should be thought of as laboratories that can provide improved environments for studying juvenile fish and for testing treatments to improve our understanding of what happens to juveniles after they leave the spawning areas. Seen in that light, hatcheries can be a powerful tool for learning about salmon." (NRC, 1995:10)

A significant feature of supplementation under the YFP is the effort to maintain the long-term genetic fitness of the salmonid populations. Some of the strategies that project managers would employ would be aimed at minimizing the potential for adverse genetic impacts. These would include, but not be limited to, the following:

- identifying and separately culturing distinct stocks of fish and returning them to their ancestral drainages;
- assuring that returning first-generation supplementation fish are not used for broodstock;
- adopting broodstock collection and natural escapement protocols to ensure that both components are representative of the population and contain adequate numbers to ensure conservation of stock characteristics and long-term fitness;
- ensuring that at least 50% of naturally spawned adults are allowed to spawn naturally by managing the proportion of hatchery-spawned and naturally spawned adults allowed to spawn naturally;
- conserving the genetic diversity of the hatchery fish by using carefully planned and monitored mating strategies; and;
- creating rearing conditions that more closely resemble natural conditions.

The project would include an extensive monitoring and evaluation program to measure Yakima River Basin salmonid responses to supplementation activities. Project managers and researchers would follow an **adaptive management policy** (see Section 2.2), which would allow goals and strategies to evolve as new information becomes available. At the same time, the YFP would proceed with the Council's long-term goal of mitigating past

impacts on the anadromous fishery in the Yakima River Basin to increase the abundance of naturally reproducing salmonid stocks and to increase harvest opportunities for Yakama tribal members and other fishers.

The following objectives shape the purposes of the YFP:

1) To test the hypothesis that new supplementation techniques can be used in the Yakima River Basin to increase natural production and to improve harvest opportunities, while maintaining the long-term genetic fitness of the wild and native salmonid populations and keeping adverse ecological interactions within acceptable limits;
2) To provide knowledge about the use of supplementation, so that it may be used to mitigate effects on anadromous fisheries throughout the Columbia River Basin;
3) To implement and be consistent with the Council's Fish and Wildlife Program; and
4) To implement the project in a prudent and environmentally sound manner.

1.3 Background

The mitigation of impacts on Yakima River Basin fisheries resources is an important feature of the Columbia River Basin Fish and Wildlife Program. The Council selected the Yakima River system for supplementation for two reasons:

- fisheries resources are severely reduced from historic levels, and
- there is a significant potential for mitigation of effects on these resources.

Historically, numbers of anadromous fish returning to the Yakima River were estimated to have ranged from 600,000 to as many as 960,000 per year (BPA, 1990b). Current salmonid runs in the Yakima River have been reduced to fewer than 7,000 adults (about 1 percent of the historical run size). Declines in anadromous fish runs in the Yakima River have been attributed to activities related to irrigation, mining, harvest, forestry, and hydroelectric power generation. A comparison of historical and present returns to the basin is shown in Table 1.2.

Similar declines in anadromous fish runs have occurred throughout the Columbia River Basin. The Council considers the Yakima River system a promising location for mitigation to compensate for losses from development and operation of hydroelectric projects elsewhere in the Columbia Basin. The YFP would help determine the role that supplementation might play in increasing natural production of anadromous salmonids throughout the Columbia Basin.

Table 1.2 Estimates of Historical Anadromous Fish Runs in the Yakima River as Compared to Recent Run Size (5-year average, 1989-1994). (Fast, per. comm., 1994)

Species/Race	Pre-1900 Run	Recent Average
Fall Chinook	132,000	1,200
Spring Chinook	200,000	3,800
Summer Chinook	68,000	0
Coho	110,000	240
Summer Steelhead	80,500	1,100
Sockeye	200,000	0

In 1982, the Council first encouraged BPA to "fund the design, construction, operation, and maintenance of a hatchery to enhance the fishery for the Yakima[3] Indian Nation as well as all other harvesters." (NPPC, 1982). In 1984, the Council provided further direction by recommending development of a master plan for the YKFP. Supplementation research was added to its stated fish production objectives. The proposed YKFP master plan, reviewed by the Council in 1987, provided the conceptual framework for the project, including types of fish and numbers to be produced, facility descriptions, management structure, schedule, and steps for evaluating the success of planned activities (Fish Management Consultants, 1987).

Following Council review, preliminary design work studies were begun to collect additional information needed for project planning. In 1990, the Preliminary Design Report (BPA, 1990b) was completed. Study results indicated that production facilities could be built in the Yakima River Basin to supplement natural production, provide harvest benefits, and gain knowledge about supplementation techniques of benefit to the entire region (BPA, 1990b).

1.4 Relationship to Other Yakima River Basin Fishery Mitigation Efforts

The YFP is part of a more comprehensive effort by the U.S. Bureau of Reclamation (USBR), U.S. Forest Service (USFS), BPA, the YIN, and the State of Washington to mitigate effects on fishery and water resources in the Yakima River Basin. The YFP would test the assumption that supplementation could be used to increase natural production of anadromous fish in the Yakima River Basin and improve harvest opportunities, while maintaining long-term genetic fitness of anadromous fish. The benefits of supplementation include increased natural production (greater abundance) and increased productivity (more surviving offspring per spawner). These benefits may become self-sustaining after a period of supplementation.

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3 Previously accepted spelling for the Yakama Indian Nation.

However, supplementation would not eliminate the need to pursue other conservation and mitigation measures planned for the Yakima River Basin. Sustained supplementation may eventually become unnecessary, but only if substantial improvements in habitat and in-river migration conditions were to reduce significantly the mortality of all salmonid stocks. While these improvements are not proposed as part of the project addressed in this environmental impact statement (EIS), there are other ongoing projects, described below, and additional improvements may be proposed in the future.

Earlier fishery and habitat mitigation efforts in the Yakima River Basin include Congressional legislation to authorize passage improvements (fish screening and adult ladders) at numerous irrigation facilities. The USBR and BPA have prepared Environmental Assessments (EAs) for these screening facilities (BPA, 1991) and have completed construction for the first phase of these facilities. Phase II fish screening activities are ongoing at this time. Other efforts, which include measures to enhance Yakima River Basin water resources, also are expected to benefit anadromous fish production. In October 1994, Congress passed legislation (the Yakima River Basin Water and Conservation Act, Public Law 103-434) to authorize water conservation activities, including improvements to irrigation water delivery systems and a basin-wide water conservation program. The USFS, as well as State and private entities, have also conducted habitat improvement activities in the Basin.

Title XII of the Yakima River Basin Water and Conservation Act authorizes improvements to irrigation facilities in the Yakima Basin (through the Yakima River Basin Water Enhancement Project (YRBWEP)). The primary focus of Title XII is a conservation program that will conserve water by improving delivery systems and on-farm practices. Sixty-five percent of the water saved through these measures will be dedicated and used for instream flows. Other elements contained in Title XII include the 1-meter (3-foot) rise of Cle Elum Dam, which will provide approximately 18.5 million m^3 (15,000 acre/feet) of water for instream flows; electrification of the Chandler hydropumps, which will improve instream flows between Prosser Dam and Chandler Powerhouse; and efforts to improve instream flows on a number of tributary streams.

Although not directly related to the YFP, implementation of Title XII will certainly complement and improve the success of efforts undertaken through the YFP. Preliminary planning for implementing Title XII is currently underway. As part of that effort, the USBR is preparing pertinent NEPA documents, including a programmatic EIS, to be completed in 1997. BPA will be a cooperating agency. Implementation of programs authorized by Title XII will occur over a number of years as funding is appropriated by Congress.

Some fishery mitigation activities are currently taking place in the Yakima River Basin under the auspices of the CRFMP. This fish conservation and management plan describes production and harvest management actions that have been agreed to by all the parties to the *United States v Oregon* treaty fishing rights case. The parties to the original lawsuit and the CRFMP are the states of Oregon, Washington, and Idaho; the United States

through representation by the NMFS and the U.S. Fish and Wildlife Service (USFWS); the four Columbia River Treaty Tribes (YIN, Confederated Tribes of the Warm Springs Indian Reservation, Umatilla, and Nez Perce tribes); and, to a limited extent, the Colville and Shoshone-Bannock tribes. Commercial, recreational, and traditional tribal fisheries in the mainstem Columbia River are managed under CRFMP provisions. The fish production and harvest provisions of CRFMP are intended to assist in the rebuilding of upper Columbia River chinook, sockeye, coho, and steelhead runs, while assuring an equitable sharing of harvestable fish between treaty and non-treaty fisheries.

Current CRFMP-sponsored activities in the Yakima River basin include programs for both fall chinook and coho salmon. The fall chinook program includes the annual production and release into the Yakima of 1.7 million smolts from the Little White Salmon National Hatchery. Between 1983 and 1994 the smolts were transported and released directly into the Yakima River. The YIN, with funds provided under the Mitchell Act program, has developed acclimation facilities in the vicinity of Prosser Dam for final rearing and release of these fall chinook smolts. These facilities will be tested by the YIN in 1995, and are expected to be on-line by 1996.

Since 1987, under the mandate of the CRFMP coho program, the Oregon Department of Fish and Wildlife's (ODFW) Cascade Hatchery (near Bonneville Dam) has provided up to 700,000 early-run coho yearly for release into the Yakima River. This program is part of a larger effort to redistribute coho for release in upper Columbia tributaries rather than in the lower Columbia. In addition to the CRFMP releases, the YIN fisheries program transferred approximately 600,000 juvenile coho (pre-smolts) into the Yakima River Basin in 1995. These fish were available as a result of unanticipated surpluses at lower Columbia hatcheries. Of these, 210,000 were planted in the Naches River Basin; 60,000 were planted in Ahtanum Creek on the Yakama Reservation; and 330,000 were moved to the new acclimation facilities at Prosser to be released as smolts in the spring of 1996.

1.5 Relationship to Other Documents, Including the Draft EIS

In conjunction with the Preliminary Design Report on the YFP, an EA was prepared on the siting and construction of central, satellite and trapping facilities for supplementing anadromous fish populations in the Yakima and Klickitat River Basins (BPA, 1990a). The EA found that no significant environmental impacts would result from this portion of the proposed action, and the U.S. Department of Energy (USDOE) issued a **Finding of No Significant Impact (FONSI)** in April 1990.

However, BPA identified the need for additional environmental documentation to cover other aspects of the project, including operation of the planned production facilities and potential impacts from the siting and construction of acclimation facilities. Because various entities have subsequently expressed concern over management practices planned for the YFP, BPA concluded that an **EIS** was necessary to consider issues relating to project management, genetic impacts, and species interactions.

Accordingly, BPA prepared and then issued a Draft EIS (DEIS) for the YFP in October 1992. The public comment period for the DEIS closed in December 1992. Comments were extensive. Many valid concerns were raised about the project, and several omissions were identified in the analysis. After reviewing these comments, BPA concluded that additional work and a revision in the scope of the project were needed to respond fully.

The Revised Draft EIS (RDEIS) presented, for public review and comment, a description of the revised YFP alternatives and additional information that was not included in the YFP DEIS. The RDEIS and FEIS follow the same general format, and except where modified, includes the text of the earlier document. (Consequently, a reader of the FEIS and RDEIS need not refer to the DEIS to integrate the documents.)

Below are listed the more significant changes to the document between the DEIS and RDEIS.

- Changes to the alternatives in Chapter 2;
- Expansion of a cumulative impacts analysis for fisheries (see Section 4.1.2.2);
- A revised natural production modeling effort, resulting in a more sophisticated description of species interactions, genetics and harvest impacts, and experimental design and monitoring; and
- Additional discussion on project management and water rights impacts.

After receiving additional comments on the RDEIS, a Final EIS (this document) was prepared. Significant changes from the RDEIS include:

- addition of an alternative acclimation site at North Fork Teanaway;
- clarification of the water rights issue and revised discussion on impacts on water availability for irrigators;
- information on impacts of Jack Creek and North Fork Teanaway acclimation sites on snowmobiling;
- information and clarification regarding the Wenatchee National Forest Land and Resource Management Plan and its relationship to watershed planning;
- additional discussion on relationship of other agencies (e.g. USBR, USFS) to the project.

The alternatives addressed in this FEIS are summarized as follows:

- **Under Alternative 1**, the project managers would conduct supplementation activities on upper Yakima spring chinook.
- **Under Alternative 2**, project managers would conduct both supplementation activities on upper Yakima spring chinook *and* a study to determine the feasibility of re-establishing a naturally spawning population and a

significant fall fishery for coho in the Yakima River Basin. This is the preferred alternative.

- **Under the No Action Alternative,** no supplementation or study activities would be funded by BPA in the Yakima River Basin under these auspices, and no facilities would be constructed.

The RDEIS and FEIS address in detail those issues relevant to these three alternatives.

Note that if Alternative 1 or 2 were selected, the project managers and BPA would continue to evaluate the possibility of supplementing additional stocks in the Yakima River Basin. Any proposals to initiate supplementation on any of the other stocks considered in the original DEIS would be addressed in subsequent supplementation plans and environmental documents. Development of detailed supplementation plans for additional stocks would rely heavily on the adaptive management process and other project management decision mechanisms described in Section 2.2.

Supplemental environmental analyses might also be required for other future activities, such as changes in the program that might occur as a result of feedback from the adaptive management process. (See Sections 2.2.2 and 2.2.3.) Uncertainties clearly exist as to the impacts of certain supplementation activities planned for the project. In fact, the adaptive management philosophy for the project anticipates resolution of uncertainties unforeseen at the inception. During an annual YFP planning process, a Science/Technical Advisory Committee (STAC) would identify possible unforeseen changes to the currently proposed project activities. Actions that would trigger impacts *not* addressed in the YFP EIS would be deferred pending additional National Environmental Policy Act (NEPA) compliance activities, such as supplemental analyses, supplemental documents, or emergency consultations with the President's Council on Environmental Quality, if necessary.

Several commenters on the DEIS suggested that a comprehensive EIS should be prepared on *all* of the salmonid production and mitigation efforts in the Columbia River Basin. In fact, the USFWS, NMFS, and BPA are currently preparing a programmatic EIS, called *Interactions of Hatchery and Naturally Spawning Salmon and Steelhead in the Columbia River Basin,* that will address the cumulative effects of the interaction between anadromous fish produced under current fish hatchery programs and naturally spawning salmon and steelhead in the Columbia River. The YFP will be evaluated along with all other existing and proposed artificial propagation and supplementation facilities being addressed in that programmatic EIS. The Draft Programmatic EIS is anticipated in early 1996. The *Interactions of Hatchery and Naturally Spawning Salmon and Steelhead in the Columbia River Basin* EIS will concentrate on cumulative impacts resulting from the mixing of the wild and hatchery fish stocks in the migration corridor, while the YFP EIS addresses the sub-basin impacts of the YFP. However, the YFP FEIS also includes a cumulative impact analysis that considers the impacts of this project on the overall Columbia River Basin fishery (see Section 4.1.2.2).

The NMFS Proposed Recovery Plan for Snake River Salmon and the March 1995 NMFS Biological Opinion on operation of the Federal Columbia River Power System in 1995 and future years are now available. These documents address protection and recovery measures for the Snake River salmon stocks listed under the Endangered Species Act (ESA). Their potential effects on the YFP will be addressed during ESA consultation with NMFS on the Yakima Fisheries Project (see Section 4.1.6.1).

1.6 Decisions to be Made

Preparation of this document is intended to fulfill the NEPA requirements for BPA. The document also has been prepared for purposes of compliance by the Washington Department of Fish and Wildlife (WDFW) with the Washington State Environmental Policy Act (SEPA). Although neither law applies to YIN activities, the YIN have chosen to participate as a cooperating entity. The requirements of NEPA and SEPA are nearly identical. The WDFW will be the lead agency for SEPA compliance for the project.

Bonneville Power Administration must decide:

- whether to fund the project as described and, if so,
- whether to fund Alternative 1, which calls for supplementation of a single chinook stock, or Alternative 2, which calls for supplementation of that single stock and additionally for a feasibility study for reintroduction of coho.

If BPA were to decide *not* to fund the project (the No Action Alternative), the portion of the Council's Program that addresses the YFP would not be fulfilled. BPA would seek other means to fulfill its mitigation responsibilities. If BPA were to choose not to fund the project, it would likely not be implemented by any of the other entities, due to lack of funding.

The factors that will be considered in making these decisions are based on the purposes defined for the project in Section 1.2. They are listed below.

- The ability of the alternative to:
  - evaluate the effectiveness of supplementation techniques for implementation throughout the Columbia River Basin;
  - increase natural production of anadromous fish in the Yakima River Basin while maintaining the long-term genetic fitness of anadromous fish in the Yakima River Basin and improving harvest opportunities;
- The alternative's consistency with the Council's Fish and Wildlife Program;

- The economic factors relative to the alternative; and
- The environmental impacts of the alternative.

1.7 Scoping and Public Involvement

A Notice of Intent (NOI) to prepare an EIS for the YFP was issued in January 1991. Scoping meetings were held in February 1991 in Yakima, Goldendale, Richland, Ellensburg, and Bellevue, Washington, as well as in Portland, Oregon. Over 200 people attended these meetings, and 95 comment letters were received from the general public. Public comments were considered and used to determine the scope of the EIS.

The following issues were identified during the scoping process:

- Genetic risks to existing wild fish populations both in and outside the Yakima River Basin (discussed in Sections 4.1.2.1 and 4.1.2.2).
- Potential negative impacts on the resident trout fishery above Roza Dam--competition for food and space, genetic risk, disease transfer, and increase in number of salmon and steelhead anglers (Sections 4.1.9.1, 4.1.2.1, and 4.1.2.2).
- EIS Scope--preparation first of a programmatic EIS for entire Columbia River Basin, with tiered, Basin-specific and even sub-Basin-specific project environmental analyses; to include cumulative analysis of all supplementation and hatchery releases throughout the Columbia River Basin (Section 1.5).
- Economic issues--total project costs, benefit-cost analysis, cost-effectiveness analysis in relation to other fishery projects in the Columbia system, and local economic impacts (Section 4.1.8).
- Project decisionmaking--what is the process, what factors will influence the final decision on the project, who will make the decision, why NEPA wasn't done before the project went to the Council (Section 1.6).
- Supplementation--definition of supplementation and how it differs from conventional hatchery programs, review and evaluation of previous supplementation work, how proposed supplementation efforts would differ from or complement existing efforts (Sections 1.2 and 2.6).
- Water rights and claims--concern about effects of project, need for specific assurances that the project would not affect private landowners' rights in any way (Section 4.1.1.1).
- Straying fish--how they could affect endangered or petitioned stocks in other basins, concern that they might stray and ultimately affect water rights (Section 4.1.2.1).
- Other ecological resources--long-term effects on the ecosystem, particularly the aquatic food base, impacts on wildlife and resident fish (Sections 4.1.3, 4.1.5, and 4.1.6).

- Suggested alternatives--No Action, hatchery outplantings for extinct runs and habitat improvement for other runs, additional steelhead production above Roza Dam, smaller-scale supplementation alternative, non-hatchery alternatives, and full production (Chapter 2).

The DEIS for the YFP was released in October 1992. Six public meetings were held throughout the region (Richland, Yakima, Portland (two meetings), Bellevue, and Ellensburg). Written remarks and comments were also accepted through December 28, 1992. BPA received a total of 107 letters and telephone calls from individuals, groups, and agencies during the comment period. In addition, more than 300 people attended the public meetings, with many individuals providing oral comments about the project.

Four issues received the most extensive comment: project purpose and need; potential impacts on water rights and claims; the genetic risks to the existing wild fish populations; and potential impacts on the resident trout fishery above Roza Dam. Other comments received focused on the EIS process, the project alternatives selected for EIS analysis, and the potential impacts on other ecological resources, including threatened and endangered species.

After major revisions to the scope of the project, a Revised DEIS was drafted and published in May 1995. There were two public meetings, and 55 comment letters were received. The following issues received the most extensive comment:

- coordination with other agencies;
- suggestions for non-supplementation alternatives;
- concerns about proposed stocks, numbers, and areas, including suggestions for expanding the project to other stocks and areas;
- concerns about the viability of supplementation and its ability to protect wild fish stocks;
- concerns about interactions with the resident trout fishery; and
- water rights and water availability to irrigators.

2. ALTERNATIVES

2.1 Introduction

The goal of this YFP is to obtain knowledge about how resource managers can use the strategy of supplementation in their efforts to protect, and mitigate impacts on stocks of anadromous fish in the Yakima River Basin. The YFP would include several artificial production facilities designed to test and apply supplementation techniques. Results of these experiments might apply throughout the Yakima Basin and Columbia River system. The ultimate result would increase the productivity and abundance of natural runs of anadromous salmonids in the Yakima River Basin.

This chapter describes several central features of the project:

- The adaptive management process (Section 2.2) to be used under either of the two alternatives that have been proposed to satisfy the need for the project (see Chapter 1);
- The two action alternatives (Sections 2.3 and 2.4);
- the No Action Alternative (Section 2.5);
- Alternatives eliminated from detailed consideration (Section 2.6); and
- A summary and comparison of the potential environmental consequences of the alternatives (Section 2.7).

Adaptive Management. The proposed adaptive management policy specifies an ongoing, iterative approach to planning for the project. Full detailed plans for supplementing the stocks would be continuously developed and revised, using information gained from the previous year's activities. Section 2.2 below provides details.

The most detailed planning has been completed for the upper Yakima spring chinook and coho stocks, the focus of the two alternatives mentioned below. Those stocks for which detailed supplementation planning has *not* been completed (e.g., summer steelhead, fall chinook) are not addressed in this FEIS. If the project managers and BPA should decide in the future to propose to undertake supplementation for any of those stocks, such plans would be addressed in additional environmental documents.

Alternatives. The DEIS's several project alternatives were distinguished from each other primarily by the number of stocks proposed for supplementation. In some alternatives, the number of smolts to be stocked also varied. The alternatives ranged from supplementation of seven stocks to supplementation of three stocks only. However, after considering public comments on the DEIS, BPA and the project managers concluded that these multi-stock options were not appropriate at that time (see Section 2.6.2). That decision has been carried forward through the RDEIS to this FEIS. Consequently, Alternative 1

discussed below focuses on supplementation of a single stock (upper Yakima spring chinook). Alternative 2 also focuses on supplementation of that stock, but adds a feasibility study for the reintroduction of coho. The No Action alternative is addressed in Section 2.5.

2.2 Adaptive Management

The project managers would use an **adaptive management policy** in order to achieve project goals and protect the basin's fishery resources from unforeseen, adverse project impacts. Adaptive management emphasizes experimental intervention into an ecosystem to provide insights into how it works and changes. The effects of management actions are monitored and evaluated, and programs, procedures, and facilities may all be modified in response to these findings.

Using adaptive management, the scientific method is incorporated into project planning and decision-making. It is particularly appropriate when attempting to mitigate for effects on otherwise declining natural resources in a complicated, large-scale ecosystem where complexities of the system are not fully understood. Such uncertainty may make scientists hesitant to act and experiment. **Adaptive management is the conscious decision in favor of *action* designed to increase understanding as opposed to *inaction* in the face of uncertainty.**

There are risks inherent in such action. Such risk is best managed by collecting baseline data, monitoring and evaluating, and being prepared to respond to new information, **even if it means drastic changes to a program.** The success of the proposed YFP monitoring program would depend on the ability of project personnel to obtain valid information about how the project is working, using available theory and technology. Likewise, the success of the proposed evaluation program depends on the commitment of project managers to institute a management and decision-making process that can respond effectively to new information calling for change. **This process must be able to overcome resistance to change and the apparent security afforded by stability.**

Under adaptive management, project managers propose actions in response to a set of agreed-upon objectives. These actions are designed as experiments to test hypotheses regarding their outcome: to see whether the predicted result occurs or whether some other result occurs. The experiments must be carefully designed to obtain valid (i.e., statistically reliable) results in a specified period of time. The experiments are conducted and carefully monitored to allow statistical evaluation of the results.

Implementing an adaptive management policy requires the following:

- a project management plan;
- a commitment to defining and expressing policy;
- a management framework for carrying out the plan.

These elements are described below to demonstrate how the YIN and the WDFW would use an adaptive management design to implement the YFP.

2.2.1 Project Management Plan

The proposed YFP Project Management Plan uses Walters' (1986) adaptive management cycle: it involves adaptive learning through management experiments rather than conservative natural resource management or basic research. The design of the experimental program for upper Yakima spring chinook involved the following basic actions (Figure 2.1):

1) identify objectives;
2) identify strategies to achieve the objectives;
3) identify operating assumptions needed to accept the strategies;
4) identify uncertainties associated with these assumptions;
5) identify the risk of not meeting the stated objectives if the assumptions are incorrect or the strategy is not feasible; and
6) develop a monitoring plan and process for continual review of results and adaptation to manage the uncertainty and risk associated with supplementation.

The Project Management Plan uses experiments designed to resolve uncertainties as it accomplishes YFP goals and objectives. The risk analysis and monitoring steps include a mechanism for review of the previous year's results, which may cause the objectives to be modified, thus restarting the process.

2.2.1.1 Planning Status Report

The YFP planning cycle is shown in Figure 2.2. Each year, the YFP STAC prepares a *Planning Status Report* (completed in 1992, 1993, and 1994 for all anadromous salmonids in the basin, and in 1995 for spring chinook and coho) documenting the objectives, strategies, and operational assumptions for the YFP (developed through the actions above) consistent with the state of knowledge and information available at that point in time. The Planning Status Report is completed early in each year and includes ongoing and new proposals to implement the objectives and strategies for supplementation in the upcoming year.

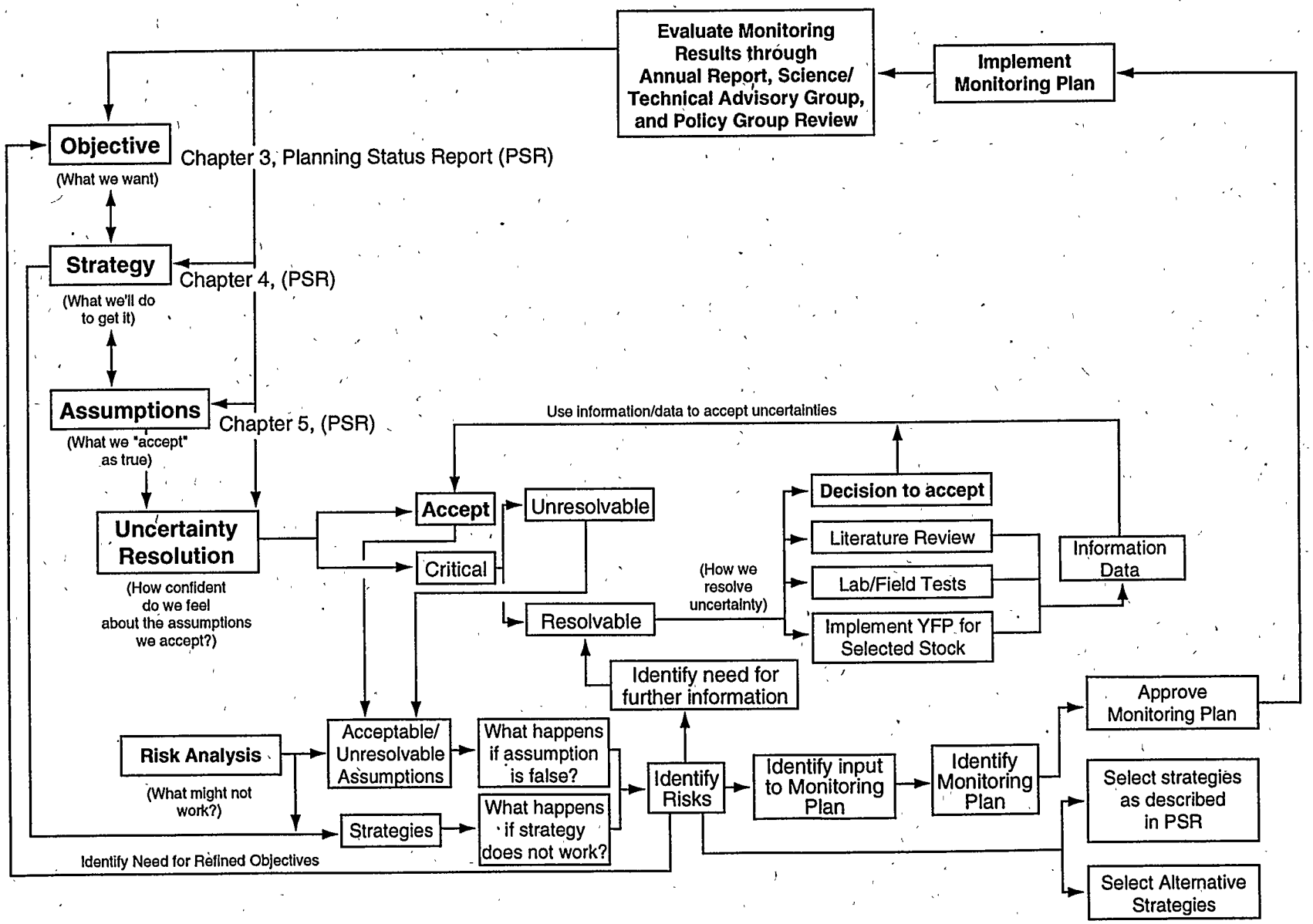


Figure 2.1 Adaptive Management Process for the Yakima Fisheries Project

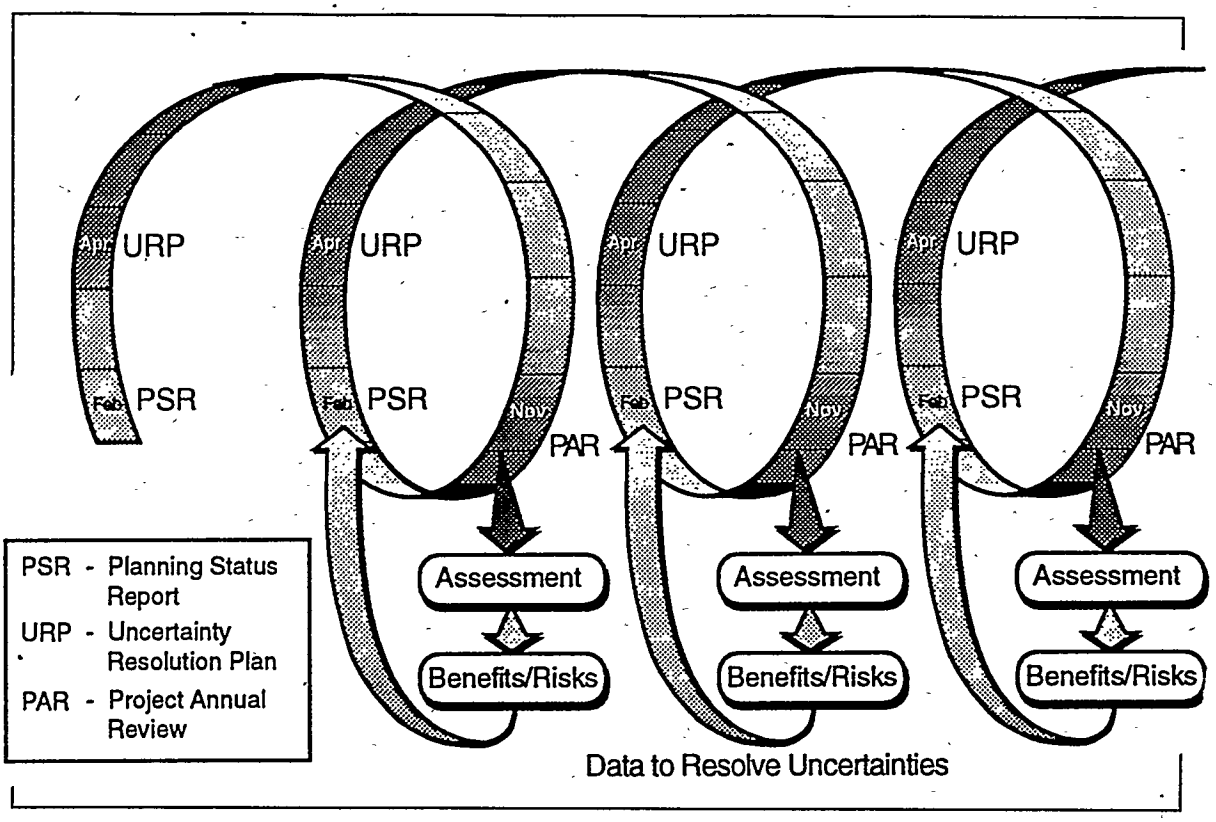


Figure 2.2 Planning Cycle for the Yakima Fisheries Project

Under adaptive management, BPA and the cooperating agencies would examine the Planning Status Report to determine whether new or revised strategy options contained in it are included in the scope of this FEIS. If not, BPA and the cooperating agencies would identify potential environmental impacts resulting from newly proposed project activities and would determine whether additional NEPA and/or SEPA work would be necessary to address these impacts. This FEIS is based on the 1995 Planning Status Report (revised upper Yakima spring chinook and coho chapters are attached as Appendix B).

2.2.1.2 Uncertainty Resolution Plan

As needed, the STAC prepares an *Uncertainty Resolution Plan* that identifies strategies to resolve uncertainties (identified in action 4 above) about project operational assumptions. These strategies can include scientific literature searches, small-scale short-term field and laboratory experiments, large-scale long-term studies, and learning from other ongoing studies. Uncertainties must be prioritized for attention so that work can be carried out promptly. *Resolvable* uncertainties are a near-term high priority: they affect strategy implementation, and the benefits of immediate resolution are high. The Uncertainty Resolution Plan therefore would also be used to prepare an annual work plan for the project. The draft Uncertainty Resolution Plan used for this FEIS was prepared in 1993 and addressed upper Yakima spring chinook.

2.2.1.3 Project Annual Review

Toward the end of each year, the project managers undertake a *Project Annual Review*, (completed in 1992, 1993, 1994, and 1995). In this Review, project staff and consultants present the results of their uncertainty-resolution work (including progress reports) to the project managers for process and policy decisionmaking. The Review is an opportunity for project scientists to present and discuss with others the new knowledge gained during the year (1) relative to project objectives and assumptions stated in the Planning Status Report and (2) resulting from resolution work described and scheduled in the Uncertainty Resolution Plan. These results are compiled; analyzed for relevance, task completion, and percent of uncertainty resolution; and formally documented.

However, reviewing/analyzing the data is only the first step. The Project Annual Review and its ensuing analyses are the processes that provide the feedback loop from the current year's cumulative learning into the following year's plans. The Project Annual Review reclassifies the resolution status of specific critical assumptions and identifies spin-off resolution tasks for the coming year. Changes in uncertainty levels of specific assumptions are based on scientific evidence. Scientific documents that form the basis for management decisions undergo peer review. Thus, the Project Annual Review and any associated peer review steps form the basis of proposed amendments submitted early the following year to project managers for consideration and possible incorporation in the upcoming Planning Status Report.

Consistent with the adaptive management process, YFP managers will review the benefits and risks of continuing the preferred strategies to meet the project's objectives. Strategies will be retained or adopted only if potential benefits exceed foreseeable risks, and if the risks of failure fall within acceptable limits. Thus, risk is managed and reduced over time through implementation of (1) the Uncertainty Resolution Plan (i.e., prior mitigation of uncertainties) and (2) the monitoring and evaluation plan. In this way, the risk of strategy failure (objectives not met and/or strategies incorrectly implemented) can be reduced through pre-implementation research *and* through risk monitoring and a willingness to change during implementation.

2.2.2 Policy Definition and Expression

The adaptive management policy described above would guide project planning and operations. Within its context, specific strategies would be selected and new information identified and applied. Project objectives would then normally be reviewed and perhaps revised, and appropriate strategies devised to achieve them. YFP policy would be created as strategies are selected to meet the stated objectives. As objectives and strategies are revised and adjusted (consistent with YFP experimentation goals), management would be adapted and consistent underlying policy would evolve.

YFP adaptive management would identify alternatives, clarify associated benefits and risks, and make full public disclosure of project findings and changes in policy direction.

Section 2.2.3 shows the corresponding project management structure within which the YFP Policy Group would serve as the main body for resolving YFP policy issues. Information on YFP implementation and policy would be available through minutes of policy meetings, newsletters, and technical and planning reports. The Planning Status Report, Uncertainty Resolution Plan, Project Annual Review, and any other related materials would be published annually. The YFP Policy Group would submit an annual summary of project progress and adaptive responses to the NPPC. The managers would be committed to public involvement through ongoing implementation under NEPA and other statewide and regional planning and management forums related to fisheries resources. As needed, the Policy Group might convene special meetings to obtain public input on specific issues.

2.2.3 Project Management

Project management would be coordinated among several groups:

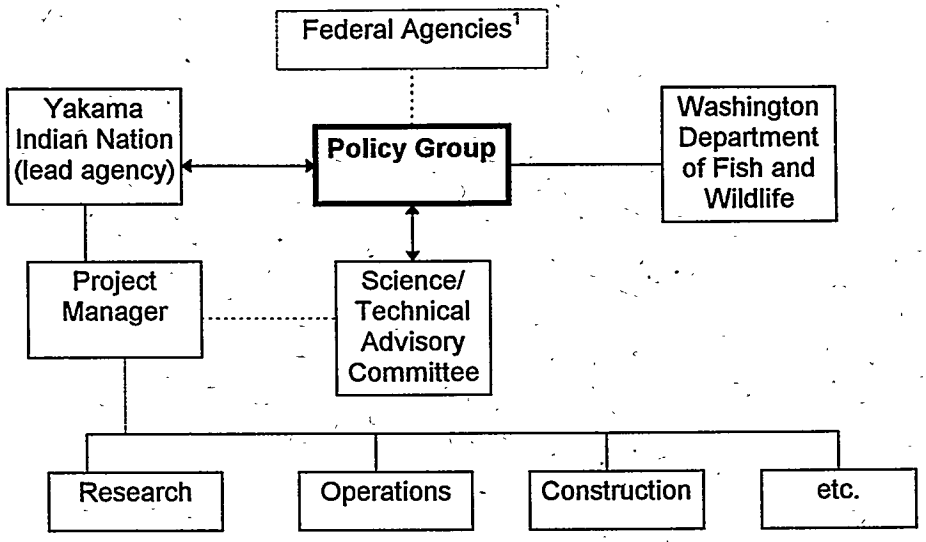
- The YIN would manage the project as Lead Agency.
- The Policy Group, with members from the YIN and the WDFW, would provide policy guidance to the Lead Agency, and review and approve annual planning documents.
- The STAC, consisting of State and Tribal biologists and others as determined or needed, would advise the Policy Group.
- A Project Manager, appointed by the Policy Group, would report to the YIN.
- Department managers for each functional area of project operations would report to the Project Manager.
- Several Federal Agencies, including BPA, USBR, NMFS, USFWS, USFS, and the Bureau of Indian Affairs (BIA) would provide funding, technical assistance, NEPA review, and other participation as arranged.

The relationship between each level of project management is illustrated in Figure 2.3.

2.2.3.1 Policy Group

The Policy Group, which includes appointed YIN and State of Washington representatives, works with BPA. The Yakama Tribal Council has appointed the Chairperson of its Fish and Wildlife Committee, acting through the YKFP Coordinator, as its representative on the Policy Group. Because the Washington Department of Fisheries and the Washington Department of Wildlife merged in March 1994, the State is now represented by the YKFP Senior Policy Representative, as appointed by the Director of the newly formed WDFW. BPA's liaison with the Policy Group is a representative from the Anadromous Fish Implementation Group of the Environment, Fish and Wildlife Group.

Figure 2.3 Yakima Fisheries Project Management Structure



[1]Bonneville Power Administration, U.S. Bureau of Reclamation, National Marine Fisheries Administration, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and U.S. Forest Service.

The Policy Group's purpose and primary responsibility is to provide policy direction to the Lead Agency with regard to YFP planning, construction, operation, and maintenance. The Group will also review and approve the project planning documents and other related project activities.

2.2.3.2 Project Managers

In 1987, the State of Washington and the YIN agreed to designate the YIN as Lead Agency for managing the project. In 1994, the State and the YIN executed a Memorandum of Understanding (MOU) that delineates and apportions each agency's responsibilities for project management.

Generally, project management functions include research and project development, planning, operations, and contract administration. The Project Manager would receive directions for project operations from the Lead Agency. It is anticipated that the YIN and BPA would enter into an agreement similar to the MOU mentioned above; it would also include a mechanism for BPA to fund project activities. BPA is and would remain the lead agency for purposes of NEPA review and compliance (due to Federal NEPA compliance requirements for projects that are Federally funded).

2.2.3.3 Science/Technical Advisory Committee

The STAC would, upon the direction of the Policy Group, review and make recommendations on project planning, construction, and operations, including objectives and strategies. In this capacity, STAC would provide general scientific oversight of project planning and related matters.

2.2.3.4 Bonneville Power Administration

BPA would remain an integral part of the YKFP during all phases of the project, as part of its requirement to fund protection, mitigation, and enhancement activities consistent with the Council's Fish and Wildlife Program and the Northwest Power Act. A representative from the Anadromous Fish Implementation Group would serve as a liaison with the Policy Group. Technical assistance would also be provided as needed with the STAC. As previously stated (see Section 2.2.3.1), BPA would remain the lead agency for facilitating the NEPA process and ESA consultation. BPA and the YIN are presently developing an MOU that will more fully detail their respective roles and responsibilities.

2.2.3.5 Relationship with Other Federal Agencies

The project managers will maintain close working relationships with other Federal agencies, including, but not limited to, the USBR, NMFS, USFWS, USFS, and the BIA. The project managers will work in conjunction with these Federal agencies to achieve the goals and objectives of the project. Project management will consult with individual agencies, consistent with their oversight responsibilities and as necessary to incorporate their overall expertise in resolving project-related issues. The project managers will seek out opportunities to build partnerships and reach consensus with these agencies on pertinent project issues such as water conservation.

2.3 Alternative 1: Upper Yakima Spring Chinook Supplementation

Alternative 1 would test supplementation on one Yakima River stock: upper Yakima spring chinook. One central facility would be built for several functions: holding upper Yakima spring chinook adults, spawning, incubating eggs, and early and extended rearing of the young fish. In addition, three sites would be constructed for acclimation and release of the smolts. The discussion below focuses first on the adaptive management framework of supplementation objectives, strategies, assumptions, uncertainties, risk analysis, and monitoring plans; then on the facilities and their operations.

2.3.1 Supplementation Objectives and Strategies

The project managers have agreed on a set of objectives and strategies for supplementing each of the Yakima River Basin stocks. These objectives and strategies are reviewed, revised, and published annually in the Planning Status Report (see Section 2.2.1).

- The objectives are statements of planned accomplishments for the basin,
- The strategies are statements of actions that the project managers believe will enable them to achieve these objectives.

The objectives and strategies are intended to be precise and increasingly specific statements about the YFP in four categories: genetics, natural production, experimentation, and harvest. The strategies are representative of those available to project managers to achieve production objectives and to contain unacceptable genetic and ecological risks. Table 2.1 presents the latest version of the objectives and strategies for spring chinook (Planning Status Report 1995, Volume 3, Summary, attached as Appendix B).

Under the YFP, no objective is static and absolute. This is because, under adaptive management, the annual planning cycle of the project regularly and repeatedly examines the capacity and constraints of the stock and stream system, as well as the performance of hatchery fish, testing and revising a theory of supplementation. The rearing and release of each new group of smolts always represent an experimental test of the latest theory. New experimental insights are used to modify or discard ineffective strategies, to improve underlying theory and, when necessary, to revise objectives to conform with perceived possibilities. Quantitative production objectives (for most of the stocks originally identified to be supplemented as part of the YFP) were formulated in 1990 in the Refined Goals section of the Preliminary Design Report (BPA, 1990b). The Refined Goals objectives were based on computer simulations generated by the Council's System Planning Model.

However, those objectives are continually re-assessed in the light of the latest demographic data, suspected ecological relationships, and modeling tools. Quantitative production objectives for upper Yakima spring chinook have been refined, based on computer simulations using the Ecosystem Diagnostic and Treatment Planning Model (EDTPM) (Lestelle et al., 1994) developed under the Regional Assessment of Supplementation Project (RASP) (RASP, 1992). For a number of reasons, BPA and the project managers have used the EDTPM for YFP planning rather than the System Planning Model, because it tracks juvenile production capacity more closely and allows for variable (density-dependent) predation on outmigrating smolts.

Table 2.1 Upper Yakima Spring Chinook Objectives and Associated Strategies

Objectives	Strategies
Genetic	
Manage genetic risks (extinction, loss of within- and between-population variability, and domestication selection) to all stocks from management of the fishery.	Segregate identified stocks by selecting broodstock for which the origin can be reasonably well determined, and release hatchery-reared progeny only in ancestral drainages. Use for broodstock only those fish that are not first-generation hatchery fish. Operate the supplementation facilities using appropriate mating procedures, naturalized environments, and experimental numbers to reduce the possibility of extinction, loss of within- and between-population variability, and domestication selection. Use less than 50% of the natural-origin returning adult escapement from each stock for broodstock purposes. Manage the proportion of natural- to hatchery-origin adults allowed to spawn naturally.
Conserve upper Yakima and Naches stocks of spring chinook salmon.	Segregate identified stocks by selecting broodstock for which the origin can be reasonably well determined, and release hatchery-reared progeny only in ancestral drainages. Collect, identify and segregate spring chinook by stock, through spawning, rearing and release.
Conserve the American River stock of spring chinook salmon.	Collect, identify and segregate spring chinook by stock, through spawning, rearing and release. Develop and apply methods to maximize the likelihood that only American River-origin fish enter and spawn in the American River.
Natural Production	
Optimize natural production of spring chinook with respect to abundance and distribution.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810,000 acclimated smolts into the upper Yakima basin.
Optimize natural production of spring chinook salmon while managing adverse impacts from interactions between and within species and stocks.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810,000 acclimated smolts into the upper Yakima basin.

Natural Production (con't)	
Maintain upper Yakima spring chinook natural production at a level that would contribute an annual average of 3,000 fish to the Yakima Basin adult return.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810,000 acclimated smolts into the upper Yakima Basin.
Maintain natural escapement of upper Yakima spring chinook (hatchery and wild) at an average of 2,000 adult returns and consistently greater than 1,700 spawners per year.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810,000 acclimated smolts into the upper Yakima Basin.
Experimentation	
Learn to use supplementation as defined by the RASP (RASP, 1992) to increase natural production of upper Yakima spring chinook and increase harvest opportunities.	Conduct experiments using upper Yakima stocks to evaluate the risks and benefits of supplementation as defined by the RASP (1992). Design and conduct experiments using upper Yakima stocks to compare risks and benefits of a New Innovative Treatment (NIT) against an Optimal Conventional Treatment (OCT) for supplementation. The NIT would use methods resulting in fish that mimic natural fish. The OCT would use methods resulting in fish raised according to the state-of-the-art hatchery definition of quality. Collect upper Yakima broodstock at Roza Dam. Release 18 groups of 45,000 fish each of the upper Yakima stock into the upper Yakima River. Release experimental groups of fish from separate acclimation sites connected to target streams. Design experiments to detect a 50% or greater difference (with 90% certainty) between test treatments for all response variables.
Harvest	
Increase harvest opportunities for all fishers consistent with requirements of genetic, natural production, and experimentation objectives.	Use selective and/or "status-index harvest" policies to increase harvest opportunities for all fishers.

As noted below, the supplementation program provides a multifaceted, but indirect, means of addressing the broadest questions related to supplementation. The YFP approach is designed to resolve specific uncertainties related to the effectiveness of supplementation and to the selection of treatments for fish in the artificial environment. The YFP supplementation project would incorporate two repeated tests or treatments: a New Innovative Treatment using incubation, rearing, and release techniques that attempt to produce smolts with attributes and, consequently, survival, similar to those of wild or native fish, and an Optional Conventional Treatment.

- **Treatment A** is an Optimal Conventional Treatment (OCT) to incubate, rear, and acclimate salmonids using the currently accepted "Best Technology" used at state, Tribal, and Federal hatcheries.
- **Treatment B** is a New Innovative Treatment (NIT) that creates a more natural environment (e.g., natural cover, substrate, and structures) to incubate, rear, and acclimate fish. The intent of this treatment is to raise and release fish with characteristics and behavior similar to those of naturally produced fish in order to achieve improved survival and productivity.

The fish from these two treatments would be compared (e.g., in terms of physical characteristics and survival to returning adults) with each other as well as to the native fish. These comparisons would be used to determine the success of the YFP. As much as possible, information on variation in ocean conditions, instream flows, harvest, and other activities and factors would be used to provide a context for interpretation of YFP findings.

There are three stocks of spring chinook in the Yakima River: an upper Yakima stock that spawns upstream of Roza Dam, a stock that spawns in the Naches River, and one in the American River (see Figure 2.4). Of these, only the upper Yakima spring chinook stock is proposed for supplementation at this time. This program would include construction of facilities to release up to 810,000 such smolts each year.

Natural production objectives for all Yakima River spring chinook stocks were modeled assuming that all upper Yakima supplementation facilities were operational and were producing a range of 600,000 to 1,150,000 smolts. As modeled, the proposed production level (810,000 smolts) would be expected to produce adult returns, spawning, and harvest objectives in the middle of the range of estimates that follow. Simulations indicated that production levels would produce a total return to the Yakima basin that would range from 8,200 to 11,590 adults: 6,600 to 9,800 upper Yakima spring chinook, 1,000 to 1,100 Naches spring chinook, and 600 to 690 American River spring chinook. Objectives for natural spawning would include 3,100 spring chinook in the upper Yakima (combined wild and hatchery fish at all production rates); 570 to 630 spring chinook in the Naches (all wild); and 340 to 390 spring chinook in the American River (also all wild). Spawning escapement (how many adult fish return to spawn) for all stocks would be above the level (approximately 200-250 spawners per year) at which loss of within-population variability becomes a concern. Harvest objectives would include a Yakima River catch between 2,480 and 6,440 fish over all spring chinook stocks (2,000 to 5,900 from the upper Yakima, 300 to 340 from the Naches and 180 to 200 from the American River stocks), and a total harvest to all fisheries (Yakima River, Columbia River and ocean) of between 4,580 and 9,620 fish. These numbers are based on a *range of smolts released.*

The quantitative production objectives described above for upper Yakima spring chinook are based on the EDTPM computer simulations. These natural production and harvest objectives make the following assumptions:

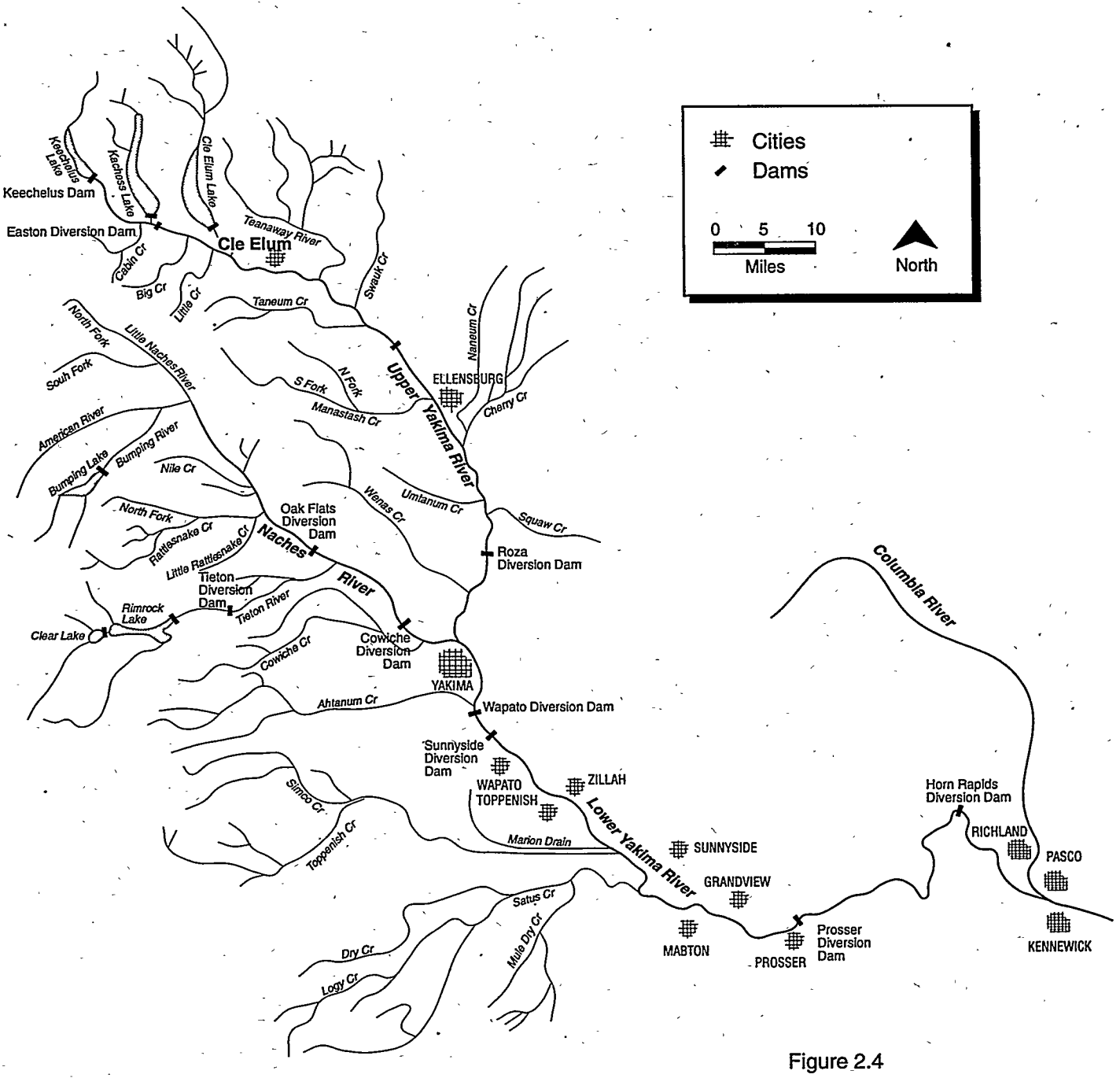


Figure 2.4
Yakima River Basin

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1) that hatchery fish survive at half the rate of wild fish in an environment in which natural production is winter-limited;

2) that carrying capacity is about 543,000 smolts naturally produced in the upper Yakima River under current habitat conditions and operation of the river for irrigation (900,000 smolts for the entire Basin); and

3) that up to 240,000 smolts (27 percent of carrying capacity) can be lost to density-dependent mortality inside the subbasin (Watson et al., 1993).

Under these conditions, the EDTPM indicates that natural production and harvest objectives are attainable with a terminal harvest rate of 30 percent, applied uniformly over all stocks. The EDTPM assumptions included selective removal of between 100 and 3,000 upper Yakima hatchery fish in order to limit the maximum proportion of hatchery fish in the natural spawning escapement to 50 percent or less. The impact analyses included in Chapter 4 are based on these assumptions.

Note that these preliminary supplementation strategies and production objectives are based on *modeled assumptions*, not on *empirical data*. The assumptions underlying the computer analyses represent a reasonable synthesis of what is known at present about the natural production and post-release survival of spring chinook in the Yakima River (Watson et al., 1993). Future and ongoing risk analysis and ecological research would be expected, through the normal operation of the annual planning and implementation cycle, to result in refinements to supplementation strategies and perhaps to objectives as well.

2.3.2 Assumptions, Uncertainties, and Risk Analysis

A set of assumptions relating to the strategies discussed above has been developed for the YFP. They are significant suppositions or statements of conditions or perceptions that affect the choice of strategies and how these strategies are to achieve specified objectives. Assumptions for the upper Yakima spring chinook program are listed in the Planning Status Report (Appendix B, Tables 5.1-4).

Each assumption is evaluated to determine its level of certainty (how certain the project scientists are that it is true). Assumptions with a high level of certainty are classified as "accepted," and monitoring is used to corroborate them. Other assumptions are further divided into "resolvable" and "unresolvable" categories. Unresolvable assumptions are those which cannot be corroborated. The project managers must decide whether or not the amount of risk associated with the unresolvable assumptions is acceptable. Again, monitoring is used to manage the uncertainty for unresolvable assumptions. Finally, the resolvable uncertainties are addressed for resolution through literature review, studies, and experiments. The Planning Status Report (Appendix B) describes in more detail this uncertainty and its relationship to the benefit/risk evaluation process.

The benefit/risk evaluation process includes a set of questions to be asked about the project's most recent objectives, strategies, and assumptions. The evaluation weighs the changing balance of opposing benefits and risks, as well as levels of uncertainty. The goal

is to inform, encourage, and/or caution project managers as they proceed to the next stage. The analysis is time-bound: it is applied to, and emerges from, the project's base of knowledge and recognized uncertainty at a given point in time along the project path. This knowledge base is reflected in the current Planning Status Report and the uncertainty-resolution matrix laid out in the Uncertainty Resolution Plan. However, adaptations to assumptions and strategies are the result of updating this benefit/risk evaluation process each year, along with its companion uncertainty-resolution process, to assist the project managers in deciding the direction for the project in the following year.

The risk assessment for the supplementation of upper Yakima spring chinook is presented in Chapter 7 of Volume 3 of the Planning Status Report (Appendix B). It is summarized in Section 4.1.2 of this FEIS.

2.3.3 Monitoring

Effective monitoring is the key to a successful adaptive management program. Monitoring enables project managers to determine whether an action achieved its objective, or whether the objective was properly developed. Monitoring should also provide insight into the actual result of an action as well as explain the success (or lack) in achieving the predicted result. In this way, new information can be gained that will facilitate better-informed decisions in the future.

The Planning Status Report (Appendix B; Volume 3, Chapter 9) lays out an integrated multi-level monitoring program for supplementing upper Yakima spring chinook. This structure ensures that strategies are implemented as intended, that experimental studies produce reliable results, and that risks associated with unresolved uncertainties are contained. It also ensures efficiency, prevents duplication of effort, and tracks progress toward meeting objectives.

The monitoring plan for the supplementation of upper Yakima spring chinook under the YFP addresses the following five monitoring categories:

- quality-control monitoring of both research efforts and project operations (to confirm that supplementation is being conducted as intended and record keeping is accurate and complete);
- product specification monitoring (to indicate how fish behave and survive);
- research monitoring (to determine whether the hypotheses regarding supplementation being tested are proven or not);
- risk containment monitoring (to evaluate whether supplementation is progressing toward the objective of increasing harvest and enhancing natural production while maintaining genetic resources); and
- stock status monitoring (to estimate annual spawning escapement and measure other biological or quantitative changes in the populations over time).

Since monitoring activities for these categories overlap, they will be developed into an integrated monitoring plan. Table 2.2 summarizes the proposed monitoring activities for upper Yakima spring chinook for all categories except quality control monitoring. The monitoring plan would be revised and expanded as part of the adaptive management process.

Quality control monitors the performance of the facilities and their operators. Quality standards would be developed for all fish culture and data collection activities as part of the certification process required for the facilities. Quality control monitoring procedures would be included in the operations manuals for all facilities and field activities. This includes the broodstock collection facility at the Roza Dam; the broodstock holding, incubation, and rearing at the central production facility; the acclimation ponds; and the juvenile and adult monitoring stations at Chandler and Roza dams.

The following **product specification** attributes would be monitored at the Cle Elum facility, the acclimation ponds, and the juvenile monitoring facilities to determine whether the fish produced by the project meet certain goals:

- fish health;
- morphology (size and shape);
- behavior; and
- survival.

Research monitoring activities would be designed to test the performance of two treatments of artificially reared fish (OCT vs. NIT) and to compare their performance with naturally reared fish. These monitoring activities would be performed at the Roza and Chandler juvenile facilities for outmigrating smolts, at the Prosser and Roza fish ladders and collection facilities for returning adults, and on the spawning grounds for straying rates and reproductive success monitoring. Research monitoring would include measurements of performance in four main areas:

- post-release survival (survival from time of release until the fish return to spawn);
- reproductive success (number of offspring produced per spawner);
- long-term fitness (genetic diversity and long-term stock productivity); and
- ecological interactions (population abundance and distribution, growth rates, carrying capacity, survival rates, transfer of disease, and gene flow).

Table 2.2 Summary of Upper Yakima Spring Chinook Monitoring Plan

MONITORING LOCATIONS	MEASUREMENT TO BE MADE[b]	MONITORING PURPOSE[a]			
		Product Specifications 1) Fish health 2) Morphology 3) Behavior 4) Survival	Research/ Hypothesis Testing 1) NIT vs. OCT 2) Natural vs. NIT 3) PTA	Risk Containment 1) Genetics 2) Ecological 3) Experimental 4) Harvest	Stock Status 1) Run size 2) Escapement
Cle Elum hatchery	Adult count	-	-	1,2,4	1,2
	Juvenile marking	1,2,3,4	1,2,3	-	1,2
	Attribute/survival histories	1,2,3,4	-	-	-
Acclimation sites	Number (time/size)	2,3,4	-	-	-
	Random biosample	1	-	-	-
	Individually mark subsamples	4	-	-	-
Roza juvenile trap	Attributes of hatchery fish	1,2,3	3	-	-
	Read marks	4	1,2	-	-
	Attributes of naturally spawned fish	1,2,3	3	-	-
Chandler juvenile trap	Attributes of hatchery fish	1,2,3	3	-	-
	Attributes of naturally spawned fish	1,2,3	3	-	-
	Read marks	4	1,2	-	-
Test fishery	Adult mark	-	1,2	4	1
Prosser adult trap	Adult mark	-	1,2	1,3,4	1
	Adult count	-	-	1,4	1
Fishery	Adult mark	-	1	1,3,4	1
	Adult count	-	-	-	1
Roza adult trap	Adult mark	-	1	1,3,4	1
	Adult count	-	2	3	1
	Adult tagging	-	2	-	-
Upper Yakima spawning grounds	Adult mark	-	1,2	1,4	2
	Adult count	-	-	-	2
Naches River spawning grounds	Adult mark	-	1,2	1,4	2
	Adult count	-	-	-	2
American River spawning grounds	Adult mark	-	1,2	1,4	2
	Adult count	-	-	-	2

[a] Quality control monitoring is not included

[b] Adult mark - sampling of adult fish: identifying whether or not they are marked; if they are marked, the mark is decoded and the experimental treatment and replicate group of the fish are determined; a set of observations is recorded for each sampled fish including time, location, size, sex, and other benign measurements; subsamples may also be subjected to tissue sampling as needed.

Adult count - count of fish by externally observable categories (e.g. marked vs. unmarked).

Adult tagging - application of individually unique marks to adults that are passed upstream at Roza for natural spawning. Representative subsamples of each of the two treatments (NIT and OCT) and unmarked fish are selected and marked. These fish are subsequently tracked and observed on the spawning grounds, where time and location of spawning are recorded; redds and carcasses may also be examined.

Juvenile marking - application of unique marks to juveniles of each replicate group that can be decoded on returning adults (without harming the fish).

PTA - Patient-Template Analysis.

The **risk containment** portion of the monitoring plan was developed based on the findings of the risk analysis for Yakima spring chinook, discussed above. There were four categories of interest identified in the risk analysis to monitor risk containment:

- experimental;
- genetic;
- harvest; and
- natural production/ecological interactions.

These four areas relate back to the objectives and strategies. The risk analysis defines risk in terms of the probability of failure to meet the objectives of the project for these four categories.

Monitoring of stock status includes measurements of run size and escapement to determine whether harvest objectives can be met without affecting natural production. It would provide information essential to track the long-term performance and fitness of the fish populations. This monitoring would be coordinated with ongoing monitoring currently being conducted by the USBR.

Implementation of the monitoring plan, annual review of the findings, and subsequent adjustment, as necessary, of the supplementation program objectives, strategies, assumptions, uncertainties, and risk analysis would complete the feedback loop that is essential to the success of the adaptive management process, and ultimately, the entire project.

2.3.4 Facilities

Alternative 1 would include the construction of a central hatchery facility at Cle Elum for holding upper Yakima spring chinook adults, spawning, incubating eggs, and early and extended rearing of young fish, as well as construction of three sites with six raceways each for acclimation and release of spring chinook smolts. (See Figure 2.5 for the location of the proposed facilities.) Table 2.3, below, lists the facilities required for the supplementation activities included in Alternative 1. Alternative locations for the upper Yakima spring chinook hatchery facilities were addressed in the EA (BPA, 1990a). These included hatchery sites at Thorp and Newman, about 8 kilometers (km) or 5 miles (mi.) upstream from the city of Ellensburg. Cle Elum was identified as the preferred site, as it had more abundant groundwater supplies.

The candidate acclimation sites were selected based on biological criteria specified by the managers. These criteria specify that the location should be adjacent to appropriate spawning habitat, that there must be adequate flow for fish migration, and that the water supply must encourage imprinting and homing to the desired spawning location. Several alternative acclimation sites have been considered in the upper Yakima basin, including (as identified in the original Draft EIS) five "clusters" or groups of three sites each near Thorp (Clark Flat, Town Diversion Dam, and New Cascade Canal); Keechelus (Keechelus Dam,

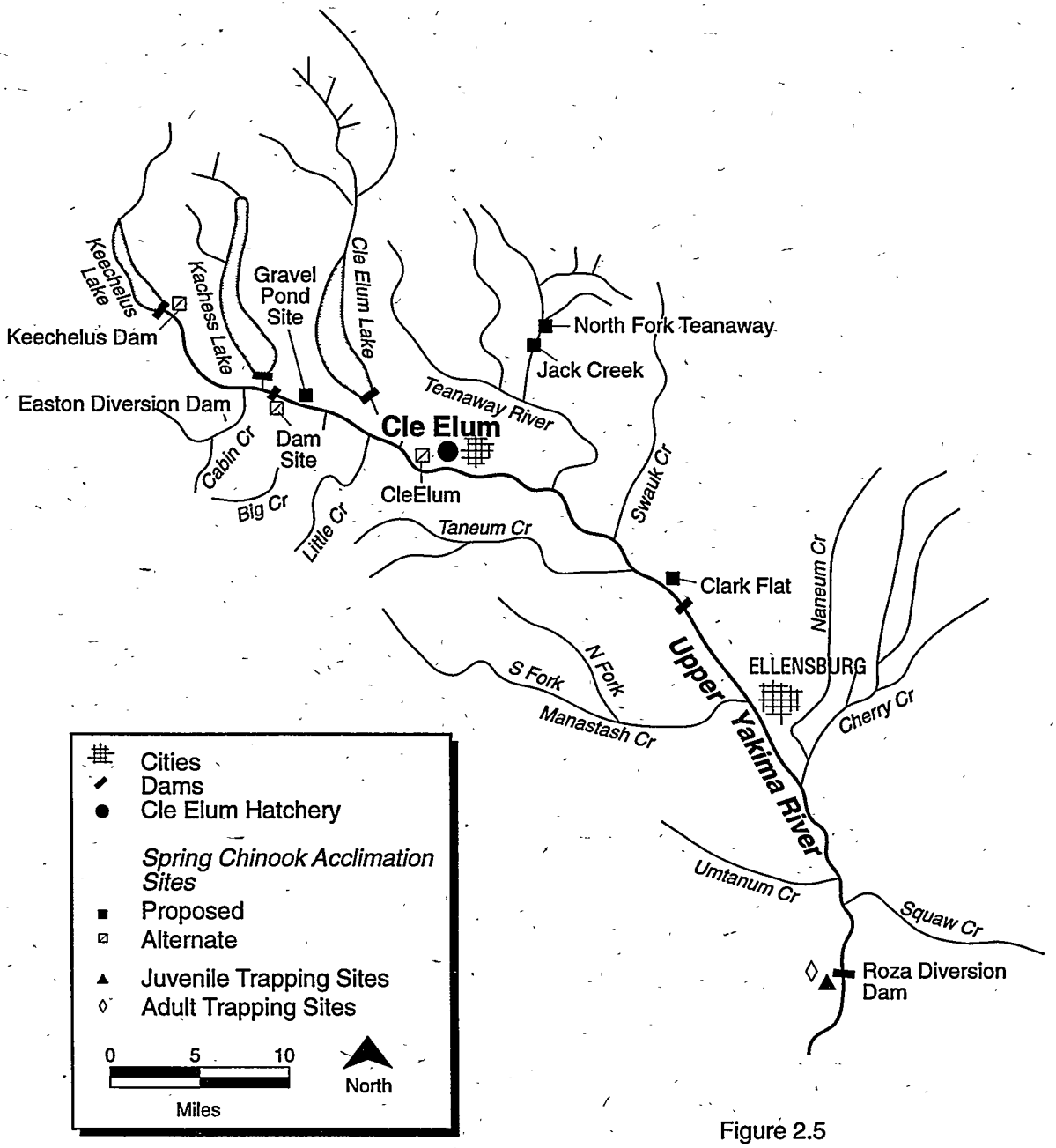


Figure 2.5
Upper Yakima River and Tributaries Project Facilities

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Stampede Pass Bridge, and Mile 210); Easton (Easton Dam, Easton Gravel Ponds, and Big Creek); Teanaway (Jack Creek, Jungle Creek, and Stafford Creek); and Cle Elum (Cle Elum Upper (hatchery site), Younger, and Mile 178).

Table 2.3 Facilities Requirements for Alternatives 1 and 2

	Raceways
Central Hatchery Facility	
Cle Elum	20
Acclimation Sites	
Clark Flat site	6
Easton site (2 siting options)	6
Jack Creek site	6

The number of acclimation sites needed was reduced as the experimental design was refined and the number of smolts proposed to be produced was reduced, given the additional information on water constraints at Cle Elum (see Section 2.3.1). The sites in Table 2.3 have been identified as the preferred sites due to experimental design, water availability, and fish access considerations (Dauble et al., 1994). A new site in the Teanaway drainage, the North Fork Teanaway site, was identified subsequent to the RDEIS. This site is now an alternate site for the Teanaway; the Jack Creek site remains preferred. Information on the North Fork Teanaway site has been added to this Final EIS. Information on two *siting options* for the Easton acclimation site (Easton Dam and Easton gravel pond sites) and on two additional *alternative* acclimation sites (the Cle Elum Hatchery site and the Keechelus Dam site) are also included in the EIS. A final decision on the exact acclimation sites to be used will be made in the Record of Decision on the project.

2.3.4.1 Central Hatchery Facility

Cle Elum would be the central facility for supplementation of the upper Yakima spring chinook stock. About 6 hectares (ha) or 15 acres (ac.) of land would be developed at the 200-ha (500-ac.) site. The facilities would consist of adult holding ponds, egg incubation facilities, raceways, groundwater wells, a pump station on the river, cleaning waste ponds for waste treatment, access roads, a storage building, offices, research facilities, interpretive facilities, parking, and residences. Figures 2.6 and 2.7 show the proposed layout of the facility. Construction would include 20 raceways and 2 adult holding ponds. There is room for expansion up to a total of 45 raceways on the site, if additional facilities were identified as needed in the future. The proposed facility has been sited to minimize wetlands impacts. The original plan described in the EA to use the onsite oxbow lakes for water supply has been changed to include a new pump station on the Yakima River. A combination of surface water from the Yakima River and groundwater from nearby wells is now proposed to supply water for the facility.

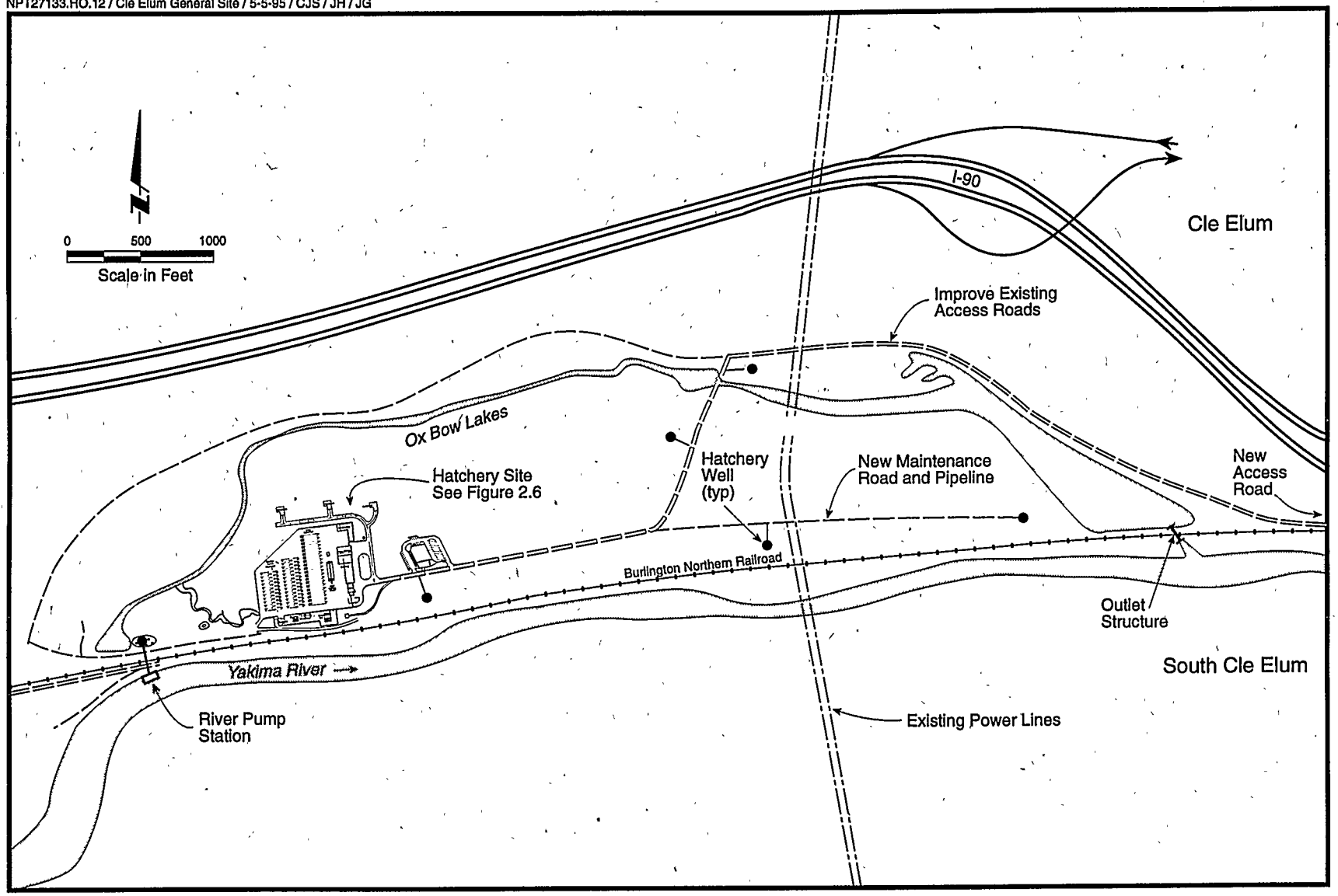
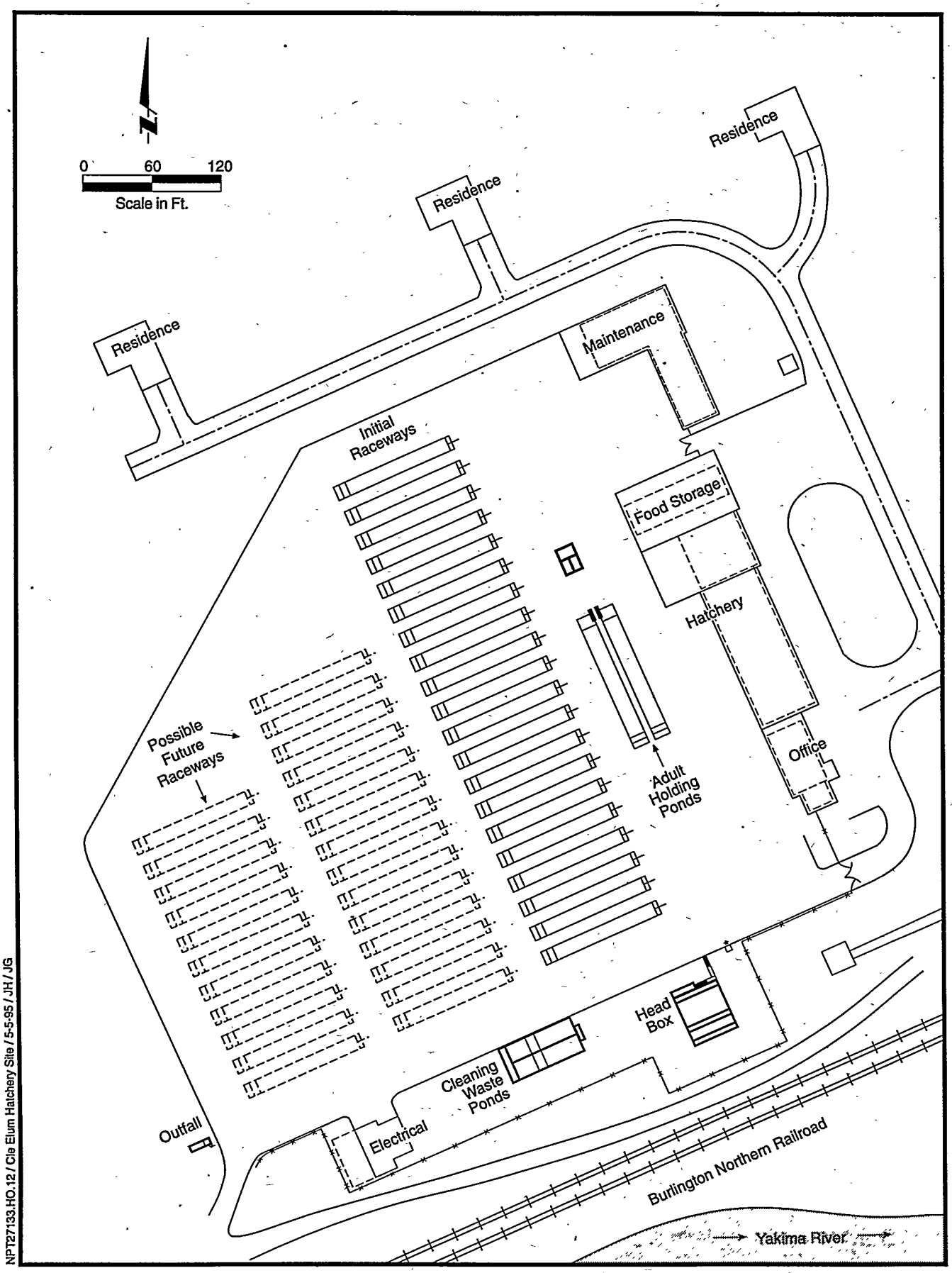


Figure 2.6
Cle Elum Hatchery
General Site Plan



NPT27133.HO.12 / Cle Elum Hatchery Site / 5-5-95 / JH / JG

Figure 2.7
Cle Elum Hatchery Site Plan

Potential interpretive facilities might be constructed in phases. The full complement of facilities might include a visitor center, parking lot, overlook, informational kiosks, and interpretive trails. Initial construction might include the parking lot, informational kiosks, walking paths, and possibly the visitor center. Additional facilities have been discussed and might be added in the future, depending upon funding availability and public use. These could include an outdoor amphitheater, observation blinds, aquarium, and expanded day use and visitor center facilities.

The undeveloped land surrounding the hatchery would be improved and protected for wildlife habitat. BPA and the project managers would develop a management plan for the site to mitigate impacts on wildlife for the YFP and for possible inclusion under the Columbia River Basin Fish and Wildlife Program.

2.3.4.2 Trapping Facilities

A major activity for the YFP is monitoring and evaluation of outmigrating smolts and returning adults. Monitoring and evaluation of *outmigrating smolts* would occur at existing juvenile facilities at Roza and Chandler. Monitoring and evaluation of *returning upper Yakima spring chinook adults* would occur at fish trapping facilities already present at Prosser and Roza Dams. Selective broodstock collection would occur at Roza Dam. Small-scale temporary traps and/or weirs might also be used to meet a variety of monitoring and evaluation needs.

2.3.4.3 Acclimation Sites

Acclimation raceways provide an environment for final rearing and acclimation of juvenile fish. The use of such sites is intended to reduce stress associated with transportation, and allow fish to acclimate and imprint on the water in which they would be released. Substantial numbers of acclimated smolts are expected to return as adult spawners to the general vicinity of the acclimation sites.

Three sites are proposed for acclimating upper Yakima spring chinook: Clark Flat, Easton (Gravel Pond siting option), and Jack Creek. (See Figures 2.8-11.) Of the 16 investigated acclimation sites, these 3 were determined to best meet project goals and have the least effect on the environment. Six raceways would be constructed at each of the sites: three for each of the two experimental treatments (NIT and OCT). Three alternate sites – Keechelus Dam, North Fork Teanaway, and Cle Elum, have also been identified (Figures 2.12-14) and are discussed in this EIS.

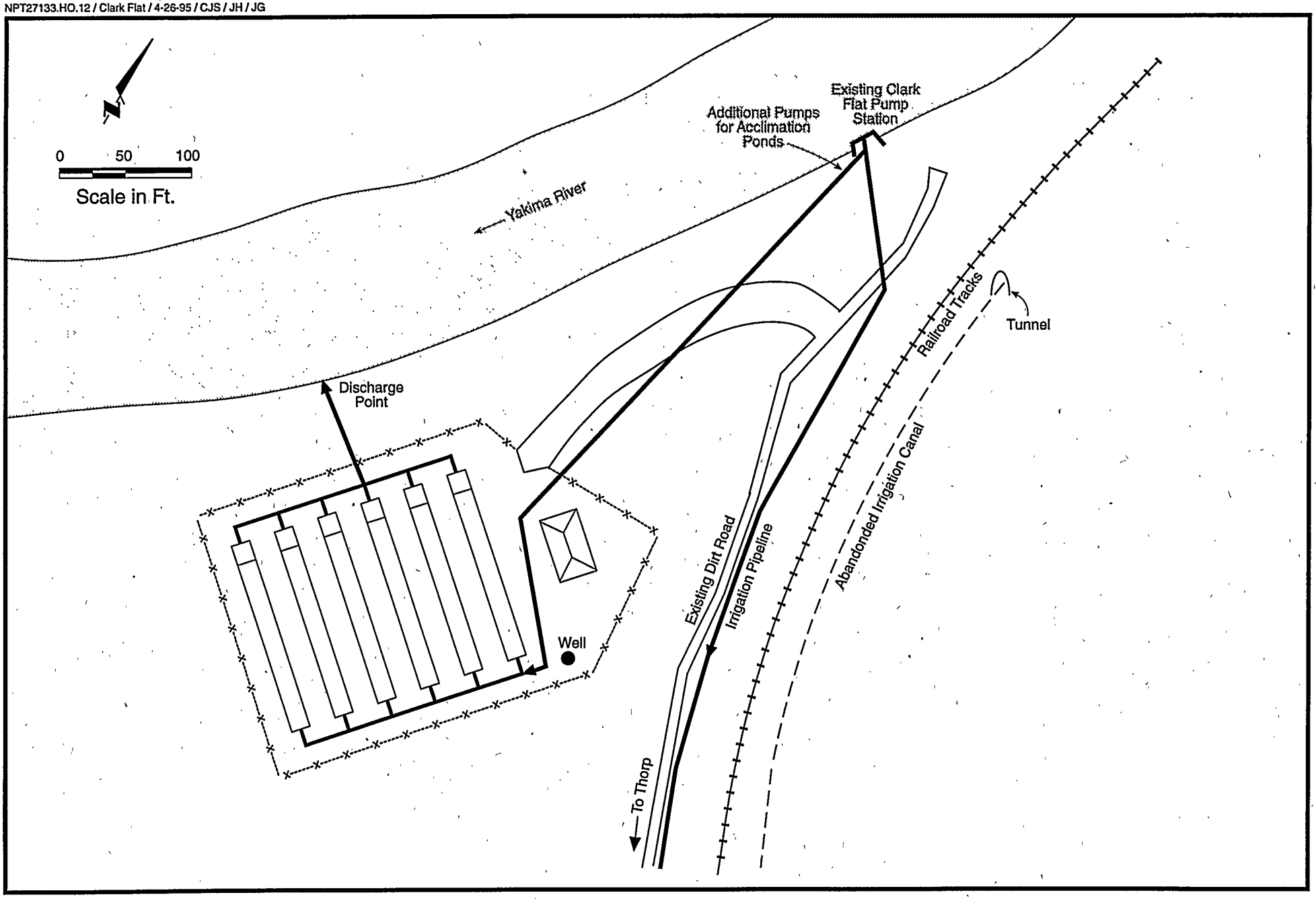


Figure 2.8
Clark Flat Acclimation Site

NPT27133.HO.12 / Canal Fish Facility / 5-5-95 / JG

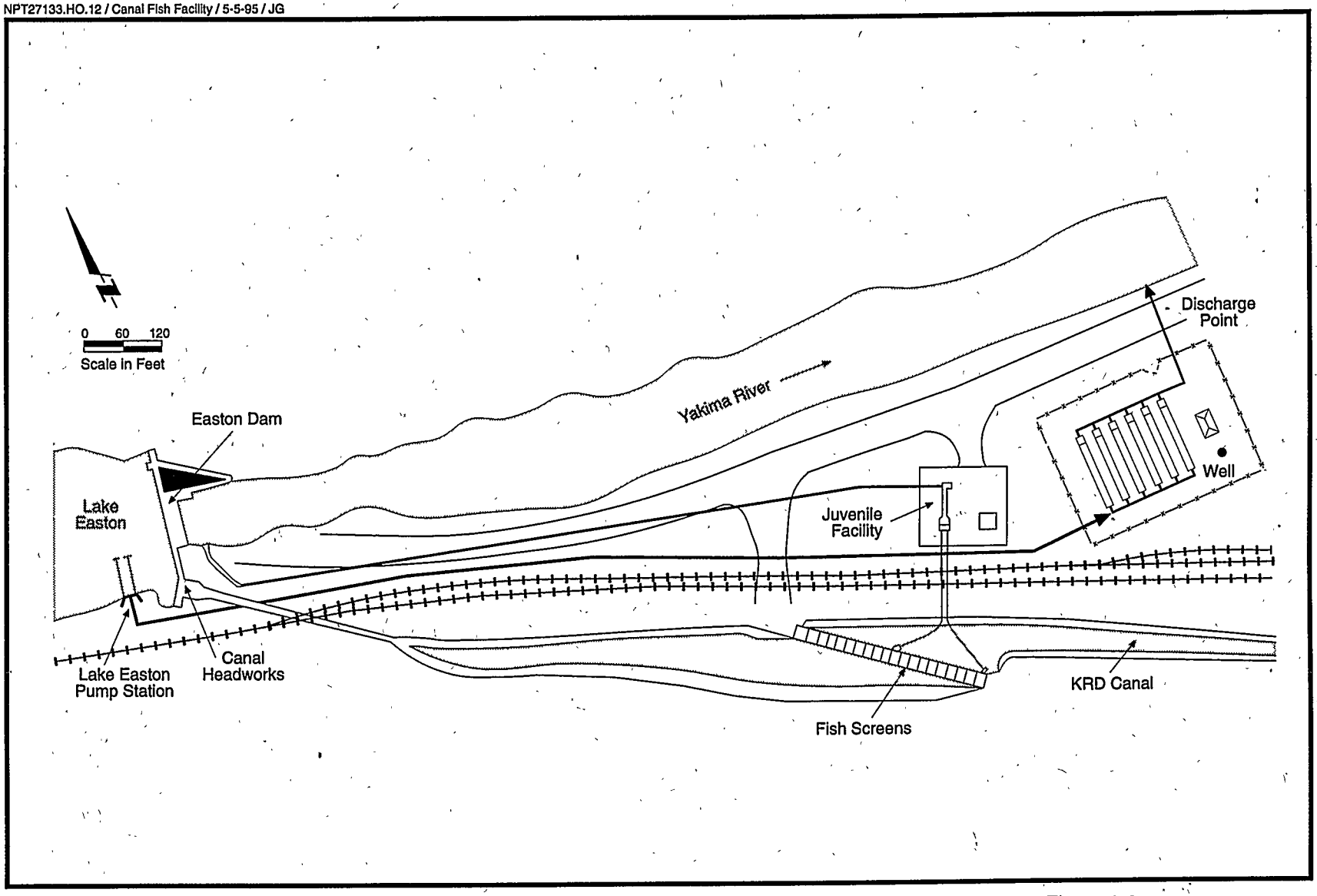


Figure 2.9
Easton Dam Siting Option
Easton Acclimation Site

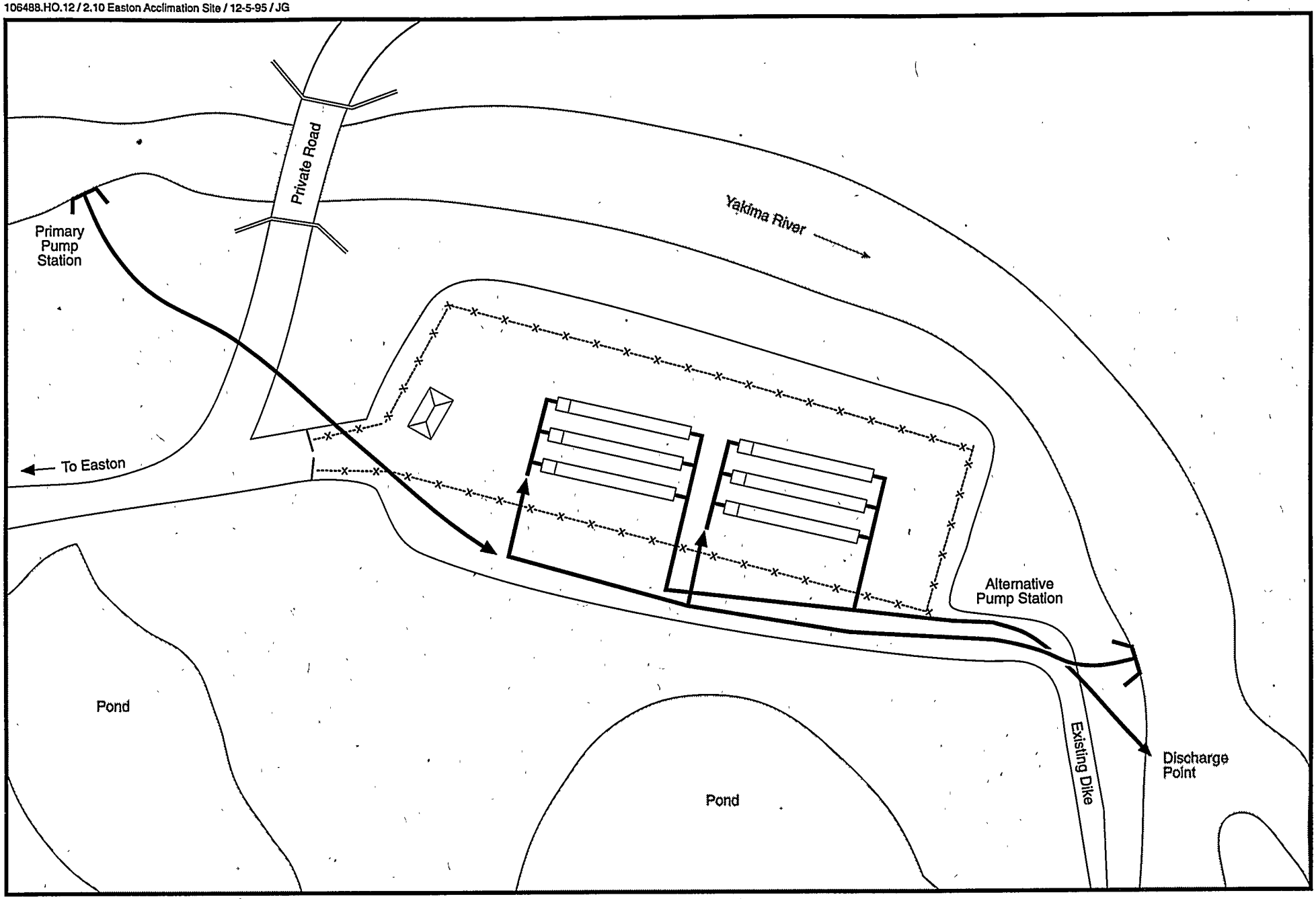


Figure 2.10
Easton Gravel Pond Siting Option (Revised) Easton Acclimation Site

NPT27133.HO.12 / Jack Creek / 5-5-95 / CJS / JH / JG

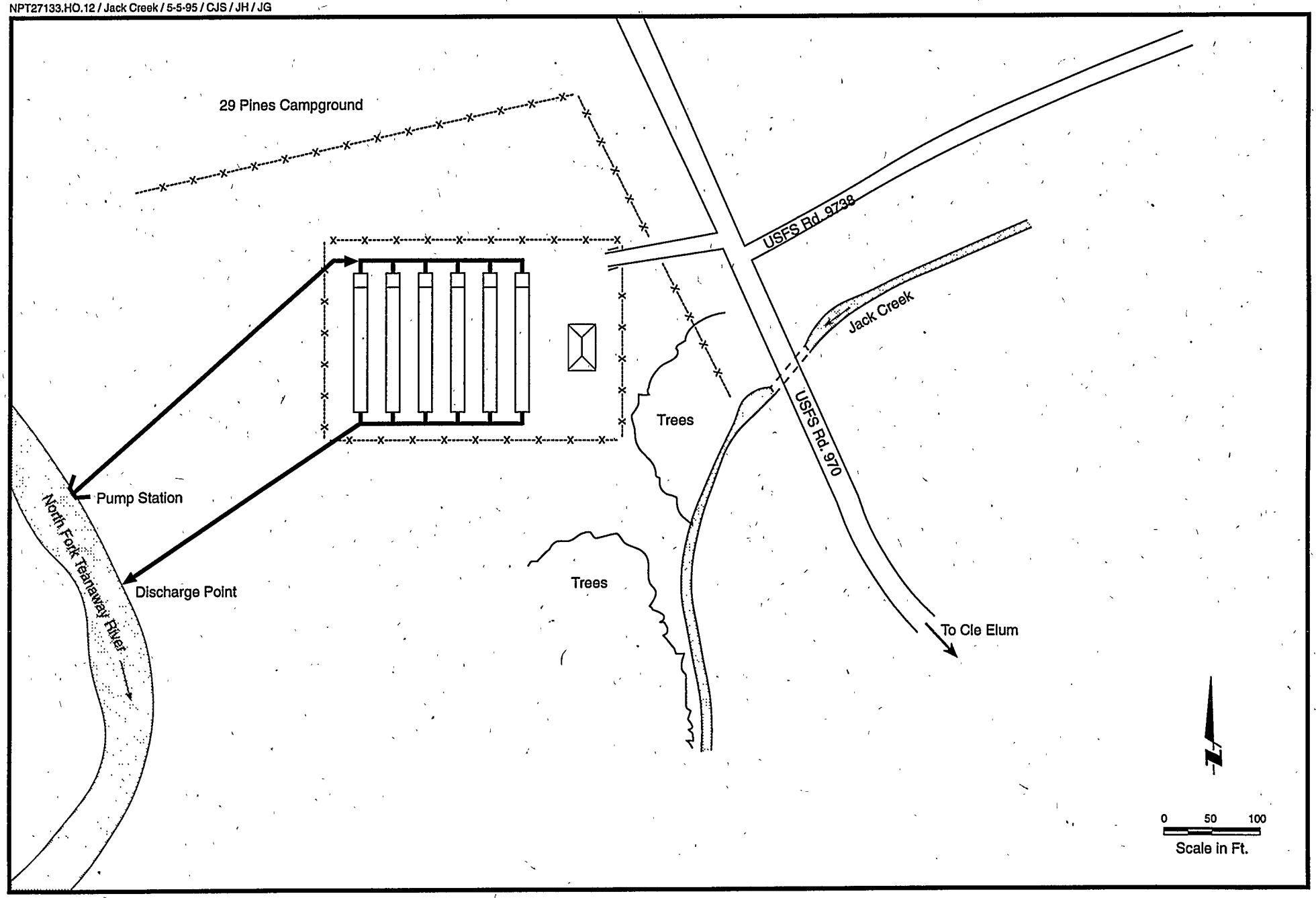


Figure 2.11
Jack Creek Acclimation Site

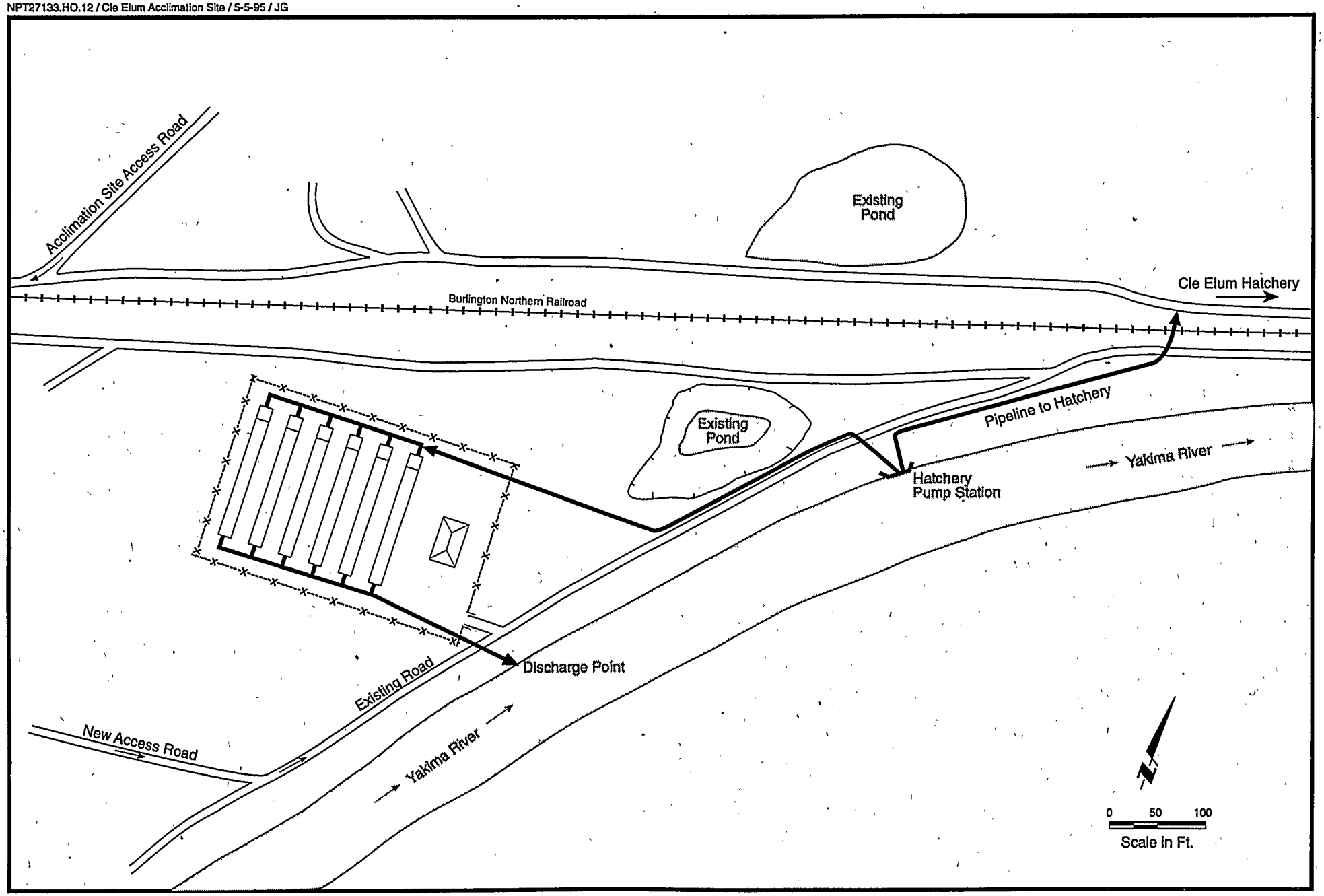


Figure 2.12
Cle Elum Acclimation Site (Alternate)

NPT27133HO.12 / Keechelus / 5-5-95 / CJS / JH / JG

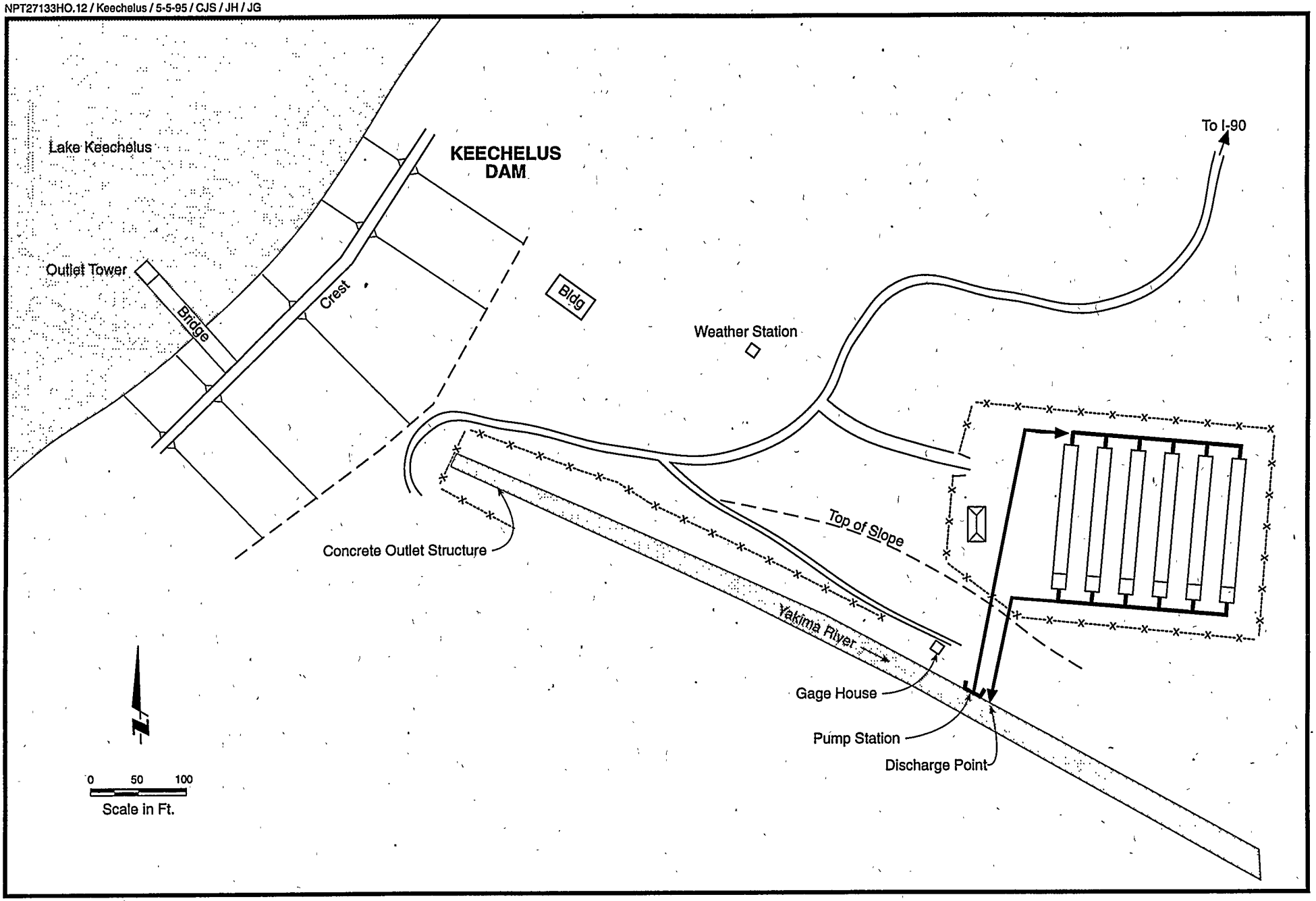


Figure 2.13
Keechelus Acclimation Site (Alternate)

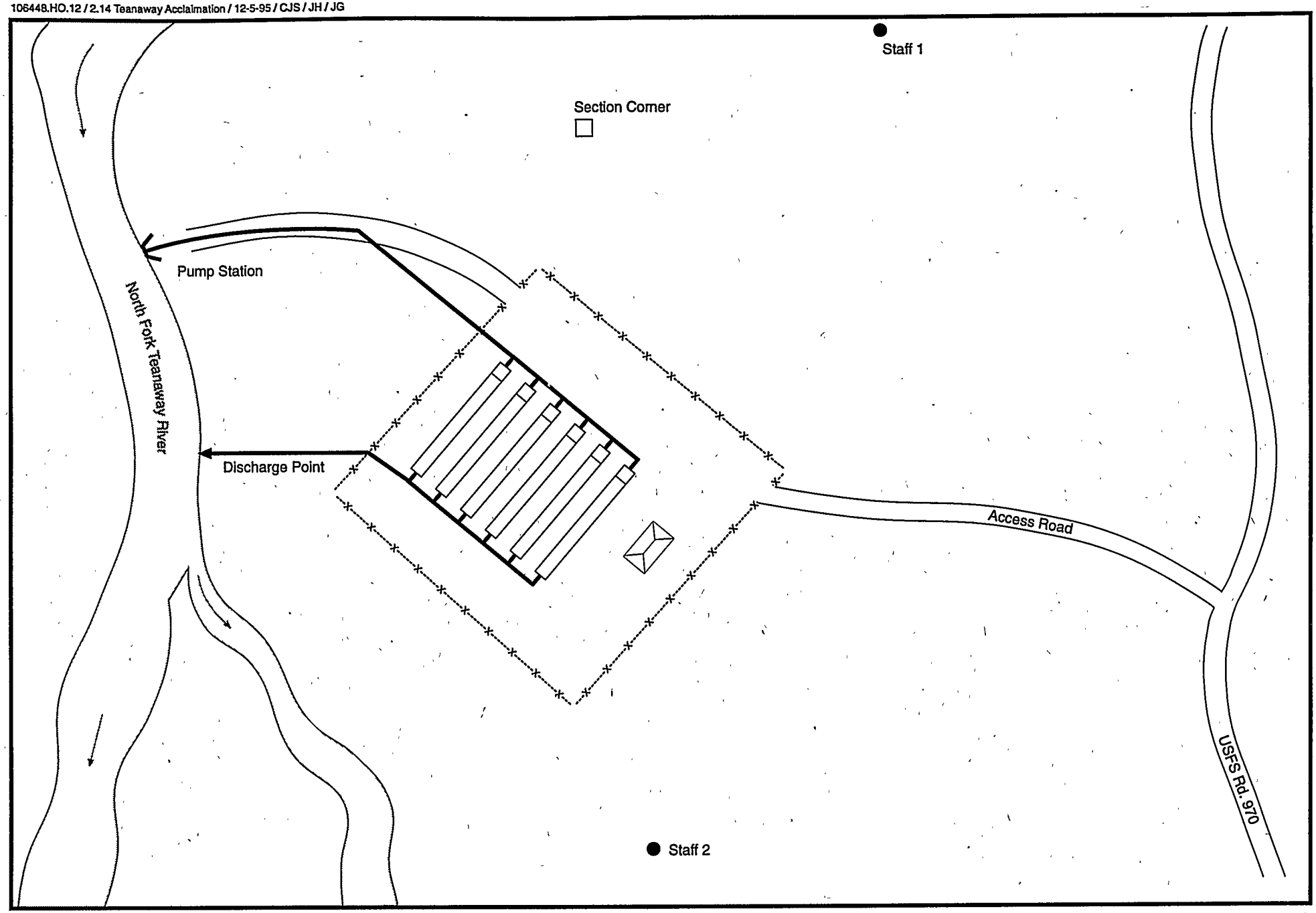


Figure 2.14
North Fork Teanaway Acclimation Site (Alternate)

Each six-raceway acclimation site would require development of less than 0.8 ha (2 ac.) of land. The acclimation facilities would allow incorporation of innovative features needed to study experimental variables such as feeding techniques, stream cover design, and predator conditioning. Raceways at each acclimation site would be constructed according to a standardized design. During operation, the raceways would be protected by security fencing, alarm systems, and devices (such as overhead wires or netting) that would protect the fish from predators.

The raceways would be supplied by a combination of surface water from adjacent tributaries and rivers and groundwater from nearby wells. The preferred mode of supplying water to the sites is by gravity flow, an alternative to be used on the higher-gradient tributaries. Where gradient is inadequate, water would be pumped to the raceways. Currently, the project managers are considering a plan to deliver fish to the acclimation sites during winter months, which would most likely result in water being pumped to the sites for purposes of reliable operation. Water would be diverted from streams during the winter and spring, when flows in the affected creeks or rivers are usually greatest. Groundwater would be used to supplement surface water supplies as necessary. Water use would be non-consumptive; all water used would be returned to the nearby river or tributary.

2.3.5 Project Operations

Broodstock would be collected at Roza Dam, transported to the central facility, and held there for spawning. The number of naturally produced adults used for broodstock would be large enough to be representative of the donor stock, but not so large that broodstock collection would impair the natural reproductive capacity of the stock. Incubation of eggs and rearing of fry would also take place at the central facility.

Rearing would include methods to encourage adaptation of released fish to the natural environment, such as teaching juvenile salmonids to avoid predators and to forage for food. Specific details regarding both OCT and NIT rearing protocols for both the would be finalized based on experiments being conducted before the facilities are built.

When ready, juvenile upper Yakima spring chinook would be transferred to the acclimation sites next to the spawning grounds to which they would be expected to return as adults. When sufficiently mature, the young smolts would leave the acclimation facilities for outmigration to the ocean. Adult fish would be expected to return 2 to 4 years later to spawn. The first experiment year depends on the construction schedule for the project; at this time project managers anticipate that the first experiment year would be 1998. In that case, the first adults (jacks) would return to the basin in the year 2000. All of the adults from the first treatment group would return by 2003. Table 2.4, below, shows anticipated releases and returns, by schedule.

Smolts and returning adults would be monitored for each experimental treatment (see Section 2.3.3) to determine success. Throughout the process, fish culture practices would

follow guidelines established to minimize genetic change caused by hatchery rearing and to encourage adaptation of released fish to the natural environment. Genetic hatchery guidelines for the YFP have been drafted and are documented (Kapuscinski and Miller, 1993).

Table 2.4 Anticipated Fish Treatments

Experiment Year	Treatment									
	First Generation Treatments					Second Generation Treatments				
	1	2	3	4	5	1	2	3	4	5
1998	Rearing									
1999	Release	Rearing								
2000	Age 2 adult returns	Release	Rearing							
2001	Age 3 adult returns	Age 2 adult returns	Release	Rearing						
2002	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing					
2003	Age 5 adult returns	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing				
2004		Age 5 adult returns	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing			
2005			Age 5 adult returns	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing		
2006				Age 5 adult returns	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing	
2007					Age 5 adult returns	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing

2.4 Alternative 2: Upper Yakima Spring Chinook Supplementation and Coho Study

Alternative 2 would involve the testing of supplementation of upper Yakima spring chinook and a study to determine the feasibility of re-establishing a naturally spawning population of coho to the Yakima River Basin. All actions relating to upper Yakima spring chinook would be identical to those described for Alternative 1. Discussion of the coho study under this alternative proceeds in the same order as for Alternative 1. **Alternative 2 has been identified by the Policy Group as the preferred alternative for the YFP.**

All approaches (adaptive management strategy, Project Management Plan, yearly Planning Status Report, environmental review as necessary, Uncertainty Resolution Plan, and a Project Annual Review) would be the same as described under Section 2.2. Monitoring and evaluation would be carried out to provide feedback for a successful adaptive management program. Policy development and expression and Project Management would also be the same as described earlier.

2.4.1 Objectives and Strategies

2.4.1.1 Upper Yakima Spring Chinook Supplementation

The program for upper Yakima spring chinook would be the same as that described in Section 2.3.1.

2.4.1.2 Coho Feasibility Study

Under Alternative 2, project managers would seek to determine the feasibility of re-establishing a naturally spawning coho population and a significant fall fishery for coho within the Yakima River Basin, while keeping adverse ecological impacts within acceptable limits.

The few naturally spawning coho salmon presently in the Yakima River Basin are considered the result of hatchery outplantings. As described in Section 1.4, the YIN is now managing a program of acclimating and releasing coho pre-smolts transferred into the Basin under CRFMP. CRFMP mandates the release of 700,000 coho annually, to supply a terminal fishery for tribal and other fishers. The program uses early-run fish from lower Columbia River hatcheries (mainly Cascade Hatchery), and has, to date, produced very few adults returning to the Yakima River. However, a program of acclimating the smolts before release was begun in 1994; it should improve the returns of adult coho to the basin. While the acclimation and release program is *not* being funded by BPA under the YFP, and its impacts are *not* addressed in this EIS, the fish being acclimated and released under this program would be used by the YFP in the proposed studies. Tribal personnel conducting both the CRFMP and YFP programs are coordinating them and working toward the common goal of establishing naturally reproducing populations of coho in the Yakima River Basin.

Under this alternative, the 700,000 smolts from the ongoing YIN coho program would be used in a feasibility study to determine the benefits and risks of re-establishing coho in the Yakima River Basin. The smolts would continue to be acclimated at low-tech facilities already developed for the Tribal coho program (Granger pond, Roza Wasteway #3 near Wapato, and the Wapato Canal net pens - see Figure 2.15). Approximately 10% of the smolts are marked by clipping and coded wire tags. The smolts leave the acclimation sites voluntarily; automatic fish counters at the exit of each acclimation facility would monitor the number of fish outmigrating each day. Smolt survival would be monitored at the Chandler Juvenile Evaluation Facility.

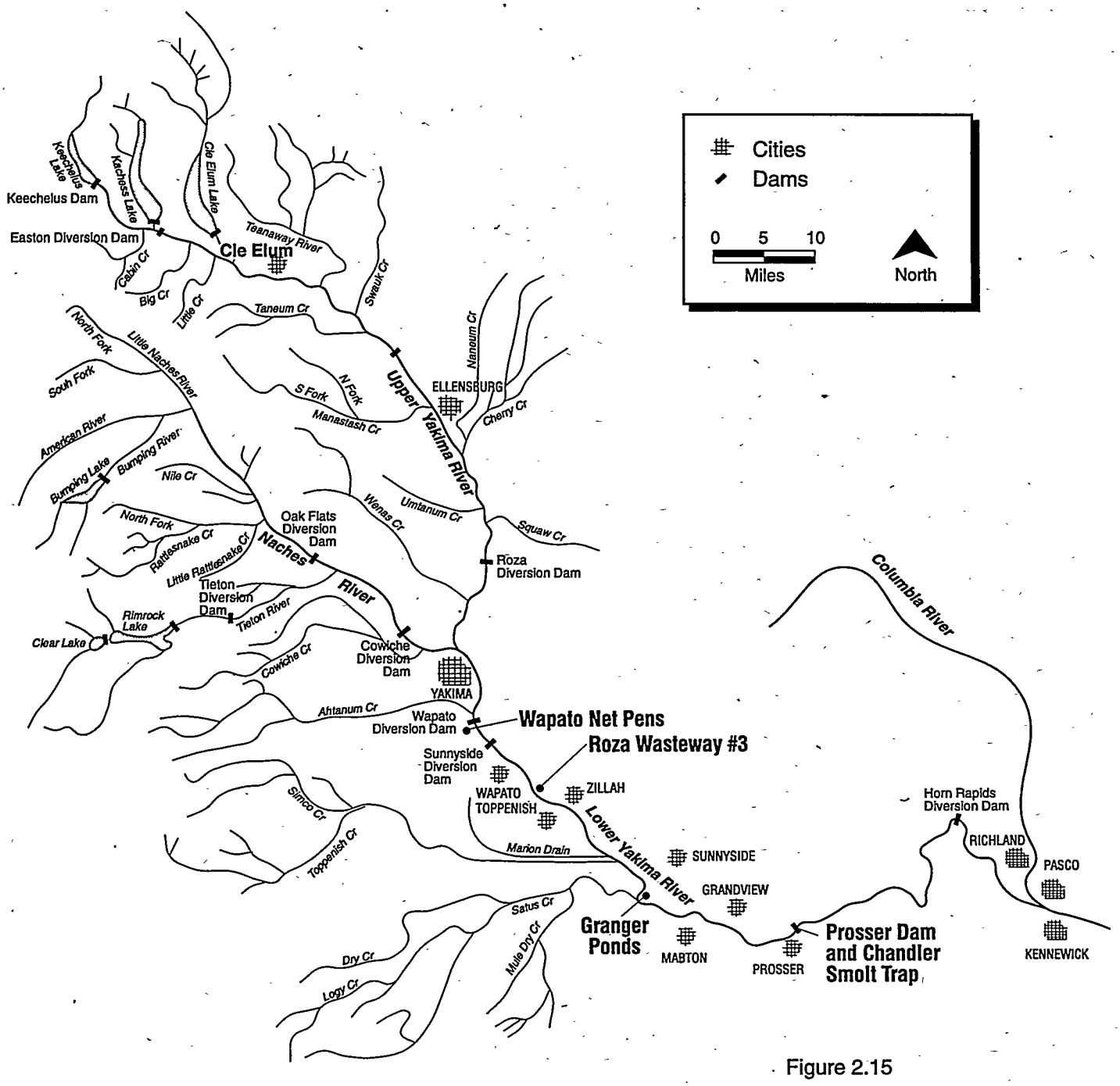


Figure 2.15
Coho Acclimation Sites

106488.HO.12 / Coho Acclimation / 12-5-95 / CJS / JG

Monitoring of the smolts released under the coho program would be conducted to study the interactions of the coho with other fish species in the Yakima River. Stomach contents of the outmigrating smolts would be sampled at the Chandler Juvenile Evaluation Facility and at selected sites in the river, to determine the food habits of the smolts. This study would be designed to evaluate the potential risk of coho smolt predation on juvenile fall chinook salmon. Returning adults would be monitored at Prosser Dam fish ladders to determine the smolt-to-adult survival rates. Other monitoring activities may be pursued as necessary to clarify other ecological interactions. Under this alternative, juvenile coho would continue to be released in the Yakima River Basin only downstream from Wapato Dam.

The project managers have agreed on a set of objectives and strategies for the coho feasibility studies. Unlike the objectives and strategies for spring chinook, which were described in four categories, objectives for the coho feasibility studies are limited to one category, experimentation. There would be no change from the current releases of coho in the basin, and the planned research effort is necessary before natural production, genetic, or harvest objectives are developed. These objectives and strategies (which are reviewed, revised, and published annually in the Planning Status Report) are more qualitative than those for upper Yakima spring chinook, since planning for coho has undergone fewer iterations and thus not as much work has been done to refine them. They will be modified and refined through the adaptive management process. Table 2.5 presents the latest version of the objectives and strategies for coho.

Table 2.5 Yakima Coho Objectives and Associated Strategies

Objectives	Strategies
Experimentation	
Determine the feasibility of returning natural production of coho salmon to the Yakima River Basin.	Evaluate the survival, escapement, and natural reproduction of introduced coho salmon in the Yakima River Basin.
Determine the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin.	Evaluate the survival, escapement, and natural reproduction of introduced coho salmon in the Yakima River Basin; calculate the potential harvest benefits.
Determine the predation impacts of releasing 700,000 acclimated coho smolts on fall chinook populations in the Yakima River Basin.	Conduct food habit analyses of coho salmon released into the Yakima River Basin to determine the impact on fall chinook populations.

2.4.2 Assumptions, Uncertainties, and Risk Analysis

2.4.2.1 Upper Yakima Spring Chinook Supplementation

The program for upper Yakima spring chinook would be as described in Section 2.3.2.

2.4.2.2 Coho Feasibility Study

The process for documenting assumptions and uncertainty resolution for the coho feasibility study would be similar to that described in Section 2.3.2 for upper Yakima spring chinook. A risk analysis for the coho study is presented in Section 4.1.2 of this EIS. The assumptions and analyses are documented in the coho chapter of the Planning Status Report (see Appendix B).

2.4.3 Monitoring

2.4.3.1 Upper Yakima Spring Chinook Supplementation

The monitoring program for upper Yakima spring chinook would be as described in Section 2.3.3.

2.4.3.2 Coho Feasibility Study

The monitoring plan for YFP coho emphasizes two major areas of interest to address the objectives and risks identified. These are:

- their survival through various life stages; and
- the rates of predation of released coho smolts on other species of concern.

The survival of smolts from the time of their release to the time they pass Prosser (smolt-to-smolt survival) would be evaluated by counting smolts at the Chandler juvenile evaluation facility below Prosser Dam. Adults returning to the Yakima basin would also be video-monitored at Prosser Dam. Approximately 10% of the released coho smolts would be tagged with coded-wire markers to facilitate their identification. The information obtained through this monitoring would be tracked through the STAC, and reports prepared for the Tribal coho program.

A monitoring plan has been drafted to address the predation issue. It would involve electroshocking coho smolts at the Chandler juvenile evaluation facility as they move downstream from the release points, and studying the stomach contents. The STAC would evaluate the results of this study and consult with the Policy Group to determine whether and how a coho reintroduction program would be developed using the adaptive management process.

2.4.4 Facilities

No major new facilities would be needed for the coho feasibility study, beyond the low-tech acclimation facilities being used for the existing Tribal coho program, and existing trapping and monitoring facilities at Prosser Dam. It is possible that small-scale, portable traps and/or weirs might be needed to meet a variety of monitoring and evaluation needs.

2.4.5 Project Operations

2.4.5.1 Upper Yakima Spring Chinook Supplementation

The project operations for upper Yakima spring chinook would be as described in Section 2.3.5.

2.4.5.2 Coho Feasibility Study

Coho smolts would continue to be imported into the Yakima River Basin under the Tribal Program. These 700,000 smolts would be acclimated at the three low-tech facilities discussed earlier (Section 2.4.1.2). When ready, the juvenile coho would leave the acclimation facilities for outmigration to the ocean. Adult fish would be expected to return to the basin the next year to spawn.

Smolts and returning adults would be monitored for survival rates; smolts would be monitored for food habits. Throughout the process, fish culture practices would follow guidelines established to minimize genetic change caused by hatchery rearing and to encourage adaptation of released fish to the natural environment. Genetic hatchery guidelines for the YFP have been drafted and are documented (Kapuscinski and Miller, 1993).

2.5 No Action Alternative

Under the No Action Alternative, BPA would not fund testing of supplementation in the Yakima River Basin. BPA would not fund the construction of supplementation facilities or the production of fish in the Yakima Basin. The activities described in Section 1.4 would continue, including passage improvements, water enhancements, and the coho program under CRFMP.

Some salmon and steelhead populations might increase because of the ongoing passage improvement activities and habitat improvement activities in the Yakima River Basin, as well as ESA recovery efforts underway in the mainstem Columbia River, but most likely at a slower rate than with supplementation. Harvest opportunities within the Yakima River Basin would remain low or depressed, and might be eliminated if runs continued to decline. They most likely would not increase as rapidly in the short term as they would under the action alternatives. The No Action Alternative would indefinitely delay implementation of measure 7.4K.1 of the Council's December 1994 Fish and Wildlife

Program, which encourages BPA to fund construction of an anadromous fish hatchery in the Yakima River Basin.

2.6 Alternatives Eliminated from Detailed Study

A number of alternatives to the YFP have been proposed by the public and agencies, both during scoping and as comments on the Draft EIS. Most of these alternatives were eliminated from further analysis in this EIS for one or more of the following four reasons:

1) they would not meet the need for knowledge about how the strategy of supplementation can be applied to the protection and mitigation of impacts on stocks of anadromous fish in the Yakima River Basin;
2) they were addressed in other environmental documents;
3) they could result in an unacceptably high impact on the environment; or
4) they were not considered feasible.

2.6.1 Passage Improvements and Other Activities

Passage improvements, habitat improvement, improvement of instream flows, water quality improvement, and controlling predation are all valid alternatives for increasing the numbers of fish in the Yakima River Basin. These activities have been proposed for the Basin as part of the Yakima Subbasin Plan (YIN, 1990), which was developed as part of the Council's planning effort. However, these proposed nonsupplementation activities would *not* meet supplementation research objectives or help reintroduce stocks that no longer inhabit the basin. Because they would not meet the need for the project, these proposed alternatives were eliminated from detailed study as alternatives to the proposed action. Many of these activities are, however, ongoing as part of the Columbia River Basin Fish and Wildlife Program and other programs discussed in Section 1.4.

2.6.2 More Supplemented Stocks

As previously indicated, the DEIS included several project alternatives distinguished primarily by the number of stocks proposed for supplementation. The seven-stock, five-stock, and three-stock alternatives discussed in the DEIS were eliminated from detailed study in the RDEIS and this FEIS because BPA and the project managers have concentrated detailed planning on only upper Yakima spring chinook and coho at this time. Alternatives 1 and 2 were developed to address this shift in priorities. Project managers are considering the implementation of supplementation for or the reintroduction of the remaining stocks in the Basin (e.g., other spring chinook, fall chinook, coho, and summer steelhead); these may be proposed as time and funds permit. At this time, project managers are emphasizing steelhead and lower Yakima River fall chinook as the most likely stocks to be added to the project in the future. Additional environmental

documentation would be prepared before any such additional supplementation becomes a project operation.

The *upper Yakima spring chinook* stock was identified in the original Draft EIS as the preferred spring chinook stock for testing supplementation, given the objective of conserving the American River populations and concerns regarding the ability to distinguish between the Naches and American River populations. Supplementation of spring chinook (as opposed to fall chinook or steelhead) was pursued by the project managers at this time because there is more data available on spring chinook than on other stocks in the Yakima Basin. This additional data allowed project managers to better define risks and set objectives for the stock, which are critical to the adaptive management process. The *coho* feasibility study is proposed under Alternative 2 because of the desire of the managers to establish a fall fishery and because it would be consistent with the Tribes' ongoing coho acclimation and release program under the CRFMP.

2.6.3 Alternative Sites

Alternative sites and configurations for the central and satellite facilities were addressed in the EA on the siting and construction of central, satellite, and trapping facilities for supplementing anadromous fish populations in the Yakima and Klickitat River Basins (BPA, 1990a). Central hatchery facilities were proposed at Cle Elum in the upper Yakima watershed, and at Oak Flats and Nelson Springs in the Naches watershed. The Cle Elum site has been proposed in this FEIS as the preferred central facility site for upper Yakima spring chinook, as it would best meet the water needs and is located closer to the acclimation sites. The Oak Flats site might not have sufficient groundwater available for holding of adults through the summer months, and the Nelson Springs site was proposed as (and is better suited for) a fall chinook and/or steelhead facility. Several acclimation sites were investigated and rejected, either because they did not meet the experimental needs of the project (and were therefore not feasible alternatives), or because they would have resulted in unacceptably high impacts on cultural resources or wetlands.

2.6.4 Research at Existing Non-Yakima River Basin Sites

After reviewing public comments on the original DEIS, BPA and the project managers considered an alternative involving supplementation research to be conducted at existing Columbia River Basin facilities outside the Yakima River Basin. Supplementation programs at three existing hatcheries were examined to determine whether they could meet YFP research goals--the Lyons Ferry Salmon Hatchery-Tucannon River Satellite (located northeast of Walla Walla, Washington, on the Tucannon River); the Methow Salmon Hatchery (located near Winthrop, Washington); and the Rock Island Hatchery Complex (located on five rivers in north central Washington). These three programs were selected as a representative sample from the list of regional supplementation programs. They are operationally similar to the proposed YFP, they are located in the State of Washington, and information on them was readily available from WDFW.

However, none of the three hatcheries could meet both of the two distinct levels of experimentation within the YFP experimental design. The first level tests supplementation success in the context of four major biological response variables (post-release survival, reproductive success, long-term fitness, and ecological interactions). The second experimental level tests the value of various hatchery rearing strategies. Both the Methow and Rock Island hatcheries could provide equivalent or greater potential than offered by the YFP to monitor and evaluate biological response variables. However, none of the three hatcheries has sufficient facilities to meet the statistical criteria for testing alternative hatchery rearing treatments set by the design of the YFP. In addition, the ability of the Lyons Ferry Hatchery to meet the supplementation success research goals has been diminished with the listing of the Snake River sockeye stocks and the spring and fall chinook stocks as endangered under the ESA.

2.6.5 Other Research Outside the Yakima River Basin

While it appears that there is some opportunity to conduct supplementation research comparable to the research planned for the YFP outside the Yakima River Basin, this alternative would not meet two of the purposes of the proposed action. The purpose of testing the assumption that new supplementation techniques can be used in the Yakima River Basin to increase natural production and to improve harvest opportunities while maintaining genetic resources can be met *only* by supplementing *Yakima River stocks in the Yakima River basin*. This alternative also would not fulfill the Council's request that supplementation be tested in the Yakima River Basin, which is another purpose of the project (see Section 1.2). Since the proposed alternative to test supplementation at other locations would not meet either of these purposes, and since none of the facilities outside the basin could provide equal or better opportunities to perform both types of supplementation research, this alternative is not discussed further in this FEIS.

2.7 Comparison of Alternatives and Summary of Impacts

This section summarizes the information in the following two chapters and presents a comparison of the environmental consequences of the two YFP action alternatives and the No Action alternative. Table 2.6 shows this comparison graphically. The environmental consequences of the alternatives for each of the major resources affected were rated as **high**, **moderate**, or **low**. These ratings take into consideration the mitigation summarized in Section 4.2.2. For a more detailed discussion of impacts, please see the corresponding discussions in Section 4.1. The following criteria were taken into consideration in these ratings:

A **high** impact is one that:

1) cannot be substantially mitigated;
2) substantially reduces the quantity or quality of a regionally or nationally significant resource;

3) would adversely affect the long-term productivity of the environment;

4) irreversibly or irretrievably damages significant resources;

5) consumes substantial quantities of non-renewable natural resources.

A **moderate** impact is one that:

1) creates an impact that can largely be mitigated;

2) may adversely affect the quantity or quality of a regionally or nationally significant resource;

3) may adversely affect the long-term productivity of the environment;

4) may involve some irreversible or irretrievable damage to the environment;

5) consumes only moderate quantities of non-renewable natural resources.

A **low** impact is one that:

1) creates few or no impacts that must be mitigated;

2) does not reduce the quantity or quality of a regionally or nationally significant resource;

3) is unlikely to adversely affect the long-term productivity of the environment;

4) involves little or no irretrievable or irreversible damage to the environment;

5) consumes only minor quantities of non-renewable natural resources.

Table 2.6 Environmental Consequences of the Yakima Fisheries Project Alternatives

	Alternative 1	Alternative 2	No Action
Water Resources			
Surface water	M	M	L
Ground water	M	M	L
Floodplains/wetlands	M	M	L
Biological Resources			
Aquatic biological resources	M	M	M
Vegetation	L	L	L
Wildlife	M	M	L
Special Status species	M	M	L
Air Resources and Noise	L	L	L
Socioeconomics	L	L	L
Recreation and Visual	M	M	L
Cultural Resources	M	M	L
Resource Management (Land use and Solid/Hazardous waste)	M	M	L

H = High impact M = Moderate impact L = Low or no impact

There are only minor differences in environmental consequences between Alternatives 1 and 2. Alternative 2 incorporates the same program for upper Yakima spring chinook as alternative 1, but adds a feasibility study for coho using the fish already being released into the basin under the CRFMP. It should be noted that there is no change in environmental impact attributable to incorporation of the coho feasibility study into the YFP because the coho release program is ongoing and will continue whether the feasibility study is included in this project, or not. Potentially high impacts on wild, native, and non-target fish populations under both alternatives would be lessened through careful adherence to the adaptive management process. While the No Action alternative would not affect resources through the construction of facilities, it could result in a moderate impact on anadromous fisheries in the Yakima River basin. This is because the anadromous fisheries are rapidly declining at present, and the No Action alternative would not contribute to reversing the decline.

2.7.1 Water Resources

2.7.1.1 Surface Water

Surface water quantity impacts for Alternatives 1 and 2 would be low. All surface water use for the project would be nonconsumptive; water would be returned to the source stream or river immediately downstream of the point of diversion after it is cycled through the facility. There are potential problems with water availability at the alternative Keechelus acclimation site when reservoir releases are stopped or slowed to allow refill. Low flows at the mouth of the Teanaway River in late summer and fall might affect upstream migration and spawning of spring chinook salmon returning to the vicinity of the North Fork Teanaway and Jack Creek sites.

Consistent with the Northwest Power Act of 1980 and the Council's 1994 Fish and Wildlife Program (Section 4.1.1), existing water rights would not be affected by the proposed project, nor would the ongoing water adjudication process in the Yakima River Basin. A potential for conflict over water availability exists due to the potential increase in fish returning to the basin. Water availability is affected by many factors, including weather, competing diverters, and other programs underway to increase both water supply and numbers of fish returning to the basin. Any of these potential conflicts would be resolved in a foum other than the YFP.

Surface water quality could be moderately affected by the project in the short-term during construction of the facilities. Erosion control measures would be implemented to minimize this impact. Effluent from the facilities would cause nutrient levels to be raised only slightly; the levels would remain within acceptable limits identified by the U.S. Environmental Protection Agency (EPA).

Due mainly to the potential for erosion during the construction period, the overall impacts of Alternatives 1 and 2 on surface water were judged to be moderate. No impacts on surface water quality or quantity would occur as a result of the No Action Alternative.

2.7.1.2 Groundwater

Impacts on groundwater resulting from Alternatives 1 and 2 were judged to be moderate, based on the moderate amount of groundwater to be used (0.5 m^3/s or 18 cfs for the Cle Elum hatchery year-round and 0.06 m^3/s or 2 cfs for each of the three acclimation sites from January to May) and the inability to return the water directly to the aquifer. The water would, however, be discharged to a nearby stream or river after cycling through the facilities. Groundwater pumping is not expected to adversely affect other wells in the vicinity of the Cle Elum hatchery or the acclimation sites due to the small amount of water to be used. No impacts on groundwater would occur as a result of the No Action Alternative.

2.7.1.3 Floodplains and Wetlands

Alternatives 1 and 2 would result in moderate impacts on floodplains and wetlands due to placement of fill, because these areas could not be avoided totally in siting the facilities. Public ownership of the floodplains and wetlands on lands acquired for the project might result in their remaining in better condition over the long term than if they were to be developed under private ownership. In addition, the sites for the project facilities would be designed to minimize impacts, and wetland losses would be mitigated through the construction of replacement wetlands in accordance with local, state, and Federal policies. Wetland impacts at the Cle Elum hatchery site would total 0.1 ha (0.24 ac.); potential impacts at the Jack Creek, North Fork Teanaway, and Clark Flat acclimation sites would be even less. No impacts would be expected at the Easton, Keechelus, and Cle Elum acclimation sites. The No Action Alternative would not affect floodplains or wetlands.

2.7.2 Biological Resources

2.7.2.1 Aquatic Biological Resources

The highest potential impact, both positive and negative, of the proposed project under Alternatives 1 and 2 is on the aquatic biological resources of the Yakima River Basin. The project has a good potential for increasing knowledge about the use of supplementation and the adaptive management process, while increasing the number of upper Yakima spring chinook returning to the basin. It also has the potential to affect existing wild and native fish populations adversely through genetic and ecological interactions. The overall impacts on aquatic biological resources of Alternatives 1 and 2 were judged to be moderate, based on the commitment of the project managers to use the adaptive management process to learn from and continually adapt their actions to prevent or correct problems that arise. The impact of the No Action Alternative was also judged to be moderate in this case, given the potential to continue the declining anadromous fish population trends in the Yakima and Columbia River basins without the knowledge and results that could be gained from implementing Alternatives 1 or 2.

2.7.2.2 Vegetation

Impacts on vegetation from Alternatives 1 and 2 are expected to be low. A total of approximately 8 ha (20 ac.) of vegetation would be cleared for project facilities at four sites. None of the sites are located in rare or unique vegetative communities, and most have been previously disturbed. The No Action Alternative would not result in impacts on vegetation.

2.7.2.3 Wildlife

Impacts on wildlife that would result from the implementation of Alternatives 1 or 2 were judged to be moderate. Approximately 8 ha (20 ac.) of wildlife habitat would be permanently affected by the facilities. Wildlife would be temporarily displaced during construction, and, in some cases, would be permanently displaced by the facilities. A wildlife mitigation plan for both the YFP and for possible inclusion in the Columbia River Basin Fish and Wildlife Plan is being developed for the Cle Elum site in consultation with the WDFW and the YIN. No impacts on wildlife would result from the implementation of the No Action Alternative.

2.7.2.4 Special Status Species

Few impacts are expected on the listed threatened or endangered species in the vicinity of the project sites. It is unlikely that listed Snake River anadromous fish stocks would be found in the Yakima Basin or that Yakima fish would stray into the Snake River Basin. None of the sites contain suitable Northern spotted owl, grizzly bear, Peregrine falcon nesting, or marbled murrelet habitat. The project would increase prey available for bald eagles. However, bald eagles wintering at the Clark Flat site could be disturbed by increased human activity. Gray wolves have been reported in the vicinity of the Jack Creek, North Fork Teanaway, and Keechelus acclimation sites. Spotted owls nesting in the vicinity of the Jack Creek and North Fork Teanaway sites could be disturbed by construction noise. For these reasons, the impact was judged to be moderate. Consultation with the USFWS on ways to minimize these impacts would be completed prior to construction. Impacts on candidate and state-listed wildlife species are not anticipated. The status of petitioned species now under review by NMFS and USFWS (e.g. bull trout, steelhead) would be monitored and consultation would be initiated if they were listed. No impacts would result from the No Action Alternative.

2.7.3 Air Resources and Noise

Impacts on air resources and noise would be minor, and would be limited within the State guidelines. The majority of the impact would occur during construction from vehicle exhaust emissions, noise, and dust generation. No impacts would result from the No Action Alternative.

2.7.4 Socioeconomics

Impacts on socioeconomics would be beneficial but low. Employment and income would be expected to increase in the areas surrounding the project from expenditures of funds for construction, operation and maintenance, monitoring and evaluation, and harvest. A portion of the employment and income would economically benefit some individual members of the Yakama Indian Nation. Secondary effects from additional rounds of economic activity were included. The No Action Alternative would not result in these positive impacts on the economy.

2.7.5 Recreation and Visual

Alternatives 1 and 2 could potentially affect the resident trout fishery, both negatively and positively. Negative impacts could result from adverse ecological and genetic interactions, while positive impacts could result from the increased prey base that would be provided by juvenile chinook smolts. Visual resources would be altered by the construction of the facilities. Impacts on snowmobiling trails and parking facilities in the vicinity of the Jack Creek and North Fork Teanaway sites would occur; mitigation for these impacts has been developed in consultation with the Forest Service and snowmobile groups. Other recreational resources are not expected to be affected negatively, and the addition of interpretive facilities planned at the Cle Elum site would provide additional recreational resources. The overall impact was judged to be moderate due to visual impacts and potential impacts on the resident trout fishery. The No Action Alternative would result in neither positive nor negative impacts on these resources.

2.7.6 Cultural Resources

Little to no impacts on cultural resources would result from the implementation of Alternative 1, 2, or the No Action Alternative. Except for those carried out at Jack Creek and North Fork Teanaway, surveys at the proposed facility sites revealed no cultural resources that would be affected by construction. Because major cultural resources were found at the North Fork Teanaway site, it has been designated an alternate (rather than a preferred) site. The cultural resource impacts at the Jack Creek site would be mitigated through avoidance, if possible. If the site could not be avoided, BPA would initiate consultation with the State Historic Preservation Office (SHPO) and YIN, and develop an Historic Property Management Plan. If other cultural resources were discovered during construction, similar consultation would immediately be initiated.

2.7.7 Resource Management

About 8 ha (20 ac.) of land would be affected by the construction of facilities under Alternatives 1 and 2, but the facilities would be consistent with local and state land use policies in most cases. Most of the impact would result from the unavoidable siting of pumps and intake and outlet facilities in riparian and protected shoreline areas. Potentially prime farmland soils are found at the Clark Flat and Easton Dam sites, but the sites are not

irrigated or currently used for farming, other than grazing at the Clark Flat site. The project staff is consulting with Kittitas County agencies to ensure project consistency with County and State land use policies and regulations. A moderate amount of solid waste and small amounts of hazardous wastes would be generated at the facilities. No land use or waste generation impacts would result from the No Action Alternative.

3. AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the existing resources that may be affected by either of the alternatives for the proposed YFP. Siting and construction of the Cle Elum hatchery (Alternatives 1 and 2) was previously discussed in the original Environmental Assessment (BPA, 1990a); updated information is included in this EIS. Siting and construction of several alternative locations for the three preferred acclimation sites for upper Yakima spring chinook (Alternatives 1 and 2) are also addressed in this document.[4]

3.2 Water Resources

Surface water resources and their current uses are described below for the Yakima River and its tributaries. Both surface and ground water would be used for the Cle Elum hatchery facility and the acclimation sites. Unless otherwise noted, the information presented below was taken from the EA (BPA, 1990a).

3.2.1 Surface Water Resources

The Yakima River drains a 15,941-square-km (km^2) (6,155-square-mi (mi^2))basin in central Washington, flowing 436 km (217 mi.) from Keechelus Lake in the Cascade Mountains (elevation 746 meters(m) or 2,448 feet (ft.)) to the Columbia River near Richland (elevation 91.4 m or 300 ft.) (See Figure 2.4.) Yearly precipitation in the Yakima River Basin ranges from about 20 centimeters (cm) (8 inches (in.)) in the eastern lowlands to over 254 cm (100 in.) in the Cascade Mountains.

The river flows in a southeasterly direction through the Kittitas Valley from Cle Elum to Ellensburg. The river then turns south as it cuts a canyon through Manastash and Umtanum Ridges (Yakima Canyon). The river continues south past Roza Dam and Selah Gap to the City of Yakima. It then flows past Union Gap, Wapato Dam, and Sunnyside Dam and into the lower valley for the final 169 km (105 mi.) to the Columbia River. The river flows in a southeasterly to easterly direction in the lower valley and passes over the last two irrigation diversion dams at Prosser and Horn Rapids.

Major tributaries to the Yakima River include the Kachess, Cle Elum, Teanaway, and Naches rivers in the upper portion of the basin and Ahtanum, Toppenish, and Satus creeks in the lower portion. The Naches River is the largest tributary to the Yakima River. It

[4] As explained in Chapter 2, 3 of the 16 acclimation sites originally identified for upper Yakima spring chinook have been identified as preferred: the Easton Gravel Pond site, Jack Creek, and Clark Flat. However, three additional alternative acclimation sites (North Fork Teanaway, Keechelus Dam, and Cle Elum upper) are also discussed in this EIS.

extends about 72.4 km (45 mi.) from its confluence with the Yakima River near Yakima upstream to the Bumping River confluence; the Little Naches and Bumping Rivers combine to form the Naches River at this location.

Six storage reservoirs have been developed in the headwaters area of the Yakima River to supplement flows during the irrigation season (March to October). Keechelus, Kachess, and Cle Elum lakes flow into the Yakima River above Cle Elum. Bumping, Clear, and Rimrock lakes flow into tributaries of the Naches River.

3.2.1.1 Water Quantity

The average annual discharge from the Yakima River Basin is 3.54 cubic kilometers (km^3) (2.9 million acre-feet) of water. About 2.93 km^3 (2.4 million acre-feet) are diverted from the Yakima River for irrigation, of which approximately 1.83 km^3 (1.5 million acre-feet) return to the river from irrigation (U.S. Army Corps of Engineers, 1978). Smaller amounts are diverted for industrial and municipal use and hydroelectric power generation. Irrigation and other diversions have caused problems for Yakima River basin fish, as smaller tributary streams are dewatered during migration and/or spawning times.

Highest flows occur during periods of runoff in the late winter and spring throughout the Yakima Basin, with the possible exception of stream reaches directly below reservoirs. In years when the reservoirs do not fill and spill, the highest flows occur later in the summer during releases for irrigation. Lowest flows occur during late summer, fall, and winter. Typically, fluctuations in flow are large in winter, moderate in spring, and small in late summer. The average annual flow in cubic meters per second (m^3/s) or cubic feet per second (cfs), is as follows:

- 9.6 m^3/s (338 cfs) below Keechelus Lake;
- 57.8 m^3/s (2,040 cfs) at Cle Elum;
- 65 m^3/s(2,297 cfs) at Umtanum;
- 71.8 m^3/s (2,534 cfs) near Parker; and
- 111 m^3/s (3,921 cfs) at Kiona (U.S. Army Corps of Engineers (Corps), 1978).

Water Resources at Hatchery and Acclimation Sites

Simulated and gauged mean monthly discharges for rivers and creeks affected by the siting of the project facilities are shown below, in Table 3.1. The table indicates mean monthly discharge for the period of operation, or during the months of January through June for all of the facilities except the Cle Elum hatchery. The Cle Elum hatchery would operate year-round. Mean monthly discharges are shown for all months at this site. Other specific information on site-specific streamflow characteristics follows.

Table 3.1 Summary of Estimated Stream Flow for Surface Water Sources for Proposed and Alternate Yakima Fisheries Project Facilities, January through June

Site	Water Source	Requirement m^3/s	Average Monthly Flow Rates [m^3/s (cfs)]					
			January	February	March	April	May	June
Cle Elum Hatchery and acclimation site	Yakima River[1]	2.0 (72.1)[2] (hatchery) 0.24 (8.7) (acclimation site)[5]	21.2 (757)	20.9 (748)	23.9 (855)	33.2 (1184)	53.0 (1892)	80.9 (2890)
			July	**August**	**Sept.**	**October**	**Nov.**	**Dec.**
			98.8 (3530)	100.9 (3602)	31.4 (1120)	13.6 (486)	16.3 (583)	14.4 (516)
Easton acclimation site (both options)	Yakima River[1]	0.24 (8.7)	13.4 (477)	11.6 (414)	12.7 (453)	13.0 (464)	19.3 (691)	14.7 (526)
Jack Creek acclimation site	N.F. Teanaway[3]	0.24 (8.7)	2.5 (91)	1.8 (65)	2.2 (79)	4.2 (149)	6.1 (217)	5.3 (189)
North Fork Teanaway acclimation site	N.F. Teanaway	0.24 (8.7)	Flows not available. They would be slightly less than those for the Jack Creek site.					
Clark Flat acclimation site	Yakima River[4]	0.24 (8.7)	33.7 (1205)	33.3 (1191)	38.1 (1362)	58.5 (2090)	83.5 (2983)	84.6 (3020)
Keechelus acclimation site	Yakima River[1]	0.24 (8.7)	4.7 (169)	3.6 (129)	1.3 (47)	6.7 (240)	15.7 (562)	16.1 (576)

[1] Estimates based on stream gauge data.
[2] Reduced during periods of river flow less than 9.8 m^3/s (350 cfs).
[3] Estimates based on North Fork Rattlesnake Creek mean monthly flow data, extrapolated using USGS equation (1978).
[4] Estimates based on USBR hydrologic model.
[5] Cle Elum acclimation site would be operated during January-June only.

The Cle Elum hatchery site is located on the Yakima River upstream from the town of Cle Elum. The hatchery would operate year-round and would be supplied with a combination of surface and groundwater. The surface water requirement of 2.0 m^3/s (72.1 cfs) would be pumped from the Yakima River, run through the facility, and then returned to the river, along with the groundwater used in the facility. Monthly mean flows for the Yakima River at Cle Elum range from an average high of about 200 m^3/s (7,100 cfs) in June to an average low of 13 m^3/s (460 cfs) in October. The lowest monthly mean flows range between 8.5 and 9.9 m^3/s (300 and 350 cfs) during the driest years. Under current agreements for protection of fishery resources (the Quackenbush ruling; see discussion in Section 3.9.2.1), flow in the Yakima River at the Cle Elum hatchery site is maintained at

325 cfs (9.1 m^3/s) during the typical fall low-flow period. Extreme low flows, however, may be as low as the 5.3 m^3/s (190 cfs) observed in October 1994.

The acclimation sites would be supplied by a combination of surface water from adjacent tributaries and rivers and groundwater from nearby wells. All flows would be returned to the river. The water would be pumped to the raceways. Diversion of water from streams, at flow rates of 0.24 m^3/s (8.7 cfs) per site (serving all six raceways), would be scheduled to occur between January and May of each year. Flows in the affected creeks or rivers are normally high in April and May. Raceways are scheduled to be drained after the fish have been released by the end of May. These flows would be supplemented with 0.06 m^3/s (2 cfs) of groundwater from nearby wells.

- **Easton Acclimation Site (both siting options).** Six raceways would be located near the Yakima River downstream of the Easton Diversion Dam, just northwest of the town of Easton. Water would be pumped to the raceways from the Yakima River. Monthly mean flows below Easton Dam range from an average high of 70.4 m^3/s (2,485 cfs) in May to an average low of about 0.7 m^3/s (24 cfs) in November. However, the USBR now provides for minimum flows at Easton for spring chinook salmon spawning of 5.7 m^3/s (200 cfs) during September and minimum incubation flows of 4.2 m^3/s (150 cfs) during winter, in conformance with the Quackenbush Decision (USBR, 1990b).
- **Jack Creek and North Fork Teanaway (alternate) Acclimation Sites.** Six raceways would be located either along Jack Creek near its confluence with the North Fork of the Teanaway River, or approximately a mile upstream on a terrace above the North Fork Teanaway. The Teanaway River is the second largest tributary to the Yakima River and drains an area of about 518 km^2 (200 mi^2). Water would be pumped to the sites from the North Fork of the Teanaway River. Simulated monthly mean flows for the North Fork at the Jack Creek site during the proposed period of use range from an average high of 6.1 m^3/s (217 cfs) in May to an average low of 1.8 m^3/s (65 cfs) in February. Flows for the North Fork Teanaway site would be slightly less, since it is upstream of the confluence with Jungle Creek. Simulated monthly mean flows for the Teanaway River near the mouth range from an average high of 24.6 m^3/s (870 cfs) in May to an average low of 2.5 m^3/s (90 cfs) in August. Periods of no or very little flow are common near the mouth from July through October. Flows during the period August 2 through October 19, 1989, ranged from 0.3 to 0.5 m^3/s (10 to 19.2 cfs). Although the mouth is well downstream of the acclimation sites, upstream migration and spawning of spring chinook salmon could be affected by these low flows.
- **Clark Flat Acclimation Site.** Six raceways would be located on the banks of the Yakima River near Thorp. Yakima River flows in this vicinity are similar to those described for the Cle Elum site. Water would be pumped from the river to the raceways.
- **Cle Elum (alternate) Acclimation Site.** Six acclimation raceways would be located next to the proposed Cle Elum hatchery site upstream of the city of Cle

Elum on the Yakima River floodplain. Yakima River flows in this vicinity are similar to those described for the Cle Elum hatchery. Water would be pumped from the Yakima River to the raceways, using the same intake facilities as for the hatchery.

- **Keechelus (alternate) Site.** Six raceways would be located along the Yakima River downstream of Keechelus Dam. Either water would be pumped from the Yakima River to the site, or gravity flow directly from the dam might be explored. Mean monthly flows near Keechelus Dam have been measured as high as 46.2 m^3/s (1,630 cfs) in August. Simulated monthly mean flows at this location range from an average high of about 20.8 m^3/s (735 cfs) in August to an average low flow of about 1.8 m^3/s (65 cfs) in March. However, low flows of about 0.08 m^3/s (3 cfs), largely from seepage, have occurred from October through April when releases from Keechelus Dam have been stopped after the irrigation season to allow the reservoir to refill.

3.2.1.2 Water Quality

Parameters affecting both aquatic life and human health can be analyzed to determine water quality conditions. The Washington Department of Ecology (WDOE) has defined water quality criteria for all surface waters in the State of Washington (WDOE, 1988). Criteria are defined for temperature, pH, turbidity, fecal coliform bacteria, dissolved oxygen, and toxicants (ammonia and selected metal and organic constituents). The criteria for some of these parameters depend on how a water body is classified. All waters are classified as fresh or marine, and as Class AA (extraordinary), Class A (excellent), Class B (good), Class C (fair), or Lake Class.

Most of the Yakima River and its tributaries are classified as Class A. The Yakima River above the Cle Elum River is classified as Class AA. The Naches River above River Mile 35.7 and the Tieton River are also classified as Class AA. Water quality problems in the Yakima River basin are largely restricted to the lower 40 percent of the river, roughly from Sunnyside Dam to the confluence with the Columbia River (BPA, 1990a).

Water temperature is critical to the survival of many aquatic organisms, especially fish. High water temperatures limit the amount of dissolved oxygen that can be carried in the water, and a low concentration of dissolved oxygen (less than 4 milligrams per liter (mg/L)) has an adverse effect on aquatic life. Water temperatures in most of the Class A segments of the Yakima River rarely exceed 21°C (70°F); the Class AA segments rarely exceed 16°C (61°F). However, summer temperatures at Prosser and Kiona (on the lower river, through which the anadromous fish must pass on their way down from the supplementation areas) frequently exceed 24°C (75°F); 90% mortality of some fish species can occur at temperatures above 21°C (70°F) (WDF/WDW, 1991). Water temperatures are affected by the operation of water storage reservoirs in the upper portions of the Yakima River basin and by irrigation diversions. Diverting and reserving water for storage reduce the amounts of water flowing downstream; the resulting reduced amounts of instream water heat up more quickly.

Spring chinook smolt outmigration occurs at Prosser from late March through early June, with the average date of 50% passage on April 22. Steelhead smolt outmigration ranges from early March through mid-June, with the date of average 50% passage on April 30. Fall chinook smolts migrate from mid-April through early July, with the average date of 50% passage on May 31. The average monthly temperature at Prosser, as well as the monthly maximum and minimum temperatures, are as follows:

- March average of 7.7 C (45.9 F), with a maximum of 12.7 C (54.9 F) and minimum of 2.0 C (35.6 F);
- April average of 11.8 C (53.2 F), with a maximum of 17.6 C (63.7 F) and minimum of 8.1 C (46.6 F);
- May average of 15.9 C (60.6 F), with a maximum of 21.8 C (71.2 F) and minimum of 11.2 C (52.2 F);
- June average of 19.2 C (66.6 F), with a maximum of 26.7 C (80.0 F) and minimum of 13.9 C (57.1 F); and
- July average of 22.2 C (71.9 F), with a maximum of 26.8 C (80.2 F) and minimum of 17.3 C (63.1 F).

The estimated mean monthly temperatures at Richland in the lower river were 18.0 C (64.5 F) for May, 21.0 C (69.8 F) for June, and 24.5 C (76.1 F) in July.

The dissolved oxygen level of the Class A segment of the Yakima River is at least 8.0 mg/L during normal daylight hours. Data reported for bimonthly sampling at Union Gap (above Ahtanum Creek) and at Kiona from 1980 to 1985 show that dissolved oxygen exceeded 8.5 mg/L on every occasion. However, dissolved oxygen problems have been observed during summer evening hours in the lower Yakima River. A 24-hour sampling in August 1973 identified dissolved oxygen concentrations as low as 4.2 mg/L in the river downstream from Mabton. A minimum value of 4.0 mg/l dissolved oxygen is recommended for fish by the National Academy of Sciences (NAS 1973), based on evidence of subacute or chronic damage to several types of fish below this concentration.

Extremes in pH have an adverse effect on aquatic life. Values for pH (hydrogen ion concentration in water) in surface waters generally range from about 6 to 9. The pH of the Yakima River is typically between 7 and 8, but exceeds 8.5 on rare occasions. A pH range of 6.0 to 9.0 appears to provide complete protection for the life of freshwater fish species and bottom-dwelling invertebrate fish food organisms, provided that those cations and anions with a pH-dependent toxicity are absent in concentrations that might be lethal (Thurston et al., 1979)

Turbidity is a measure of suspended matter that interferes with the passage of light. (The direct effect of suspended matter on aquatic life is noted below, under the discussion of solids.) Light interference elevates water temperatures and decreases plant growth by absorbing radiant energy. The turbidity criterion for Class AA and Class A fresh waters is

not to exceed 5 nephelometric turbidity units (NTU) over background when the background turbidity is 50 NTU or less. The background turbidity in the Yakima River is less than 50 NTU. Bimonthly measurements in the Yakima River from 1980 to 1985 showed that total turbidity averaged 6.1 NTU (0.7- to 35-NTU range) at Union Gap and 8.5 NTU (2– to 48-NTU range) at Kiona. Measurements taken at 12 stations in the Yakima River from April to October 1974 showed a trend of increased turbidity at successive downstream stations. Average values ranged from a low of 2 NTU at Cle Elum to a high of 17 NTU at Kiona. Turbidity increases downstream of Union Gap as irrigation returns enter the Yakima River.

Total suspended solids (TSS) include all materials (sand, silt, clay, and organic material) held in temporary suspension in the water. Suspended solids have an adverse effect on fish health and plant productivity. Also, these solids settle out in calm water and adversely affect aquatic life by smothering bottom organisms. For these reasons, guidelines have been recommended: maximum levels of 25, 80, and 400 mg/L offer a high, moderate, and low level of protection for aquatic communities, respectively (Corps, 1978). Based on these guidelines, average TSS concentrations in the Yakima River at Union Gap offer a low to moderate level of protection from May through November and a moderate to high level of protection from January through March. Thus, aquatic life in the Yakima River is most likely to be affected by TSS during the winter and early spring.

Nutrients feed the growth of aquatic plants and microbes (algae and bacteria). Excessive nutrient concentrations lead to excessive plant growth. Such growth contributes to depressed oxygen levels from plant respiration and decomposition, and presents an esthetically unpleasant appearance. The principal nutrients that control plant growth are nitrogen and phosphorus. Critical thresholds for these two nutrients are 1 to 2 mg/L nitrate nitrogen (Rinella et al., 1992) and 0.1 mg/L total phosphorus (USEPA, 1986; Rinella et al., 1992) to avoid excessive growth. Bimonthly average nutrient concentrations at Union Gap range from 0.12 to 0.36 mg/L for nitrate-nitrogen and from 0.067 to 0.113 mg/L for total phosphorus. Nitrate levels downstream at Kiona are about five times higher than those at Union Gap during the irrigation season, presumably from fertilizers in irrigation-return water.

Yakima River Basin fish populations are potentially affected by historical use of chlorinated pesticides leaching from soil. Total concentrations of dichlorodiphenyltrichloroethane (DDT) in four of the mid-watershed tributaries (Birchfield Drain, Granger Drain, Sulphur Creek, and Spring/Snipes Creek) have high enough concentrations to cause a chronic response in resident fish populations, although reproduction does not appear to be affected. Resident fish are more likely to be affected than anadromous fish because of their feeding habits and long exposure time.

3.2.2 Groundwater Resources

Shallow unconfined groundwater is generally found next to rivers and streams in the Yakima River Basin. Groundwater sources include rainfall, snowmelt, and irrigation

water that infiltrates porous surface soils. The ready infiltration and groundwater recharge make the shallow groundwater susceptible to pollution from the application of pesticides and fertilizers to the land surface, as well as from animal and human wastes.

Deeper and/or confined groundwater is generally derived from rainfall and snowmelt in the higher elevation areas surrounding the watershed. Such groundwater is likely to be less affected by pollution from lowland agriculture and industry because it is not hydraulically connected to surface sources.

Typically, shallow unconfined groundwater is hydraulically connected to the surface waters. At higher elevations and in the upper parts of the watersheds, the rivers and streams may be maintained by discharge from groundwater. In the lower reaches of the rivers and streams, and from behind dams and other surface water impoundments, water may flow into and recharge the groundwater.

Groundwater resources are described below in the area of the Cle Elum hatchery, which would require a year-round source of 0.5 m^3/s (18 cfs) of groundwater from a proposed well field. Water withdrawn from wells at the site would be returned to surface waters through the hatchery outflow.

Surface material at the site consists of about 4.6 m (15 ft.) of Quaternary alluvium and glacial outwash. The surface material is underlaid by a dense clay unit that acts as a confining layer for a confined (artesian) sand and gravel aquifer below. Bedrock consists of sedimentary rocks of the Roslyn Formation.

The USBR investigated the site area in 1989 with a six-line resistivity study to aid in delineating potential locations for water supply wells (USBR, 1990a). Four potential drilling sites were selected, and one observation and one production well were drilled. A flowing artesian aquifer was found at approximately 32.6 m (107 ft.) below the land surface, and aquifer tests indicated that the production well could yield about 0.03 to 0.04 m^3/s (1.3 to 1.5 cfs) for sustained periods of time, based on a maximum pumping rate of 3028 liters per minute (800 gallons per minute) during the test.

CH_2M Hill conducted additional groundwater investigations at the Cle Elum site in 1991, including three seismic refraction line tests to estimate depth and configuration of the bedrock at the site (USDOE, 1991). Based on results from the seismic study and USBR results, CH_2M Hill drilled a 40.6-cm (16-in.) test/production well to a depth of 65 m (213 ft.). The well encountered flowing artesian groundwater at a depth of 34.4 m (113 ft.) in the sand and gravel aquifer, which continued to a depth of 57.6 m (189 ft.).

Aquifer pumping tests were performed at pumping rates up to 5678 liters per minute (lpm) or 1,500 gallons per minutes (gpm) to determine aquifer parameters. Analysis of test data indicated that the well could be expected to sustain a yield of up to 0.09 m^3/s (3.3 cfs). Temperature and test data also suggested that the aquifer is effectively isolated from the

Yakima River by the clay layer, and that there is insignificant leakage (recharge) at the site from the river to the aquifer.

Based on their results, CH_2M Hill recommended installation of four additional 40.6-cm-diameter (16-in-diameter) wells located in a line along the Burlington Northern Railroad right-of-way, each pumped at 0.09 m^3/s (3.3 cfs). These wells, plus two existing USBR production wells, would supply the groundwater requirements for the Cle Elum hatchery. Groundwater resources at the acclimation sites have not yet been investigated. However, due to the small amounts of water (0.06 m^3/s or 2 cfs) necessary and the limited period of use (January to May), neither groundwater depletion nor maintenance of sufficient flows is anticipated to be a problem at these sites.

3.2.3 Floodplains and Wetlands

The proposed YFP facility sites were selected to minimize floodplain impacts. Detailed floodplain studies have been completed for the Cle Elum hatchery facilities; they would be outside the floodway of the Yakima River. The river pump station at Cle Elum, however, would be located at the edge of the floodway, and portions of the facilities would be located in the 100-year floodplain, as designated by Federal Emergency Management Agency flood hazard mapping. All buildings, however, would be constructed above the 100-year flood level.

Although detailed flood studies have not been completed at the acclimation sites, these sites were selected to minimize flood impacts. Preliminary studies were conducted and the facilities were sited by experienced floodplain hydrologists. Detailed floodplain studies would be completed, as necessary, during final design of the facilities.

Based on National Wetland Inventory maps, a variety of wetlands has been identified in the vicinity of the Cle Elum Hatchery and of several of the proposed and alternative acclimation sites (Table 3.2). However, the National Wetland Inventory maps indicate only general habitat types; verification requires a quantitative evaluation (called a *delineation*) of wetland habitats. Qualitative habitat surveys were conducted by the Pacific Northwest Laboratory in fall 1991, spring 1992, and summer 1994 at each of the planned and alternative acclimation sites. Based on the field reconnaissance, wetland habitat potentially affected by planned YFP facilities was identified, and recommendations were made to relocate facilities or acclimation sites. Additionally, a wetland delineation was completed for the Cle Elum hatchery site facilities by CH_2M Hill in 1994.

Table 3.2 Wetland Designations of Planned and Alternative YFP Site Locations Based on National Wetland Inventory Maps.

Facility/Location	Wetland Designation
Cle Elum hatchery site	palustrine emergent seasonally flooded/well drained
Cle Elum acclimation site	no wetlands designated on site
Easton acclimation sites	
Easton gravel pond site option	no wetlands designated on site
Easton Dam site option	no wetlands designated on site
Jack Creek acclimation site	riverine upper perennial open water permanently flooded
N.F. Teanaway site	no wetlands designated on site
Clark Flat acclimation site	palustrine forested seasonally flooded
Keechelus acclimation site	no wetlands designated on site

- **Cle Elum Hatchery Site.** Wetlands in the area consist of the oxbow ponds and excavated depressions that are intermittently surrounded by sedges, cattails, rushes, alder, bitter cherry, chokecherry, black cottonwood, red osier dogwood, wild rose, snowberry, black hawthorn, and blue elderberry.[5] The proposed facility site was located to minimize losses to any wetlands in the area. It is on a terrace above the oxbow ponds, in an area that has previously been disturbed. A fringe of riparian wetland occurs at the site of the proposed discharge from the lower oxbow pond.
- **Cle Elum Acclimation (alternate) Site.** No wetlands were identified at the acclimation site.
- **Easton Acclimation Sites - Easton gravel pond site option.** Quarry ponds are located slightly north of the site and an emergent marsh south of the site; however, there are no wetland habitats on the site.
- **Easton Acclimation Sites - Easton dam site option.** No wetlands were identified at the site.
- **Jack Creek Acclimation Site.** The Jack Creek site is located next to the riparian habitat along Jack Creek, in an open field. The site is located in the floodplain that constitutes the only potential wetland habitat. Vegetation includes primarily cottonwood and willow.
- **North Fork Teanaway Acclimation (alternate) Site.** The site is divided between an upper and lower terrace. The lower terrace is located in the floodplain and potentially contains wetland habitat. The upper terrace is out of the floodplain and does not appear to contain wetland habitat.
- **Clark Flat Acclimation Site.** The area adjoining the river at the site is designated palustrine by the National Wetlands Inventory and the WDFW Priority Habitats

[5] Scientific names for all mentioned species are found in **Appendix C.**

System Database (WDFW, 1994). This riparian area adjacent to the river supports willows and mature cottonwoods.

- **Keechelus Acclimation (alternate) Site.** Although the site itself is not located within a designated wetland, the surrounding area includes a wetland complex associated with Keechelus Marsh (WDFW, 1994).

3.3. Biological Resources: Aquatic

Supplementing the populations of upper Yakima spring chinook salmon in the Yakima River Basin may affect other aquatic resources. Descriptions of the fisheries and other aquatic resources that may be affected by the YFP are provided below. Resident trout resources are described in Section 3.3.1.7, and the resident trout fishery is described separately, in Section 3.7.1, to facilitate discussion of specific concerns raised during the YKFP scoping process.

3.3.1 Fisheries Resources

Around the middle of the 19th century, numbers of anadromous fish in the Yakima River were estimated to have ranged from 600,000 to 960,000 annually (Bryant and Parkhurst, 1950; USBR and USFWS, 1976; YIN et al., 1990). The Yakima River contained spring, summer, and fall chinook salmon; sockeye salmon; coho salmon; and summer steelhead. Wild sockeye and coho salmon are now extinct; the handful of sockeye and coho salmon now present in the Yakima River Basin are the result of strays from other Columbia River watersheds or hatchery plants of nonlocal fish into the Yakima River. They have not established naturalized populations in the Yakima River. Summer chinook are believed to be extinct, but this has not been confirmed. Spring and fall chinook salmon and summer steelhead are present, but at a fraction of their original numbers. The 1989-1994 5-year mean annual return of salmon and steelhead to the Yakima River system is approximately 5,100 adults. Species of concern are discussed below.

3.3.1.1 Spring Chinook Salmon

Spring chinook salmon are prized as sportfish and for commercial, ceremonial, and subsistence fishing. Spring chinook salmon historically comprised one of the largest anadromous fish runs in the Yakima River Basin. Smoker (1956) estimated that spring chinook salmon production from the Yakima River alone accounted for about 13.8 percent of the total Columbia River spring chinook salmon run in the early 1950's. The historical size of the spring chinook salmon run has been estimated at about 200,000 fish per year (YIN et al., 1990). Since 1957, however, annual returns of spring chinook salmon to the Yakima River have ranged from 166 to 9,442 fish, with the 1990-94 average at 2,941 fish (Fast, per. comm., 1994).

The capacity of the Yakima River to support spring chinook salmon smolts has been estimated using two computer models: the Council's model and the instream flow

incremental methodology (flow model). The estimated smolt capacity for the Yakima basin, as derived from the Council's model, ranges from 2.4 million for current production areas and present conditions to 3.8 million, including all potential habitat with all habitat improvements. The flow model predicts the smolt capacity at 1.5 million under current conditions.

Based on 2 years of extensive genetic analysis by WDFW (Busack et al., 1991), there appear to be three genetically distinct substocks of spring chinook salmon in the Yakima River Basin: the American River, Naches River, and upper Yakima stocks. These stock distinctions are based on differences in electrophoretic data, age composition, and observations of spawning timing between 1989 and 1993.

Adult spring chinook salmon begin migrating upstream past Prosser Dam in late April and have completed passage by late July. Spring chinook salmon begin spawning in the American River in late July, and the other Naches populations spawn about 4 weeks later. Upper Yakima River populations spawn in early-to-mid September and usually reach peak spawning by late September. American River and Naches populations reach peak spawning by mid-August and mid-September, respectively. All spring chinook salmon populations have completed spawning by mid-October. American River spring chinook salmon return primarily as 5-year old fish, while adults destined for the upper mainstem of the Yakima River are generally 4 years old.

Historical and current distribution of Yakima spring chinook salmon are illustrated in Figure 3.1. The historical spawning areas for Yakima spring chinook salmon include the Yakima River upstream from the City of Ellensburg, the Naches River, the Cle Elum River (upstream and downstream from Lake Cle Elum), the Tieton River (north and south forks), Rattlesnake Creek, and the Bumping, Little Naches, Teanaway, and American rivers. Other areas that may have been important are the Cooper and Waptus rivers and Naneum, Wilson, Taneum, Swauk, Manastash, Wenas, Cowiche, Ahtanum (plus tributaries), and Logy creeks.

Spring chinook salmon currently spawn in the Yakima River upstream from the city of Ellensburg and immediately downstream to Roza Dam; the Cle Elum River downstream from Lake Cle Elum; the mainstem Naches, Bumping, Little Naches, and American rivers; and Rattlesnake Creek.

Spring chinook fry emerge from the gravel from late March through early June. The juveniles rear in the Yakima for 1 year before outmigrating to the ocean. The smolt outmigration occurs from late March through early June at Prosser. The average date at which 50% of the smolts have migrated past Prosser is April 30. Adults can return from the ocean after 1, 2, 3, or 4 years, with the Upper Yakima stock generally 2-year ocean fish and the American River stock mostly 3-year ocean fish.

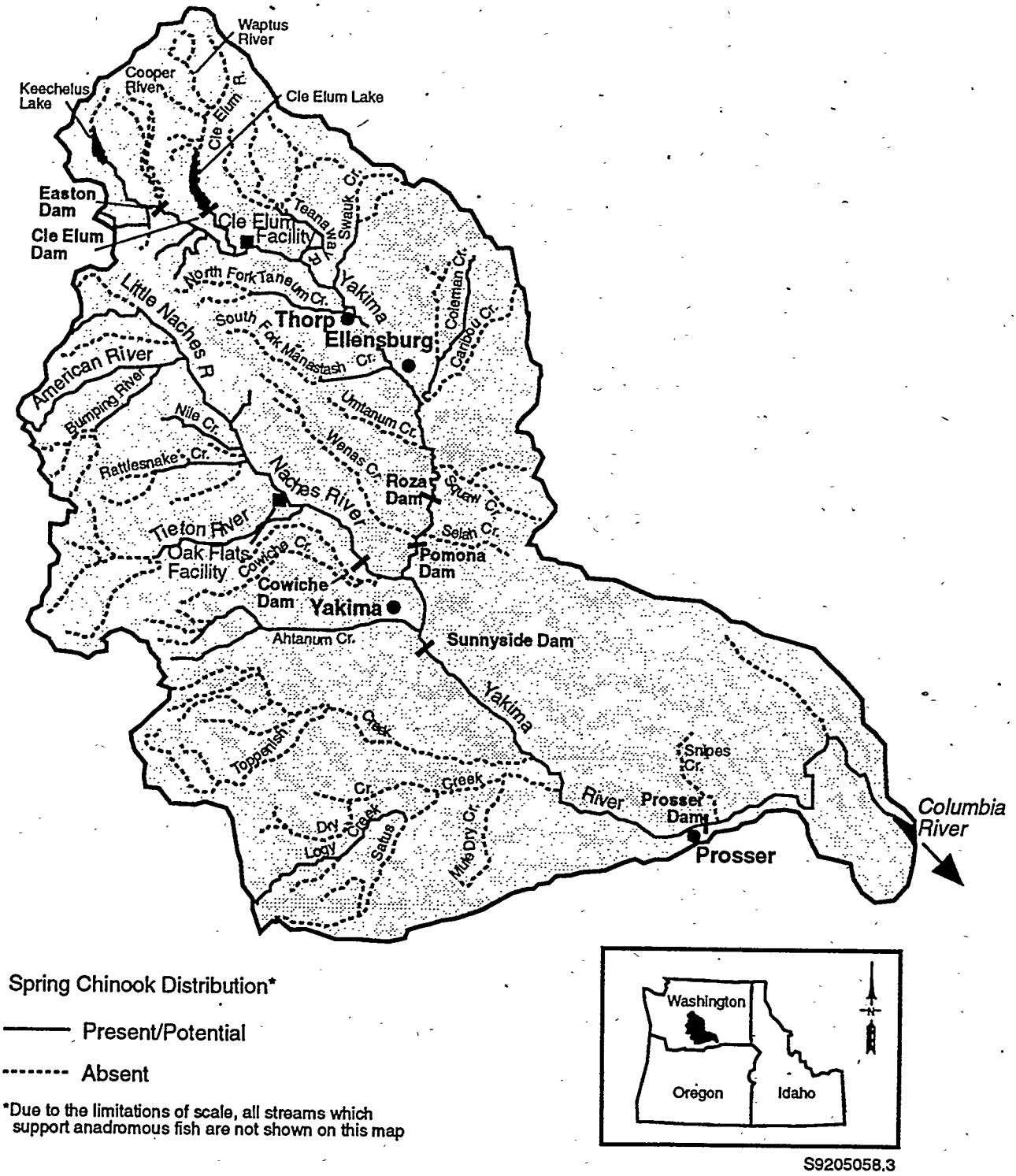


Figure 3.1 Historical Distribution of Yakima Spring Chinook Salmon.

Causes for Decline

About 90 percent of the fisheries for all anadromous salmonids was lost between 1850 and 1900. A portion of this decline was attributable to lower Columbia River fisheries. The in-basin causes of this decline include:

1) construction of unladdered irrigation dams (especially Pomona Dam around 1880 and Sunnyside Dam in 1893) that completely blocked adult migration during part of their run;
2) entrainment of fry and smolts in unscreened diversion canals (few of which were screened before 1934);
3) periodic destruction of spawning beds by downriver log drives that forced large volumes of water to be released from dams like the one at Pomona;
4) intensive local fishing;
5) irrigation activities;
6) elimination of braids and natural floodways by diking and channelization; and
7) drastic reduction in the number of beavers and beaver ponds, and the resultant loss of natural water storage and rearing habitat (Davidson, 1953).

Constraints on Natural Production

Spring chinook salmon production in the Yakima River Basin is limited by both too-high and too-low instream flows at the wrong times of the year, lack of passage around irrigation diversions in tributaries, degraded riparian and instream habitat, and low oxygen levels from excessive water temperatures in the lower basin.

3.3.1.2 Summer Chinook Salmon

Little is known about the historical Yakima River summer chinook salmon population levels. Recent estimates for the historical run size, however, place the combined salmon run of fall and summer chinook salmon at up to 250,000 fish. Natural production might result in a run of around 10,000 summer chinook salmon adults, estimated using parameters for the Wenatchee River stock (YIN et al., 1990).

In the Wenatchee River, adults ascend to the middle and upper reaches of the river during summer and early fall. Spawning occurs in late September and early October (WDF/WDW, 1990). Juveniles emerge from mid-February through mid-April, rearing as they migrate through the Wenatchee and Columbia rivers. Peak outmigration occurs in June and July, with migrants continuing to pass mainstem dams through August.

Historic spawning and rearing areas for summer chinook salmon are believed to have been in the middle reaches from Sunnyside Dam to Roza Dam on the Yakima River and in the lower Naches River from the mouth to the Tieton River. The last summer chinook spawning nest (redd) was recorded in 1970, and summer chinook salmon may now be extinct in the Yakima River.

Causes for Decline

The in-basin causes for historic decline include construction of unladdered dams, entrainment of juveniles in unscreened diversion canals, log driving and sudden releases of water, intensive local fishing, diking and channelization, and loss of natural water storage and rearing habitat. Additionally, irrigation withdrawals resulted in low flows and high water temperatures in July and August, the period during which summer chinook salmon adults would normally migrate in the mainstem.

Constraints on Natural Production

Factors limiting natural production of summer chinook salmon in the Yakima River are high water temperatures, low flows, predation, and poor water quality downstream of Sunnyside Dam during July and August. The water temperature and flows in the lower river are affected by slow-movement and shallow-water exposure to sunlight, as well as by warm silt-laden irrigation returns. Flow subordination from power plants would likely provide improved passage. Likelihood of improvements to water temperature in the middle and lower river is considered "slight" (USBR/WDOE, 1987).

3.3.1.3 Fall Chinook Salmon

Fall chinook salmon were fairly abundant in the Yakima River Basin. Historical production of fall chinook salmon may have been as high as 250,000 adult fish (YIN et al., 1990). Little is known about the historical distribution of fall chinook salmon within the Yakima River, although the production area is believed to have been confined to the area between the Sunnyside Dam and the Columbia River confluence (Fast et al., 1990). There are no data describing the historical run timing, age composition, sex ratio, size-at-age, fecundity, or population structure of Yakima fall chinook salmon.

Data suggest the portion of the Yakima fall chinook salmon run that spawns upstream from Prosser Dam averages approximately 853 fish (based on counts at Prosser Dam from 1983 to 1992). Some of these fish likely originated in the Marion Drain, a 27.4-km (17-mi.) canal carrying irrigation return water, located 58 km (36 mi.) upstream from Prosser Dam. Significant spawning also occurs downstream from Prosser Dam. Fall chinook juveniles rear for several months in the Yakima Basin and migrate past Prosser from mid-April through early July, with the average date of May 31 for 50% passage of smolts at Prosser.

Based on adult counts at Prosser Dam, the upper river run begins around the second week in September, peaks after mid-October, and is completed by the third week of November.

The movement of spawners into the Marion Drain may be triggered by water surges associated with shutting down the irrigation diversion to Satus Ridge and raising of the Marion Drain control gate.

The Preliminary Design Report for the project (BPA, 1990b) assumed a single fall chinook salmon population with the life history traits identical to those of Hanford Reach fall chinook salmon (Howell et al., 1985). A reevaluation of this assumption reveals uncertainty regarding the actual adult age structure and sex ratio of mainstem Yakima fall chinook salmon. The uncertainty is due to 1) problems associated with locating and sampling adults in a large turbid river system such as the lower Yakima River, and 2) biases inherent in spawning ground sampling methods (Peterson, 1954; Clutter and Whitesel, 1956; Eames and Hino, 1981; Eames et al., 1981).

New genetic information about the Marion Drain stock (Busack et al., 1991) suggests that two populations of fall chinook salmon occur in the Yakima River Basin. *The larger population* is found in the mainstem Yakima River, with the highest concentrations downstream from Benton City. The lower mainstem fish may represent approximately 70% of the total spawning population in the Yakima River, although there are no accurate census data for mainstem spawners downstream from Prosser Dam. The mainstem fish are genetically indistinguishable from fall chinook salmon found in the Hanford Reach area of the mainstem Columbia River and associated hatchery stocks (commonly referred to as upriver brights). *The second population* (Marion Drain) is genetically different from the mainstem Yakima River population, and is similar to fall chinook salmon populations found in the Snake (Lyons Ferry Hatchery) and Deschutes rivers. The Marion Drain population may represent original Yakima fall chinook salmon; the mainstem population is composed of a mix of original Yakima fall chinook salmon hybridized with hatchery releases of Hanford Reach/Priest Rapids-type fish (including Umatilla strays).

As discussed in Section 1.4, under the CRFMP of *U.S. v. Oregon*, the YIN's current fall chinook program in the Yakima River Basin includes the production and release into the Yakima of 1.7 million smolts from the Little White Salmon National Hatchery. Between 1983 and 1994, the smolts were transported and directly released into the Yakima River. With funds provided under the Mitchell Act program, the YIN has developed acclimation facilities in the vicinity of Prosser Dam for final rearing and release of these fall chinook smolts; they began operation in 1994.

Causes for Decline

The in-basin causes for decline of Yakima fall chinook salmon are high smolt and presmolt mortality from predation, sedimentation of spawning substrate, degraded water quality in the lower river, irrigation activities, and losses at lower Yakima River dams.

Preterminal harvests have had some impact on fall chinook salmon production. Exploitation rates of 48% have been estimated for the lower Columbia River (below

Bonneville Dam), Alaska, and ocean fisheries for the period 1984-1993. However, there has been no significant in-river Yakima fall chinook salmon fishery for at least 40 years.

Constraints on Natural Production

Factors limiting fall chinook salmon production within the Yakima River Basin may include smolt and presmolt mortality due to sedimentation in spawning areas downstream of Sunnyside Dam, and water quality and high temperatures in the lower Yakima River.

3.3.1.4 Coho Salmon

Indigenous natural coho salmon no longer occur in the Yakima River Basin. The only natural spawning now occurring is thought to be the result of hatchery fish outplantings in the basin or strays from hatchery releases outside of the Yakima basin. Mullan (1984) estimates that coho salmon comprised 19 percent of the total salmon runs upstream of Roza Dam between 1949 and 1967. This run of coho salmon may have numbered 114,000 fish annually. Unfortunately, there are no historical data on age composition, size at age, or stock structure of Yakima River coho salmon.

In recent years, 700,000 coho salmon smolts have been released into the Yakima River Basin annually as part of the *U.S. v. Oregon* CRFMP. In 1995, approximately 600,000 pre-smolts surplus to lower Columbia River production needs were also released into the Yakima Basin by the YIN under the CRFMP. These releases were intended to promote and diversify local fishing opportunities for the YIN. The program uses early-run fish from lower Columbia River hatcheries (mainly Cascade Hatchery), and has produced very few returning adults. The average number of coho observed at Prosser Dam from 1989 to 1992 was 140. However, as discussed in Section 1.4, the YIN initiated a program in 1994 to acclimate these fish in ponds near Wapato.

Coho salmon spawn in late October to November. Columbia River coho salmon typically spend 1 year in freshwater before outmigrating as yearling smolts in the spring (April-May). After outmigrating, coho salmon spend about 18 months at sea before returning to spawn. Sexually precocious males (jacks) return to spawn after 6 months at sea.

The historical distribution of coho in the Yakima basin is shown in Figure 3.2. The historical mainstem production areas for Yakima coho salmon were probably restricted to the reaches upstream of the mouth of the Teanaway River. Virtually all major upper Yakima River tributaries (Teanaway River and Taneum, Manastash, Swauk, Big, and Umtanum creeks) supported coho salmon. The Naches River and tributaries upstream from the Tieton River also produced substantial numbers of coho salmon. Lower production has been reported in the upper Tieton River (upstream from Rimrock Lake), the upper Cle Elum River and its tributaries (upstream from Cle Elum Dam), and Ahtanum and Logy creeks (Bryant and Parkhurst, 1950; Smoker, 1956; Anonymous, 1967; Mongillo and Falconer, 1980).

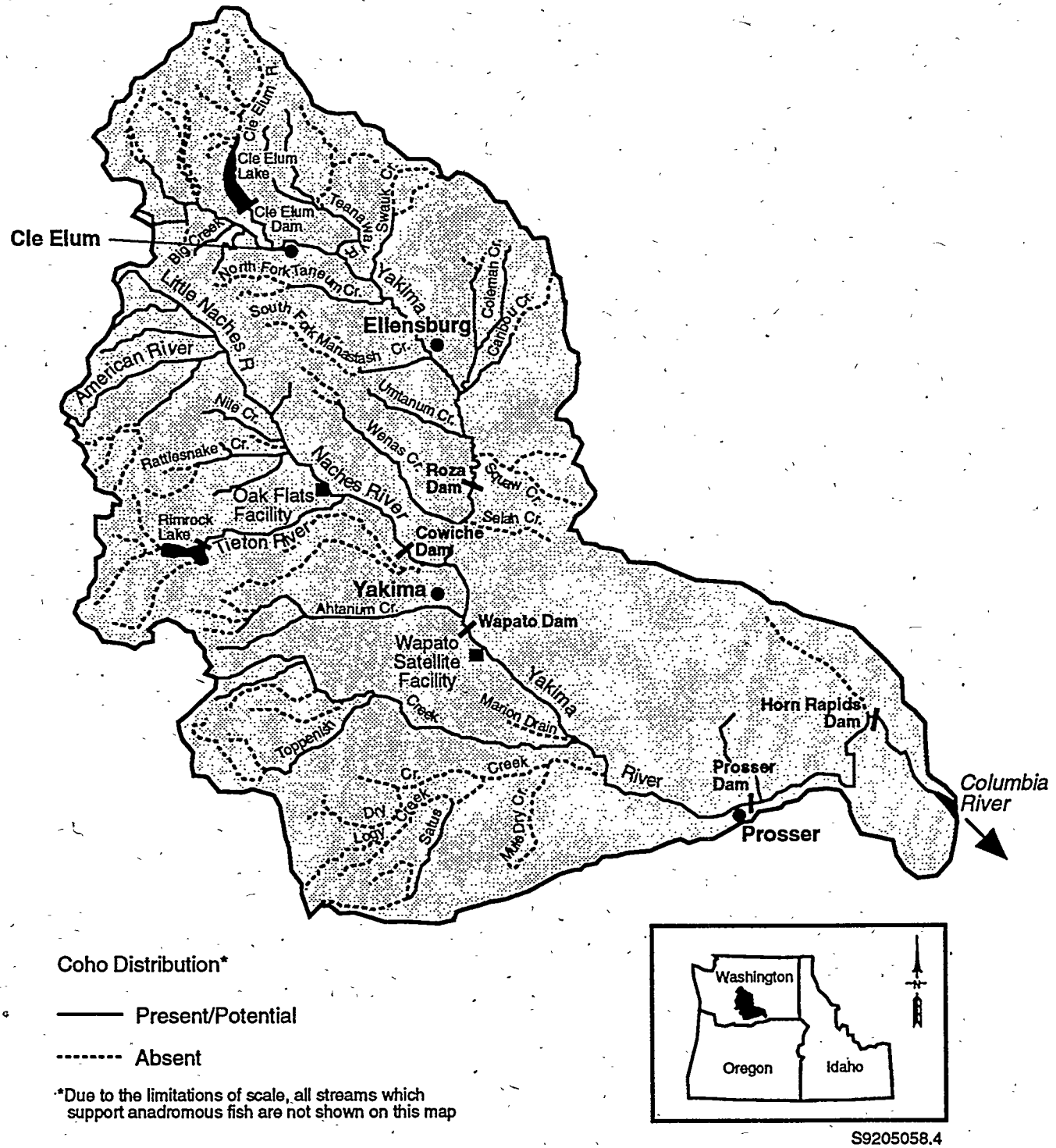


Figure 3.2 Historical Distribution of Yakima Coho Salmon.

Causes for Decline

The in-basin causes for decline include construction of unladdered dams, entrainment of juveniles in unscreened diversion canals, sudden releases of water for log driving, irrigation activities, intensive local fishing, diking and channelization, and loss of natural water storage and rearing habitat. Factors outside the basin included the advent of the major dams on the mainstem Columbia and the steady increase in fishing effort in the ocean and lower mainstem Columbia.

Constraints on Natural Production

Factors limiting natural production of coho salmon in the basin are lower mainstem Columbia River and ocean harvest rates and smolt mortality within the mainstem Yakima River. An issue that affects the mitigation strategy for coho salmon is a limited amount of tributary spawning and rearing habitat, and water limitations imposed by existing uses.

3.3.1.5 Sockeye Salmon

The once-abundant Yakima River sockeye salmon is extinct. The sockeye run contributed significantly to the Columbia River fishery at the turn of the century. Before dam construction, four sockeye nursery lakes were accessible to sockeye salmon: the 502-ha (1,240-ac.) Keechelus Lake (blocked 1904), the 1110-ha (2,744-ac.) Kachess Lake (blocked 1904), the 802-ha (1,982-ac.) Cle Elum Lake (blocked 1909/1910), and the 255-ha (631-ac.) Bumping Lake (blocked 1910). Sockeye salmon juveniles used Bumping, Cle Elum, Kachess, and Keechelus Lakes for fresh-water rearing. Spawning areas were probably located above these lakes. Based on the historic nursery area of the Yakima River Basin, and using a mean productivity rate of sockeye salmon in Lake Wenatchee of 38.8 adults per ha (15.7 adults per ac.) (Mullan, 1986) and an upward adjustment of the Wenatchee production rate (to account for losses at mainstem dams that did not occur historically), the historical annual Yakima River sockeye salmon run is estimated to have been approximately 200,000 adult fish (Robison, 1957; YIN et al., 1990).

The sockeye salmon run was eliminated so long ago that accurate details of sockeye salmon life history in the Yakima River Basin are unknown. In the Wenatchee River, sockeye salmon adults migrate into the river from July through September, with spawning occurring from the middle of October to the end of November in tributaries to Lake Wenatchee. Eggs incubate until the end of February, with emergence occurring in March through May. If hatched in lake tributaries, newly emerged fry migrate downstream into the lake where they rear for 1 to 2 years. Smolt migration usually occurs between May and June of the following year.

Causes for Decline

Habitat destruction and overfishing drastically reduced run abundance before the early 1900's. Sockeye salmon runs were eliminated from upper reaches of the Yakima River

Basin with development of irrigation storage reservoirs in the early 1900's. Since 1986, the NMFS has been conducting a feasibility study to determine whether introduced sockeye salmon could successfully outmigrate from Cle Elum Lake and the Yakima River system (Flagg et al., 1988, 1989). A final report on the study is anticipated to be completed in early 1996.

Constraints on Natural Production

The one major constraint to natural production of sockeye salmon in the Yakima basin is the lack of passage for juveniles and adults at all of the major irrigation storage reservoirs in the system. No significant natural production of sockeye salmon can occur in the basin until both upstream and downstream passage is provided at these facilities.

3.3.1.6 Summer Steelhead

Historical summer steelhead runs were estimated to range between 80,000 and 100,000 adult fish. Summer steelhead were found in all the reaches of the mainstem Yakima River and its tributaries that supported spring chinook salmon, as well as in many other tributaries. Because steelhead spawners prefer smaller streams with steeper gradients than do spring chinook salmon, virtually all accessible permanent streams and some intermittent streams once supported steelhead. Even today, some steelhead spawn in such lower-valley tributaries as Spring and Snipes creeks. There was probably no downstream limit to summer steelhead distribution.

The historical stock structure of wild summer steelhead in the Yakima River is unknown. Biological data describing age composition, length, sex ratio, or fecundity of Yakima summer steelhead begins in 1979. The relative numbers of wild fish vary from year to year. In recent years, total returns have averaged about 1,700 fish, with hatchery fish contributing about 10 to 20 percent of the total run, as monitored at Prosser Dam. Returns of hatchery summer steelhead to the Yakima River were from fish reared at the former WDW's Yakima Hatchery. Before 1990, releases from this facility averaged slightly under 100,000 (with ranges of 50,000 to 200,000) summer steelhead smolts that were released mainly into the Naches River. From 1991 through 1994, production from this hatchery was reduced to about 33,000 smolts, or the number of smolts required for investigations of species interactions in the Yakima River system above Roza Dam. No further releases of steelhead smolts from the Yakima Hatchery are planned.

Production areas for steelhead occur throughout the Yakima River Basin. Little production, however, occurs upstream from Roza Dam. The greatest number of steelhead estimated to have passed above Roza Dam in any of the past 5 years is 125 fish.

An effort to ascertain the number of steelhead stocks in the Yakima River was initiated in 1989 (Busack et al., 1991). In the Yakima River Basin, three genetically distinct steelhead populations have been identified in the river by electrophoretic analysis. These three populations are found in Status Creek, Toppenish Creek, and Naches/upper Yakima rivers.

No evidence of gene flow from hatchery steelhead has been found in the Satus and Toppenish creek populations. However, gene flow from hatchery steelhead is apparent in the Naches/upper Yakima River population. In addition, some gene flow has occurred between hatchery rainbows and steelhead in the Naches and upper Yakima rivers.

Juvenile life history traits of steelhead are more diverse than those of Pacific salmon. Steelhead from the Satus and Toppenish systems apparently emerge during May through June. Steelhead in the Naches system emerge during June through August. This asynchrony is doubtless the result of the relatively lower water temperatures in the Naches River. In the Yakima Basin, naturally produced steelhead smolts migrate predominantly at age 2; however, some smolts also migrate at ages 1, 3, and 4. Steelhead smolts migrate past Prosser from early March through mid-June, with the average date of April 30 for 50% smolt passage by Prosser. Adults can rear in the ocean for 1 to 3 years before returning to the Yakima basin to spawn. Unlike Pacific salmon, which die after spawning, steelhead can recover and return to the ocean for 1 or more years and return to the basin to spawn again.

Causes For Decline

The in-basin causes for decline include construction of unladdered dams, entrainment of juveniles in unscreened diversion canals, log driving, fishing, diking and channelization, and loss of natural water storage and rearing habitat. Steelhead-specific causes for decline include diversions and riparian degradation; the completion of Roza Dam in 1940 severely limited access to about half of the steelhead habitat. (In 1989, steelhead access was improved via modification of the fish ladder system.) As the hydraulic regime of the Yakima River has been altered by flow management activities, high summer flows have led to suboptimal rearing conditions for emergent fry. In addition, low spring flows have affected upstream migration of adults.

Constraints on Natural Production

Natural production for most salmonid stocks in the Yakima River Basin, including steelhead, is limited by high summer flows and suboptimal spring flows in the mainstem, lack of passage around irrigation diversions, degraded riparian and instream habitat, and excessive temperatures in the lower portions of the Toppenish and Satus creek drainages. As noted above, the existing hydraulic regime provides severe conditions for steelhead/ rainbow fry: their life history requires that they emerge from spawning gravels in the summer. This may be a severe bottleneck to natural production of this species.

3.3.1.7 Resident Salmonids

Eight species of resident salmonids are known to exist in the Yakima River drainage, including the resident form of summer steelhead, or rainbow trout. Other resident fish species include Westslope cutthroat trout, bull trout, mountain whitefish, and kokanee. Introduced species include eastern brook trout, brown trout, and lake trout. Brown and

lake trout have a very limited distribution, but eastern brook trout are more widely distributed and occupy areas similar to those used by cutthroat trout. Cutthroat and bull trout generally inhabit clean cold water of high elevation streams, whereas rainbow trout occupy the river's mainstem and the low- to mid-elevation areas of tributaries. Of particular interest to anglers are the resident rainbow trout in the mainstem Yakima River above Roza Dam. The rainbow trout fishery in this area is arguably one of the best stream angling opportunities for resident trout in the State (see Section 3.7.1 for a discussion of the rainbow trout fishery).

Preliminary genetic analyses of resident rainbow trout in the upper Yakima River have discerned five genetic groups (Pearsons et al., 1993). Using electrophoretic methods, the analysis found that rainbow trout and steelhead were genetically similar where they occurred together. Hatchery-origin rainbow trout have hybridized with wild rainbow trout and steelhead in the Yakima River (Campton and Johnston, 1985; Pearsons et al., 1993). In general, the genetic contribution of hatchery rainbow trout to wild trout appears to be greatest in the mainstem Yakima River and low-elevation tributaries, and least or non-existent in high-elevation tributaries. Despite the level of interbreeding, the groups identified as rainbow trout still are genetically discernible from four hatchery rainbow trout strains that have been released into the river in the past.

Rainbow trout spawn throughout the entire upper Yakima basin, with the possible exception of some high-elevation portions of a few tributaries (Pearsons et al., 1993; Pearsons et al., 1994). In the mainstem of the upper river, rainbow trout spawn in clean gravels, next to cover, with velocities averaging about 0.6 m/second, a water depth of 0.3 m, and redd areas of 1.9 m^2. They spawn in close proximity to the bank, and may use side-channel habitat. Rainbow trout in the upper river spawn from February through June, although some fall spawning may also occur (Hindman et al., 1991; McMichael et al., 1992; Pearsons et al., 1993). The peak time of spawning is positively correlated with elevation, with spawning beginning first in low-elevation areas and later in high-elevation areas (Pearsons et al., 1993; Pearsons et al., 1994).

Taneum and Swauk creeks have the highest densities of rainbow trout of the upper Yakima River (0.10 fish/m^2 in index sites) (Pearsons et al., 1994). In the mainstem Yakima River, trout densities averaged about 300 fish/km in five index sections (Pearsons et al., 1993; Pearsons et al., 1994). The length of rainbow trout at each age was smaller in tributaries than in mainstem sections, with the exception of low-elevation streams such as Cherry and Wilson creeks. Rainbow trout in the upper Yakima basin generally do not live longer than 6 years, with few reaching lengths of over 56 cm (22 in.).

Kokanee (landlocked sockeye) are present in a number of lakes in the Yakima River Basin, including Cle Elum, Kachess, Keechelus, Rimrock and Bumping lakes.

3.3.1.8 Resident Non-salmonids

Few studies have been conducted on non-salmonid resident fish populations in the Yakima River. Patten et al. (1970) surveyed fish populations in the Yakima River during 1957 and 1958 and found 33 species present. The USBR (1979) collected four new species in 1979, bringing the total to 37 species, of which 10 were from the family *Salmonidae*. The six most abundant resident non-salmonid species present in the basin were chiselmouth, redside shiner, northern squawfish, largescale sucker, speckled dace, and torrent sculpin. Carp are the most abundant exotic non-salmonid species. Important non-salmonid sport species in the Yakima River below Prosser include exotics such as largemouth and smallmouth bass and channel catfish.

Fish assemblages in the tributaries of the upper Yakima River are typical of coldwater assemblages found throughout the Pacific Northwest. In 1993, the WDFW identified three major assemblage types in the upper Yakima River system (Pearsons et al., 1994). Assemblage types were distinguished using stream elevation above sea level, temperature, and size. Fish species that characterized assemblages in sites that were relatively high in elevation and within small streams (elevation 2,040-3,620 m (6,693-11,877 ft.), discharge 0.002-0.7 m^3/s (0.71-24.7 cfs), width 2.7-9.3 m (8.9-30.5 ft.)) were bull trout, cutthroat trout, and brook trout. Assemblages inhabiting relatively low-elevation sites in small streams (elevation 1,540-2,040 m or 5,052-6,693 ft., discharge 0.001-0.01 m^3/s or 0.035-0.35 cfs, width 1.8-3.9 m or 5.9-12.8 ft.) were represented by a high proportion of speckled dace. Assemblages inhabiting relatively low elevation sites in larger streams (elevation 1,430-1,960 m or 4,692-6,430 ft., discharge 7.3-29.4 m^3/s or 258-1,038 cfs, width 33.8-56.6 m or 110.9-185.7 ft.) were characterized by northern squawfish, chiselmouth, various suckers, redside shiners, longnose dace, mountain whitefish, and spring chinook salmon. Rainbow trout and sculpins were ubiquitous and were present in all assemblages. Bridgelip suckers make spawning migrations into some tributary streams such as Umtanum, Swauk, and Taneum creeks. These suckers migrate into the same streams as rainbow trout migrate to spawn, but shortly thereafter (Pearsons et al., 1993; Pearsons et al., 1994). Leopard dace have not been collected recently in areas that contained them during surveys in 1957 and 1958 (Patten et al., 1970; Pearsons et al., 1993; Pearsons et al., 1994).

3.3.2 Other Aquatic Resources

Little information about Yakima River aquatic resources other than fish is available. Available information concerning these resources and a brief description of ongoing studies are summarized below.

In 1975 to 1976, the EPA collected benthic macroinvertebrates from four sites in the Yakima River to develop a suitability index for swimming and fishing in the Yakima River (CH_2M Hill, 1977). These data were not published but were later summarized by the United States Geological Survey (USGS) in their surface water assessment of the Yakima River Basin (Rinella et al., 1992). Organisms belonging to the blackfly family were

dominant at the proposed Cle Elum hatchery site in August. Caddisflies were the most abundant taxa in November and December samples from Cle Elum, and in the summer and winter samples from Ellensburg and Yakima. Aquatic earthworms were dominant in August and November samples at Kiona. Caddisfly larvae were dominant in December. Density or abundance of aquatic insects appears to decrease in the lower Yakima River. For example, the average number of organisms (over three sample periods) decreased from 2,300 individuals and 28 taxa at Ellensburg to 120 individuals and 12 taxa at downstream Kiona (Rinella et al., 1992). Kiona also had the lowest numbers of insects considered to be sensitive to degraded water-quality conditions. However, other factors, such as increased temperature, fine sediment, and organic carbon, likely contribute to observed differences in the composition of the aquatic community (Rinella et al., 1992).

The USGS has collected extensive data on periphyton and macroinvertebrates in the Yakima River at several sites from 1987 to 1990. In addition, fish tissue samples were collected for analysis in 1989 and 1990. The USGS also has data concerning the chlorophyll pigment content and biomass of periphyton from the Yakima River at Cle Elum, the Naches River near North Yakima, and the Yakima River at Kiona. Dissolved and suspended carbon analyses are also available for these sites.
Information regarding the macroinvertebrate community in the upper Yakima River Basin has been collected through a cooperative project between the WDFW and Central Washington University (Paul James, unpublished data). This project was conducted in the Teanaway River over a 4-year period (1991-1994). The study found that 40-50% of the benthic insects by number were mayflies, with stoneflies, caddisflies, and true flies composing the remaining 50-60%. Aquatic macroinvertebrates found in the drift were composed of terrestrial insects (35-50%), mayflies (20-30%) and true flies (15-25%). The Cle Elum District of the USFS is also initiating a monitoring program in streams, but to date no data have been published.

3.4 Biological Resources: Wildlife and Vegetation

The construction of facilities for the Yakima Fisheries Project may affect vegetation and wildlife. These biological resources are described below.

3.4.1 Vegetation and Wildlife

The proposed facility sites along the Yakima River and its tributaries are located in naturally forested and nonforested areas east of the Cascade Mountains in Yakima and Kittitas Counties. Forested areas are characteristically dominated by conifers, and the nonforested areas by desert shrubs and grasses. Some of the forested areas have been logged, and much of the nonforested area has been grazed by domestic livestock. Some areas are under cultivation. A narrow band of broad-leaved, deciduous trees forms a more-or-less continuous riparian corridor along the shorelines of the Yakima River and its tributaries.

Wildlife use of the areas varies with vegetation and the amount of disturbance at the site. Riparian vegetation and adjoining cultivated fields in the Yakima River Basin provide habitat for elk and a variety of other big-game species. Breeding and wintering birds also use the Yakima River and shoreline vegetation.

Vegetation and wildlife use near the proposed Cle Elum hatchery facilities are described in the EA (BPA, 1990a) and summarized below. The existing vegetation and wildlife at each of the proposed and alternative acclimation sites are also described. Discussion is limited to wildlife species of regulatory and recreational importance, with general community descriptions provided, where appropriate.

- **Cle Elum Hatchery Site.** The proposed site is located on a parcel that consists of an old oxbow or river channel cut off from the Yakima River by the Burlington Northern Railroad. The approximately 200-ha (500-ac.) parcel includes wetlands, riparian forest, upland forest, and several large ponds. The proposed site for the hatchery development supports second-growth ponderosa pine/Douglas fir upland forest. Black cottonwood also grows abundantly throughout the area. Understory vegetation is sparse.

  Wildlife observed during winter site visits included osprey, common snipe, killdeer, belted kingfisher, hairy woodpecker, northern flicker, red-breasted nuthatch, raven, black-capped chickadee, golden-crowned kinglet, varied thrush, and Douglas squirrel. One beaver dam was noted.

  The riparian area along the Cle Elum River below Cle Elum Lake and the mainstem Yakima River in the vicinity of the Cle Elum site is used by wintering bald eagles and cavity-nesting waterfowl. Large ponderosa pines and cottonwoods along the river that provide perches for wintering bald eagles are limited on the site. A pond on the northeast end of the site about 610 m (2000 ft.) away from the proposed developed area contains two large snags that support osprey nests. The area is used by cavity-nesting waterfowl that nest along the John Wayne Trail, about 2 km (1.2 mi.) from the site.

  The site is located within an elk wintering area (WDFW, 1994); about 100 animals use the area along the Cle Elum River below Cle Elum Lake Dam. The elk range on either side of the river and wander into the southern portion of the site.

  Large woody debris abundant on the site provides habitat for reptiles and amphibians. Reptile and amphibian species observed on the site include sharp-tailed snakes, alligator lizards, Western fence lizards, garter snakes, and rubber boas (Renfrow, 1994).

- **Easton Gravel Pond Acclimation Site.** The western half of the Easton gravel pond option is surrounded by a forested stand of approximately 90% canopy. Understory vegetation includes snowberry, bedstraw, alder, vine maple, cottonwood, blackberry, thimbleberry, oceanspray, and rose. Several large-

diameter cottonwoods are located at the periphery of the site, and a section of alder adjoins the site. Several snags occur throughout this stand. The site is located next to the I-90 corridor, and adjacent forest land has been heavily logged. The eastern half of the site is characterized by highly disturbed soils that have been imported by physical deposition or from flooding. Cottonwoods occur along the eastern edge of the site. Ground and understory vegetation is patchily distributed and includes daisy, fireweed, mullein, aster, goldenrod, and dock. The western edge of the site is bordered by a willow, cottonwood, and alder thicket that adjoins a backwater of the river. The backwater is vegetated by rush, willow, and cattail. A forested stand adjoining this pond includes young-age-class cottonwood. Understory vegetation includes snowberry, vine maple, hawthorn, coltsfoot and thimbleberry. Based on observations at the site, great blue herons, downy woodpeckers and other cavity-nesting species, and amphibians are found at the site.

- **Easton Dam Acclimation Site.** The site is located next to existing facilities and may be the location of a former switchyard. The river is about 0.16 to 0.2 km (one-tenth to one-eighth of a mile) downslope and to the north of the site. Location of the return pipe would require removal of about 10 trees from the adjoining sideslope that descends at a 45-degree angle about 4.6 to 6 m (15 - 20 ft.) to the river. The site is opposite Lake Easton State Park and is highly disturbed. Vegetation was likely planted with both woody and evergreen as well as herbaceous species. Vegetation includes mullein, clover, vetch, thistle, daisy, squirrel tail, strawberry, rush, pearly everlasting, tumblemustard, cottonwood, snowberry, Ponderosa pine, Douglas fir, kinnickinnick, Oregon grape, blackberry, knapweed, willow, bursage, and lupine. No wildlife species were observed during the site visit.
- **Jack Creek Acclimation Site.** The shoreline vegetation along Jack Creek consists of cottonwood and alder. The site is located in an open field. The adjacent forest is dominated by Douglas fir and ponderosa pine with some grand fir. Some of the more mature trees in the area may provide perch sites for bald eagles. The common shrubs are snowberry, red osier dogwood, hawthorn, and vine maple. The grassy area supports wheatgrass, knapweed, yellow salsify, and yarrow.

  The Jack Creek site is open range and has been heavily grazed by cattle. Over-grazing likely has altered the complement of wildlife in the area. The area is also a hunting area and receives repeated recreational use by campers, hunters, and anglers.
- <u>**North Fork Teanaway Acclimation (alternate) Site.** The majority of the site is located on a terrace above the North Fork Teanaway River. It is sparsely treed with Douglas fir, grand fir, and ponderosa pine; cottonwoods are found on a lower terrace next to the river. The upland vegetation species are generally invasive, with an approximate 60% cover of knapweed.</u>

The site has been heavily grazed and has been affected by logging activity. Passerine bird species (e.g. common yellowthroat) and evidence of use by elk were noted at the site.

- **Clark Flat acclimation site.** The shoreline vegetation at the Clark Flat site consists of a narrow corridor of cottonwood and alder associated with shrub willows, wild rose, snowberry, red osier dogwood, choke cherry, and mock orange. There is some reed canary grass, a wetland indicator species, growing along an irrigation ditch. The site is in an open area with scattered shrubs of bitterbrush. The common herbs include knapweed, Carey's balsamroot, Sandberg's bluegrass, cheatgrass, and Russian thistle. The site is not in the coniferous forest zone, but there are a few scattered ponderosa pine trees and a single oak tree in the general area. The adjacent slopes support bitterbrush and bluebunch wheatgrass.

  The Clark Flat site is situated in a field that shows sign of overgrazing. The few bitterbrush in the area may attract deer in the winter. Tall trees along the Yakima River likely provide perch sites for bald eagles during the winter and fall. A private home is located within 0.8 km (0.5 mi.), and a railroad track traverses the north side of this site. The adjacent slopes are grazed by livestock and may also be used by mule deer and elk as winter range.

- **Cle Elum Acclimation (alternate) Site.** The shoreline vegetation at the Cle Elum acclimation site is characterized by a corridor of tall cottonwood and shorter-stature alder trees. The site is located in a swale probably formed by excavation to create a levee located between the site and the river. Herbaceous plants are sparse, with knapweed dominating the herbaceous vegetation growing on the levee. The nearby slopes are vegetated with ponderosa pine and Douglas fir.

  The Cle Elum site has previously been disturbed and is situated between two gravel roads that show signs of frequent use. There is a large marsh within a kilometer of the site, but the project facilities are not likely to affect the wildlife quality of the marsh.

- **Keechelus Acclimation (alternate) Site.** Shoreline vegetation at the Keechelus Dam site is sparse because extremely steep banks confine water flow to the main stream channel. Several cottonwood trees are rooted in the slope opposite the acclimation site. The site would be located in a small clearing in the adjoining coniferous forest, east of the creek. The forest stand includes a mixture of Douglas fir, western hemlock, western red cedar, lodgepole pine, western white pine, grand fir, and Pacific yew. The understory consists primarily of bracken fern, Oregon grape, blackberry vines, and bear grass.

  The Keechelus Dam site is situated next to the concrete banks of the existing outflow, outside of the adjacent timber stand. The timber stand contains critical habitat for the spotted owl, but no birds were observed during site surveys (see Section 3.4.2). A pair of osprey was observed nesting within 1.6 km (1 mi.) of the

site. A gray wolf adult and two juveniles were reported about 3.2 km (2 mi.) from the proposed acclimation pond site in 1992 (WDFW, 1994).

3.4.2 Threatened, Endangered, and Special Status Species

Section 7(c) of the Endangered Species Act (ESA) (16 CFR 1536) requires Federal agencies to consult with the USFWS and/or the NMFS, as appropriate, to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of a listed species or result in the adverse modification or destruction of their critical habitat. Upon determination that an endangered or threatened species may be present in the area of a proposed action, the responsible agency must prepare a Biological Assessment (BA) to identify how the listed species might be affected. A BA is being prepared for this project to address the listed species discussed below, and any necessary consultation will be completed prior to the Record of Decision. Candidate and petitioned species are not addressed in detail in the BA; their status would be monitored and consultation would be initiated if they were added to the threatened or endangered species list.

Population segments of several anadromous fish species have been listed under the ESA in the upper Columbia River system in recent years (e.g. Snake River sockeye, fall and spring/summer chinook). None of the listed species or population segments or their critical habitats are present in the Yakima subbasin, and it is unlikely they would be affected by the proposed project. Most other anadromous species in the Columbia River system have been included in coastwide status reviews now being conducted by the NMFS. These species include steelhead, coho, chinook and sockeye salmon in the Yakima River Basin. Decisions regarding potential listings have not yet been made by NMFS. The occurrence of these species in the Yakima River drainage is discussed in Section 3.3.1 of this FEIS.

The USFWS recently determined that listing of bull trout under the ESA was "warranted but precluded." This species exists in the Yakima River system. Nonmigratory populations of bull trout are primarily restricted to cold, headwater streams across the Pacific Northwest. Bull trout populations exist in the upper Yakima (e.g., Cle Elum, Waptus, Kachess, and Keechelus lakes; Kachess River; and Box Canyon, Mineral, Rocky Run, and Gold creeks). A resident population exists in the upper reaches of the North Fork of the Teanaway River and has been encountered during recent sampling activities of ongoing species interactions studies (Pearsons et al., 1993) (see Section 3.3.1.7). For example, bull trout have been collected in juvenile outmigrant sampling operations in the North Fork of the Teanaway River and Jungle Creek. Also, a small number of individuals has been observed in index sections of the mainstem Yakima River near Ellensburg and Cle Elum; a single individual was sampled from the mainstem of the Yakima River near the mouth of the Naches River during steelhead broodstock collection efforts in 1993. Finally, researchers observed a single bull trout while monitoring a trap located at the mouth of Swauk Creek near its confluence with the Yakima River mainstem. Bull trout also occur in the Naches and Ahtanum subbasins.

According to the USFWS, several Federally listed bird species may occur in the vicinity of the various facilities. These include the bald eagle, northern spotted owl, marbled murrelet, and peregrine falcon. The gray wolf may occur in the vicinity of the Jack Creek, North Fork Teanaway, and Keechelus Dam sites (M. Hinchberger, USFS, pers. comm.). The grizzly bear may occur near the Cle Elum, North Fork Teanaway, and Jack Creek sites.

According to the list provided by the USFWS, approximately 24 Federal candidate species may also occur within the project area (see Appendix D for list). If and when any of these species should be identified by the USFWS as threatened or endangered, the project managers would perform all appropriate environmental surveys and biological assessments.

The species listed by the USFWS as threatened or endangered are discussed below.

- **Bald Eagle.** During the 1988 Midwinter Bald Eagle survey, 38 bald eagles were counted in the Yakima River Basin. The 5-year average (1984-88) was 33 eagles. Wintering eagles are attracted by fish, waterfowl, and big-game and domestic livestock carcasses. Their movements depend largely on available food sources such as those listed above, perches, and roost sites. A BA of the project's effect on bald eagles was prepared as part of the EA (BPA, 1990a). BPA determined that the project would have no effect on nesting or wintering bald eagles, their habitat, or food supply.

  Surveys were conducted by the Pacific Northwest Laboratory from December 1991 through May 1992 to determine bald eagle use of habitat near proposed acclimation sites. All tributaries of the Yakima River and the Yakima River itself with proposed acclimation sites were surveyed. Primary concentrations of eagles were observed on tributaries to the Yakima River. All eagles observed were perched in large trees, with the exception of two adults: one was found soaring over Nile Creek, and a second near Nelson Springs. Additionally, a survey for bald eagle nesting activity was conducted in May 1993 by the Pacific Northwest Laboratory. The aerial survey covered the entire Yakima River mainstem from Stampede Pass to the Columbia River, and the Naches River. No bald eagle nesting was observed.

  All of the project sites have been identified by the WDFW (1994) as bald eagle wintering areas. The floodplain and associated wetlands between the Yakima Canyon and the confluence of Swauk Creek (Clark Flat site) are used by approximately 25 to 30 wintering eagles (WDFW, 1995). An additional 10 to 15 eagles use the area in late spring upstream from Swauk Creek and downstream from Cle Elum (Easton and Cle Elum sites).

- **Northern Spotted Owl.** The USFS and the WDFW were contacted regarding the occurrence of northern spotted owls in the vicinity of the proposed acclimation and hatchery sites. No suitable habitat is present at either the Cle Elum acclimation or

hatchery sites, or at the Clark Flat or Easton acclimation sites. The Jack Creek and North Fork Teanaway sites are included within both the 2.9- and 4.3-km (1.8- and 2.7-mi.) radii for habitat management for the Teanaway and Jack Creek owls. The most recent observations for Jack Creek were recorded in 1993 (WDFW, 1994). The Cle Elum site is located within the 2.9- and 4.3-km (1.8- and 2.7-mi.) radii for habitat management for the Prospect Creek and Oso Creek owls. The most recent sighting of the Prospect Creek owl was during 1994 (WDFW, 1994). The Keechelus site is located within the 2.9- and 4.3-km (1.8 and 2.7-mi.) radii for habitat management for the Mosquito Creek, Jack Creek, Cold Creek, and Little Kachees Lake Owls. Habitat surveys were conducted at all sites in 1993 by the Pacific Northwest Laboratory. No suitable owl habitat was identified at of any of the sites; however, suitable habitat was located in the vicinity of the Keechelus, North Fork Teanaway, and Jack Creek sites. A calling survey was also conducted at the Keechelus site by Pacific Northwest Laboratory in 1993; no spotted owl activity was recorded. Calling surveys have been conducted at the Jack Creek and North Fork Teanaway sites by others.

- **Peregrine Falcon.** Peregrine falcons require rocky cliffs or outcrops for nesting and use marshes, lakes, rivers, and open habitat for foraging. Peregrine falcons may travel up to 16.1 km (10 mi.) between nesting and feeding habitat. The WDFW inventoried portions of the Wenatchee National Forest for active nest sites; however, no active nests have been identified. Individuals migrate through the region during August and October, and have been observed in the forest. Use of habitat by peregrine falcons can be affected by timber harvest, road construction, and recreation.

- **Marbled Murrelet.** No observations of marbled murrelets have been reported in the WDFW database for the project sites; however, specific surveys for marbled murrelets have not yet been conducted. Murrelets use mixed stands of mature and old-growth conifers and range a maximum reported distance of 80.5 km (50 mi.) from ocean waters (Pacific Seabird Group, 1994). Murrelet habitat would be expected only at the Jack Creek, North Fork Teanaway, and Keechelus sites. The Jack Creek and North Fork Teanaway sites are out of the range of the species. Although the Keechelus site may border murrelet nesting area, the proposed activity would not remove murrelet habitat from the site.

- **Grizzly Bear.** Surveys for suitable grizzly bear habitat in the vicinity of the proposed acclimation sites were conducted during spring 1992. No recent sightings of grizzly bear have been reported near the Keechelus, Clark Flat, or Easton sites. In 1989, one grizzly bear sighting was reported for the Teanaway Butte area, approximately 16 km (10 mi.) north of Cle Elum (Almack, 1990). The home range of the individual would overlap the Cle Elum, North Fork Teanaway, and Jack Creek sites.

- **Gray Wolf.** Gray wolf howling surveys were conducted in the Teanaway watershed (Jack Creek and North Fork Teanaway sites) during early summer 1992. An unconfirmed siting of a gray wolf was reported for the vicinity of the

North Fork of the Teanaway River during 1992. No recent sightings have been confirmed in this area, but the site lies within the known historical range of the species. One adult and two yearling gray wolves were reported near the Keechelus site in 1992 (WDFW, 1994).

Sharp-tailed snakes, a State "monitor" species, have been reported to occur at the Cle Elum site (Renfrow, 1994).

A number of rare vascular plant species are known to occur in Kittitas County. These are listed by the Washington Department of Natural Resources as endangered, threatened, or sensitive species (see Appendix D). These include Hoover's tauschia, pine broomrape, green-fruited sedge, swamp saxifrage, adder's tongue, and Victorin grape-fern. Hoover's tauschia is also a Federal candidate species. However, none of these plants is known to occur at any of the proposed sites (WDFW, 1994), although the Keechelus and Easton gravel pond sites may provide habitat for unique species in the adjacent wetlands.

3.5 Air Quality and Noise

3.5.1 Air Quality

Air quality in the Yakima River Basin ranges from good to excellent. Air quality at all YFP sites complies with the National Ambient Air Quality Standards and Washington State standards. Higher elevation areas in the upper basin have excellent air quality. Lower valley areas can have high levels of natural windblown particulates originating from fallow croplands during windy periods. Burning crop and forest residues and vehicle travel on gravel roads are often sources of particulates during the summer and fall. The urban Yakima area, which is surrounded by hills and ridges, can experience poor atmospheric dispersal of pollutants from automobiles and industry during winter inversions. Occasionally, standards for carbon monoxide and suspended particulates are exceeded for short periods in the Yakima metropolitan area.

3.5.2 Background Sound Levels and Noise

Ambient noise levels at the potential facility sites in the Yakima River Basin are probably typical for rural to semi-urban locations and range from 40 to 50 decibels (A-weighted) (dBA) at rural locations such as the Cle Elum hatchery site, to 50 to 60 dBA at more urbanized locations closer to highways (such as the Easton gravel pond site).

3.6 Socioeconomic Resources

The YFP may affect socioeconomic resources in Kittitas and Yakima Counties. The population trends of these two counties are summarized in Table 3.3. Yakima County is classified as metropolitan, while Kittitas County is classified as nonmetropolitan. While some economic impacts could extend to other counties in the area, Kittitas and Yakima

Counties would experience the greatest economic impact because of the size and type of proposed facilities in these counties, the size and nature of the local economies, and the interaction of economic flows (BPA, 1990b, Appendix D). Current socioeconomic resources for these areas are described below.

Table 3.3 Population Trends of Affected Counties

Year	Kittitas	Yakima
1930	18,154	77,402
1940	20,230	99,019
1950	22,235	135,723
1960	20,467	145,112
1970	25,039	144,971
1980	24,877	172,508
1990	26,725	188,823
1993	29,200	197,000

3.6.1 Kittitas County

Kittitas County covers 6009 km^2 (2,320 mi^2). The estimated total population for the county in 1993 was approximately 29,200, with 4.9 persons per km^2 (46.1 persons per mi^2). Blacks, Indians, and Hispanics make up 5.4% of the population. The principal economic activities in Kittitas County are education (Central Washington University), food processing, agriculture, and services. Agriculture crops include hay, grains and fruit; ranching is also important. The 1992 sources of total income are shown in Table 3.4.

Table 3.4 Earnings and Personal Income in 1992 (in Thousands of 1995 Dollars), and as a Percent of Total, for Kittitas and Yakima Counties

Industry	Kittitas County		Yakima County	
Agriculture	$22,806	4.7%	$356,371	9.8%
Mining	$72	0%	$483	0%
Construction	$9,775	2.0%	$96,545	2.7%
Manufacturing	$25,357	5.2%	$284,961	7.9%
Trans./Utilities	$17,812	3.7%	$102,066	2.8%
Trade	$53,119	10.9%	$452,074	12.5%
Services	$44,650	9.2%	$549,685	15.2%
Government	$103,085	21.2%	$372,314	10.3%
Transfer Payments & Misc.	$209,712	43.1%	$1,348,489	37.2%

Source: Regional Economic Information System on CD by the US Bureau of Economic Analysis, Economics and Statistics Division

The inclusion of Central Washington University accounts for the high percentage of government activity. Per-capita income is $10,490; the county ranks 32 out of 39

Washington counties. With a 1993 unemployment rate of 11.1%, Kittitas County is designated a distressed area.

3.6.2 Yakima County

Yakima County covers 11,067 km^2 (4,273 mi^2). The estimated total population in 1993 was about 197,000. Population density is about 17.8 persons per km^2 (46.1 persons per mi^2). Thirty percent of the population is of Black, Indian, or Hispanic origin. The principal economic activities in Yakima County are agriculture, food processing, wood products, and manufacturing. Yakima County is one of the nation's richest agricultural counties, and leads the State in apple, pear, peach, and grape production, while other agricultural specialties such as hops and mint also play a major role. The 1992 personal income sources are shown in Table 3.4. Per capita income was $10,380. With an unemployment rate of 12.5%, the Yakima Metropolitan Statistical Area is the only Metropolitan Statistical Area in the State to be designated a distressed area.

The Yakama Reservation lies primarily within Yakima County. It comprises a significant cultural, social, and economic subset of the county, and will receive a large portion of the YFP economic impact because of the YIN's status as the Lead Agency for the YFP for operations, maintenance, monitoring, and evaluation activities.

Because of the Yakama Reservation, Yakima County has a significant Native American population of 8,420, or 4.5% of the population. Per-capita annual income for the Native American population from the 1990 census was $5,676; this is 53% of Yakima County's per-capita annual income and only 38% of the Washington State per-capita annual income. The Native American population has low labor participation rates, and unemployment rates exceeding 15%. Of all persons living on the Yakima Reservation, 32.8% have incomes below the poverty level.

3.7 Recreational Resources

Recreational activities near potential YFP sites include sportfishing, rafting, and floating. The Yakima River is not designated as a Wild and Scenic River. The following sections discuss aspects of the wild trout fishery (a primary sportfishery), aesthetics and visual resources, and other recreational resources in the Yakima River Basin. Unless otherwise noted, information is taken from the EA (BPA, 1990a).

3.7.1 Resident Trout Fishery

The primary recreational fishery in the Yakima River Basin is trout, with whitefish (winter) fished to a lesser extent. There is presently no recreational steelhead fishery in the Yakima River. The WDFW considers the Yakima River trout fishery of special significance to the State. The Department estimates that 330,000 recreation angler trips are made per year on the Yakima River and tributaries. They also estimate that 108,000 angler trips per year are made to fish above Roza Dam on the mainstem Yakima River.

In 1990, the Yakima River was designated a catch-and-release fishery to preserve trout populations in the area. At the same time, the river was opened for year-round fishing.

3.7.2 Aesthetics and Visual Resources

The Wenatchee National Forest has inventoried the visual quality of the forest lands in the vicinity of some of the project sites. In their Forest Plan, the Cle Elum Valley is classified as having "slightly altered" visual conditions. The visual quality objective for the forest lands in the valley is classified as partial retention. This classification allows for minor disturbances that may be noticeable but that do not attract attention.

The **Cle Elum** Hatchery and acclimation sites are located in the vicinity of the Milwaukie, St. Paul, and Pacific railroad right-of-way. Unregulated use and recreation disturbance limit the aesthetic value of the site, although it is located in a natural-appearing setting.

Both of the **Easton** site options lie within a scenic corridor designated by the Washington State Department of Transportation (WDOT). The gravel pond site option is situated in and next to an active WDOT gravel operation. It is bisected by a road maintained for commercial hauling. The Easton Dam site option is located next to a diversion dam, fish screening facility, and the railroad tracks.

The **Jack Creek, North Fork Teanaway,** and **Clark Flat** sites are located adjacent to areas disturbed previously by agriculture, logging, and/or grazing. The sites are immediately adjacent to USFS recreation and county roads, respectively, and provide access for recreation upstream within the watershed.

The **Keechelus Dam** site lies within a scenic corridor designated by WDOT. However, existing recreation disturbance and disturbance associated with dam maintenance and unregulated use of the site limit the aesthetic value of the site.

3.7.3 Other Recreational Resources

As mentioned above, the Yakima River is used extensively for fishing. Other recreational activities in the Yakima Basin include hunting, camping, cross-country skiing, and off-road vehicle (ORV) use.

Hunting near the Yakima River includes upland bird, elk, deer, some waterfowl and a few bighorn sheep. Many campgrounds along the river are managed by the U.S. Bureau of Land Management (BLM) in the mid-summer for river rafters and in the autumn and winter for fishers and hunters.

The upper portions of the Yakima River Basin are used for winter snowmobiling and cross-country skiing. There is a snow park below Keechelus off Interstate 5. The North Fork Teanaway Road is a designated groomed snowmobile trail north from Lick Creek, which is south of the Jack Creek and North Fork Teanaway acclimation sites.

The Yakima River and its tributaries also are used for rafting and floating, occasionally near project sites. In the stretch of the Yakima River around Cle Elum and Ellensburg, boating is discouraged because of potentially dangerous obstructions. However, boaters continue to use this area. The river level drops substantially in September when the flow from the three large upstream reservoirs is curtailed, and rafting activities diminish along this stretch of the river. The heaviest rafting and floating use on the Yakima River occurs in the stretch between Ellensburg and Roza Dam. No potential sites for the YFP are located along this portion of the river.

3.8 Archaeological, Historical, and Cultural Resources

A series of cultural resources surveys and test excavations was conducted at proposed central and satellite facility sites for the YFP by personnel from Archaeological and Historical Services (AHS), Eastern Washington University, during 1988-89. Additional work has since been conducted for the proposed acclimation sites. The findings from these activities are discussed below. As required by the National Historic Preservation Act (see Section 5.7), all cultural resources discovered were evaluated as to their eligibility for the National Register of Historic Properties (NRHP). AHS has consulted with YIN officials and the State Historic Preservation Office (SHPO) regarding all prehistoric cultural resources identified at the proposed facility sites.

The findings and recommendations for the Cle Elum hatchery site were discussed in the EA (BPA, 1990a). Surveys were also conducted for the acclimation sites by AHS. A summary of these findings and results of additional surveys follow.

- **Cle Elum Hatchery Facility.** No cultural materials were found during the initial site visit in 1989. An additional survey of the proposed expansion site by AHS in 1991 also revealed no cultural resources. No cultural resources are likely to exist intact on the property because it has been severely disturbed.

- **Easton Sites.** No cultural resources were observed at the Easton gravel pond site option, and none are likely to exist. The site has been completely disturbed by gravel excavation for construction of Interstate 90. A pony truss bridge was identified adjacent to the parcel proposed for the water intake structure. Although the bridge is potentially National Register-eligible, it is out of the project area and would not be affected by the project.

  A portion of an abandoned railroad siting was located at the Easton Dam site option, but it is not one of the significant property types affiliated with the Milwaukee Railroad. The archaeological report concludes that there would be no effects of the proposed project on significant cultural resources.

- **Jack Creek Site.** Prehistoric cultural materials were discovered at the site during surveys in fall 1995. Surface concentrations of lithic artifacts, including tools of various lithic materials and functional types, were found in the vicinity of the aerial

survey marker near the south end of the are proposed for pond development. Limited numbers of lithic flakes were recovered from subsurface shovel test holes in that vicinity as well. More subsurface testing would be needed to determine NRHP eligibility if the area (approximately 150 x 60 m) containing the concentration of cultural material were to be affected by proposed pond development.

- **North Fork Teanaway (alternate) Site.** Extensive prehistoric cultural materials were found during surveys at the site. Given the amount of lithic material observed on the ground surface scattered over a considerable area (approximately 400 x 200 meters), and that recovered from subsurface testing (over 60 items in each of two 1 x 1 meter units, and materials in smaller shovel test holes), the site appears to have the potential to yield important information, thus meeting National Register eligibility requirements under Criterion D.
- **Clark Flat Site.** No cultural resources were observed at the Clark Flat site, and none appear likely to exist. The site has been considerably disturbed.
- **Cle Elum (alternate) Site.** No cultural resources were observed at the site, and none are likely to exist, since it appears to be heavily disturbed.
- **Keechelus (alternate) Site.** Two historic resources were noted at the Keechelus Dam site. An historic dump is recorded as part of the Keechelus Lake Construction Camp (USFS Site 0617-03-23, Houck and Gamble, 1984) at the proposed location for facility development. Presumably associated with construction of Keechelus Dam, the dump has been disturbed by logging activities and does not appear likely to yield information important to the history of the dam. The dump does not meet criteria for inclusion in the NRHP; the SHPO determined that the site was not eligible for the NRHP. A steel pony-truss bridge with wood plank deck spans a small creek on the access road connecting the site with Interstate 90. The bridge is an excellent example of a significant bridge type and is potentially eligible for inclusion in the NRHP.

  Load limits of vehicles using the pony-truss bridge should not exceed 10 tons as posted. Should need arise to exceed that tonnage or to replace or alter the bridge, a determination of eligibility for the NRHP would be prepared for the bridge.

3.9 Resources Management

Resource management activities related to the YFP include fisheries management, land-use management, and solid and hazardous waste management, all of which are discussed below.

The State and Tribal project managers have regulatory authority over fisheries and fisheries production in the Yakima River Basin, but not over many land and water uses that may affect the fisheries resources. Water quality and quantity issues are subject to laws administered by the WDOE. Instream and nearstream activities are subject to the

State Hydraulic Code and other State and Federal laws. Section 404 of the Clean Water Act (CWA) authorizes the Corps to issue dredge and fill permits for United States waters. The USFS controls land-use activities on National Forest System lands.
There are numerous ongoing cooperative programs to protect and promote fish and fish habitat in the Yakima River Basin. These include the following:

- *Yakima River Basin Water Enhancement Project* - This project is a result of Federal legislation passed in 1994. When fully implemented, the emphasis of the project will be to increase the reliability of irrigation water for farmers and for fish by emphasizing conservation through modernization of equipment and delivery systems. Besides the USBR, participants include the state and Federal agencies, the YIN, irrigation districts, and individual landowners.

- *Timber/Fish/Wildlife Agreement* - This agreement, commonly referred to as TFW, provides a forum and adaptive management context to address a multitude of Washington's forest practice issues and their interaction with other forest values, including fish resources. It provides a linkage to the Forest Practices Act and is advisory to its regulatory body, the Forest Practices Board. In the Yakima River Basin, a wide range of participants are involved, including state agencies, YIN, USFS, timber companies, environmental organizations, irrigation interests, and universities.

- *Yakima Resource Management Cooperative* - This group was formed to develop and implement a cooperative management review process for forested areas of the upper Yakima River Basin. The group is comprised of representatives from the timber industry, state and federal resource agencies, the YIN, and environmental groups. Fish habitat interests include road management, watershed analysis and restoration, stream sediment/temperature management and monitoring, and database management.

- *Fish Habitat Enhancement Programs* - Several projects are currently being undertaken that are directly aimed at instream and riparian habitat improvements. First, the YIN recently implemented projects under the "Jobs for the Environment" program, which is directed at improving degraded elements of the upper Yakima River floodplain. Specific activities have been directed at improving nursery habitat for newly emergent salmon fry, and creating and improving their overwintering habitat. The YIN has led this effort and collaborates with WDNR, Plum Creek Timber Co., Washington Central Railroad, WDFW, USBR, BLM, and Kittitas County. A second major effort is the Salmon Corps, a part of the Americorps program, whereby local volunteers work to restore and enhance salmon habitat. Examples of their activities in the Yakima River Basin include fencing projects to protect streambanks and improve riparian vegetation, and planting of trees and other vegetation along streams to stabilize streambanks, provide shade, and trap inflow of sediments. This program is directed by the YIN, and involves local landowners, the City of Yakima, Yakima County, BPA, and USBR. Finally, the Yakima River Salmon Enhancement Project is a joint venture among the WDOT, the Yakima Greenway Foundation, the YIN, and the Salmon

Corps. This project is attempting to improve overwintering habitat for salmon by introducing large woody debris into selected side channels of the Yakima River between Union Gap and Selah.

- *System Operations Advisory Committee* - Resulting from court decisions regarding water resources in the Yakima River Basin, this group advises USBR on matters pertaining to flow and its impacts on fish resources. Participants include representatives from the YIN, WDFW, USFWS, and irrigation districts.
- *Proposed Lower Teanaway Flow Enhancement Project* - This proposed project is intended to improve flows for fish while maintaining delivery for irrigation needs. Cooperators include BPA, landowners, irrigation district, WDFW, and YIN.
- *Proposed Re-regulation Reservoir Below Sunnyside Dam* - This project has progressed through its design stage but has not yet been implemented. It is intended to bolster flows in a particular section of the river to stabilize those needed for fish. This project involves the YIN, USBR, WDFW, irrigation districts, and WDOE.
- *Operation of Adult and Juvenile Fish Counting Facilities* - Cooperative agreements exist to monitor adult and juvenile fish at various existing facilities in the Yakima River Basin. These efforts involve the USBR, BPA, irrigation districts, YIN, and WDFW.
- *Snoqualmie Pass Adaptive Management Area (AMA) Planning Processes* - The natural production of salmonids has been identified as an aspect of late-successional forest management. As a result, the AMA planning processes may provide an opportunity to address fish habitat protection issues and to develop production approaches that will benefit fish stock recovery in the upper Yakima River Basin.

3.9.1 Fisheries Management

3.9.1.1 Harvest Management

Fisheries management activities are outside the scope of the proposed project. However, changes in policies and planned efforts would influence mitigation efforts in the basin. The YFP is designed to operate within the constraints of existing harvest management regimes. BPA has no harvest regulatory authority. The Tribal and state fishery managers recognize the need for adequate harvest management regulations and will regulate the fisheries to assure that YFP objectives are met.

In the Yakima River Basin, salmon and summer steelhead harvest management is a cooperative venture between the YIN and the WDFW. A subbasin harvest management planning process currently exists for spring chinook salmon and summer steelhead.

A summary of the status of specific resource management activities in the Yakima River Basin is below; a more detailed discussion is presented in Appendix E.

Existing Harvest Management and Managers

Existing harvest is managed by several agencies with different (and sometimes overlapping) jurisdictions.

Ocean Harvest Management

The coastal states regulate harvest in ocean waters out to 4.8 km (3 mi.) from the U.S. coast. The North Pacific Fishery Management Council and the Pacific Fishery Management Council regulate harvest from 4.8 to 322 km (3 to 200 mi.) off the U.S. coast. Decisions on management in U.S. waters are made in the context of public hearings and review. Canadian ocean waters are managed by the Canadian Department of Fisheries and Oceans. All of these fisheries are regulated under the guidelines of the Pacific Salmon Treaty.

Columbia River Harvest Management

The Washington and Oregon Departments of Fish and Wildlife independently regulate non-Indian recreational harvest for salmon, steelhead, and other species in the Columbia River system. The WDFW controls recreational salmon, steelhead, and other fisheries in the Washington tributaries of the Columbia River. ODFW regulates recreational fishing for salmon, steelhead, and other game species in Oregon tributaries. Their regulations are also adopted in the context of public hearings. Technical staff of Tribal, state, and Federal co-managers develop recommendations for Indian and non-Indian commercial fisheries. The Columbia River Compact, a Federally sanctioned compact between the states of Washington and Oregon, is empowered to approve regulations for non-Indian commercial fisheries.

The YIN and other Columbia Basin Treaty Indian Tribes (Nez Perce, Umatilla, Warm Springs) regulate Indian treaty fishing in Zone 6 (Bonneville to McNary dams) within the bounds set by the Columbia River compact. Tribal regulations generally are adopted also by the states into state law. Other Tribes in the Columbia Basin also have treaty fishing rights.

Yakima River Basin Harvest Management

In the Yakima River Basin, salmon and steelhead harvest management is a cooperative venture between the YIN and the WDFW. A subbasin harvest management planning process currently exists for spring chinook salmon and summer steelhead.

Tribal subsistence fishing regulations for the Yakima River are adopted by the Yakama Nation Tribal Council. Technical staff prepare a set of options for fisheries that will provide for tribal fishing opportunity while meeting conservation needs. The Tribal Council reviews each option and adopts the one that best balances the needs of tribal anglers with the needs of the resource.

The annual harvest plan for Yakima River spring chinook salmon is part of a larger process aimed at providing equitable harvests for treaty and nontreaty anglers in terminal fisheries above Bonneville Dam. The State and Tribal co-managers have agreed

that treaty/nontreaty harvest sharing need not be 50/50 in each terminal fishery, so long as the sum of projected harvests across all co-managed terminal fisheries is approximately 50/50 or is considered "equitable." This allows flexibility between the parties to prioritize harvest needs in terminal areas. (For details on the subbasin harvest planning process, see Appendix E.)

Relationship between Harvest Management and Supplementation

Without supplementation, harvest management alone could not serve to rebuild spring chinook status above current levels. In the Yakima River Basin, current harvest levels on wild and naturally spawning populations of chinook salmon are relatively minor. For example, the CRFMP requires that harvests of Yakima River spring chinook salmon in the Pacific Ocean and mainstem Columbia River remain below 12 percent when the aggregate upriver spring chinook salmon run does not reach the Bonneville Dam escapement goal of 128,000. This has been the case every year since 1977. Since 1989-94, the average terminal harvest rate in the Yakama River Tribal subsistence fishery has been 7.9 percent of the total adult run returning to Chandler. Despite these low harvest rates, spring chinook salmon stock abundance in the Yakima River is not increasing. (For information on steelhead, see Appendix E.)

As mentioned in previous sections, coho are believed to be extinct in the Yakima River Basin. Under the CRFMP, there is no formal harvest allocation scheme for upper Columbia River coho stocks, and the YFP coho program would be unlikely to materially affect current management. As part of the preferred alternative for the YFP, the feasibility of increasing coho returns to improve harvest opportunities in the basin will be evaluated. Positive results from the evaluation may lead to future consideration of coho restoration or supplementation using broodstock obtained from Yakima River returns.

Non-Supplemented Harvest

Harvest of a wide variety of species not targeted for supplementation is also managed within the Yakima subbasin by the WDFW. These include warmwater game fish species such as bass, perch, channel catfish, resident coldwater fishes (e.g. rainbow trout, bull trout), whitefish and squawfish. These species must be managed concurrently to achieve a balance among objectives such as recreational opportunity, resource protection and maintenance, and impact on YFP supplementation activities or target stock rebuilding.

3.9.1.2 Predator Control

Predation was identified as an important factor potentially influencing current and potential production of anadromous fish in the Yakima River Basin (Watson et al., 1993). Predators (e.g., northern squawfish, channel catfish, bass, and gulls) may be responsible for high losses of smolts before they leave the Yakima River Basin. Low flows in April and May may exacerbate smolt losses in the Yakima River.

Although no program has yet been implemented, a study of the potential impact of predators on anadromous salmon would provide valuable information on the extent to which predation influences smolt mortality and production potential, and would help identify possible means to reduce smolt losses (e.g. predator management).

3.9.1.3 Production

The CRFMP was negotiated in 1987 as an interim settlement to the *U.S. v. Oregon* litigation. This plan provides for the yearly release of 1.7 million upriver bright fall chinook and 0.7 million coho smolts into the Yakima River Basin. The fall chinook and coho smolts are currently being imported from out-of-basin hatcheries on an annual basis. Steelhead previously produced at the WDFW's Yakima hatchery were not produced after 1994.

3.9.1.4 Fish Passage

The Council's 1982 Fish and Wildlife Program included the construction of new fish passage facilities in the Yakima River Basin, with a goal of providing protection for rearing and migrating adults and juvenile salmon and steelhead at diversion dams and canals. Construction was begun in 1984. By 1989, construction of new fish ladders and screens was completed on most of the major diversion dams and canals in the Yakima Basin. In 1990, construction began on screening over 60 medium and smaller diversion canals and ditches. Construction of these screens is projected to extend through the year 2000. Thirteen of the Phase II screening projects will be operational by outmigration in 1996.

3.9.2 Water Management

A number of water management activities affect the fisheries resources in the Yakima River Basin. These include the following.

3.9.2.1 Quackenbush Decision

In November 1980, U.S. District Judge Quackenbush entered a ruling (*Kittitas v. Sunnyside Valley Irrigation Dist.*) that requires the USBR to operate the Yakima Irrigation Project in such a way as to protect spring chinook redds in the upper Yakima River. This ruling has given rise to the annual "flip-flop" operation, in which releases from basin storage reservoirs are manipulated to prevent dewatering of spring chinook redds.

3.9.2.2 Yakima River Basin Water Adjudication

The adjudication of surface water rights in the Yakima River Basin was initiated by the WDOE. On October 12, 1988, under the caption of *Department of Ecology v. Acquavella et al.*, Yakima County Superior Court No. 77-2-01484-5, the DOE filed its Statement of Facts, which contained the names of all known claimants of water rights in the basin, including the United States of America. In addition to other Federal claims,

the United States filed a claim for instream flows on behalf of the YIN. This claim was based upon the Yakama's reserved water rights as established by the Treaty of 1855 (12 Stat. 951, June 9, 1855), which included water rights for fish, wildlife (and other natural resources), irrigation, and other non-agricultural uses.

In November 1990, Yakima Superior Court Judge Walter Stauffacher issued an Amended Summary Judgment in *Acquavella, supra.* In his decision, Judge Stauffacher defined the treaty-reserved instream flow rights for fish as follows:

> "The maximum scope of the diminished treaty water right for fish is the specific 'minimum instream flow' necessary to maintain anadromous fish life in the river, according to the prevailing conditions as they occur. . . ." *Ibid.*

However, the court did not quantify specific instream flow levels, but left the flow level determinations up to the USBR, which relies upon the advice of the Systems Operations Advisory Committee (SOAC). The Partial Summary Judgment was appealed to the Washington State Supreme Court, which upheld Judge Stauffacher's decision in its opinion dated April 23, 1993.

Early in 1995, Judge Stauffacher further clarified his original decision when the court issued its Tributary Order, which affected the water rights in tributaries to the Yakima River, including, but not limited to, the Teanaway River, Swauk Creek, and Manastash Creek. In the Tributary Order, Judge Stauffacher ruled that the Yakama Indian Nation held a diminished treaty water right for fish that was related to the same water right held by the Tribe in the mainstem Yakima River. He further ruled that the subject water right was limited to maintaining fish life at all 'usual and accustomed' fishing locations identified in the Yakama Indian Nation's Petition filed in Docket 147.

The impacts of Judge Stauffacher's rulings upon Yakima River Basin fish resources are uncertain. However, this project and its outcomes will not change or affect his decisions or the treaty water rights held by the Yakama Indian Nation.

3.9.2.3 Roza and Chandler Power Plant Flow Subordination

For the past several years, the USBR has, in response to drought, curtailed power production at Roza and Chandler power plants in order to provide increased instream flows in sections of the Yakima River. Discussions concerning the level and duration of subordination are continuing.

3.9.2.4 Habitat Improvement

In 1987, the Council initiated the development of an integrated system plan for the Columbia River Basin. The Council's Integrated System Plan (YIN et al., 1990) is based on recommendations from fishery agencies and Tribes for each of the Columbia Basin's 31 subbasins. System planning is intended to specify mitigation projects and priorities for

implementation over the next several years. Habitat enhancement activities for the Yakima River Basin are identified in the Yakima Subbasin Plan.
The Plans' habitat improvement strategies were prioritized, based on expected smolt capacity increases and other juvenile and adult contributions; estimated costs; and other biological and ecological objectives. Implementing these habitat improvement activities is expected to increase the effectiveness of the YFP. The project managers would integrate the habitat improvement activities with management and planning of the proposed YFP, but these activities would proceed regardless of which YFP alternative were chosen.

3.9.2.5 Increased Streamflows

Fisheries biologists generally agree that unseasonably high or excessively low instream flows (due to irrigation releases and withdrawals) are the largest single in-basin constraint on natural production in the Yakima River Basin. In low-water years, the demand for water for consumptive uses exceeds the water supply available from the Yakima River. Thus, attempts are being made to address instream flow needs through legislation, cooperation, and other means. Other efforts, which include measures to enhance Yakima River Basin water resources, also are expected to benefit anadromous fish production. In October 1994, legislation was passed by Congress (the Yakima River Basin Water and Conservation Act, Public Law 103-434) to authorize water conservation activities, including improvements to irrigation water delivery systems and a basin-wide water conservation program. Title XII of this Act focuses primarily on a conservation program that will conserve water by improving delivery systems and on-farm practices. Sixty-five percent of the water saved through these measures will be dedicated and used for instream flows. Other elements contained in Title XII include the 1-meter (3-foot) rise of Cle Elum Dam, which will provide approximately 18,510,000 m^3 (15,000 acre-feet) of water for instream flows; electrification of the Chandler hydropumps, which will improve instream flows between Prosser Dam and Chandler Powerhouse; and efforts to improve instream flows on a number of tributary streams.

3.9.3 Land Management

Land management activities can affect fisheries habitat in the Yakima River Basin. Several programs are ongoing in the Yakima Basin, including those discussed below.

3.9.3.1 Wenatchee National Forest Land and Resource Management Plan

Much of the salmon and steelhead spawning and rearing habitat in the Yakima River Basin is located on or near the Wenatchee National Forest. Lands controlled by the Wenatchee National Forest are managed pursuant to the Land and Resource Management Plan. This plan includes protection of and improvement to salmon and steelhead spawning and rearing habitat.

In addition, the Wenatchee National Forest Land and Resource Management Plan has been amended by the Record of Decision for Amendments to Forest Service and Bureau

of Land Management Planning Documents Within the Range of the Northern Spotted Owl (1994) (also referred to as the "President's Forest Plan"). There are four specific components of the President's Forest Plan that affect land and aquatic resource species and stocks: 1) Riparian Reserve designation; 2) Key Watersheds, which comprise a system of refuges for at-risk fish species and stocks; 3) Watershed Analysis; and 4) Watershed Restoration. These components are designed to operate together to maintain and restore the productivity and resilience of riparian and aquatic ecosystems (USDA/USDI, 1994).

3.9.3.2 Timber, Fish and Wildlife

The Timber, Fish and Wildlife agreement was developed in concert with State agencies, Tribes, citizen groups, and the timber industry. The group has assembled to try to develop forest practice rules that accommodate competing demands on resources while maintaining salmon and steelhead spawning and rearing habitat, among other resources, located on state and private timberlands.

3.9.4 Land Use at Proposed Project Facility Sites

Construction of the project facilities would involve a number of sites and land-use policies, plans, and procedures. For example, the Keechelus and Easton Dam sites are owned by the USBR. If these sites were chosen, a grant of a right-of-way would be required for each site. Other land-use policies affecting the Cle Elum hatchery site were discussed in the EA (BPA, 1990a), and are updated and summarized below. Current land-use management at acclimation sites is also discussed below. Ownership and location of the facility sites are summarized in Table 3.5. Consistency with local land use plans is addressed in Section 5.2, and farmlands are addressed in Section 5.10 of this EIS.

- **Cle Elum Hatchery and Acclimation (alternate) Site.** The Cle Elum hatchery and acclimation site is located on private land within a forested area. The site is not improved for recreation, but there is some recreational use.
- **Easton Site.** One alternative tract for the Easton gravel pond site option is owned by the WDOT; the other alternative tract is privately owned.

  The Easton Dam site option is located on the south side of the Yakima River just downstream of Easton Dam. It is in a field situated between the fish screens for the Main Canal, a dirt road paralleling the river, and some railroad tracks. It is owned by USBR.
- **Jack Creek Site.** The acclimation site is owned by Boise Cascade. The site is sparsely forested and has been grazed. Boise Cascade permits camping in a designated campground next to the site.
- **North Fork Teanaway (alternate) Site.** The site is owned by Boise Cascade. It is sparsely forested and has been logged and grazed.
- **Clark Flat Site.** The Clark Flat site is situated in a privately owned field that has been extensively grazed. An illegal dump site on the property appears to have been cleaned up.

- **Keechelus (alternate) Site.** The Keechelus Dam site lies on Federally owned land, but is too close to the dam to be of recreational significance. Public access to this location is generally closely controlled by the USBR.

Table 3.5 Location and Ownership of Land at Proposed Facility Sites

Site	Location	Ownership
Cle Elum hatchery	T20N, R15E, Sections 27, 28, 33, 34	Burlington Northern RR[1], Plum Creek Timber Roslyn, WA
Easton acclimation site Easton gravel pond site option Easton Dam site option	 T20N, R13E, Section 12, SE/4, SW/4 T20N, R13E, Section 11, NW/4, SE/4	 WDOT and private USBR
Jack Creek acclimation site	T21N, R16E, Section 8, E/2, E/2	Boise Cascade Corp. Yakima, WA
North Fork Teanaway acclimation site	T 21N, R16E, Section 4, SW/4 of NW/4 and Section 5, SE/4 of NE/4	Boise Cascade Corp. Yakima, WA
Clark Flat acclimation site	T19N, R17W, Section 28, SW/4	Privately owned
Cle Elum acclimation site	T20N, R15E, Section 33, W/2, W/2	Plum Creek Timber Roslyn, WA
Keechelus acclimation site	T21N, R12E, Section 10, SW/4, SW/4 T21N, R11E, Section 12, E/2, E/2	USBR

[1] BPA is currently negotiating with Burlington Northern Railroad for purchase of the portion of this site that BNR owns.

3.9.5 Solid Waste and Hazardous Materials Management

Facility operation would generate a number of waste materials. The following subsections describe current solid waste and hazardous materials management plans developed for the YFP.

3.9.5.1 Solid Waste

Because most of the proposed facility sites are currently vacant or have very little development, a limited amount of solid waste generation, collection, and disposal is occurring at facility sites. However, solid waste collection and disposal service is available in each of the counties in which facilities are proposed.

In Kittitas County, an exclusive franchise has been granted to Waste Management of Ellensburg, Inc., for solid waste collection and disposal. Under this agreement, Waste Management is required to provide service to any location in the county when requested.

3.9.5.2 Hazardous Materials and Waste

The Cle Elum hatchery site was audited in 1990 for the presence of hazardous substances. None was identified at either of the sites. Hazardous substance audits were also conducted at the alternative acclimation sites in 1993. No evidence of hazardous materials or toxic substance contamination were discovered at the Easton Dam, Jack Creek, North Fork Teanaway, Clark Flat, Cle Elum, or Keechelus sites. The Easton gravel pond site was found to have been used for asphalt batching over the last 20 years, and concern was raised regarding the potential for hydrocarbon contamination. If this site were selected, and hazardous substances were identified at the site, they would be disposed of and the site would be remediated, if necessary, in accordance with applicable regulations. The location of the acclimation site or the site layout would be adjusted, if necessary.

Several chemicals would be used in conjunction with the fish handling facility operations. The chemicals and their handling are discussed in Section 4.1.11.1. The use of herbicides, lubricant oils, and greases at the facilities is also discussed in this section.

4. ENVIRONMENTAL CONSEQUENCES

This chapter contains an analysis of the potential environmental consequences of each project alternative, organized by resource. Potential impacts resulting from the project alternatives (Alternatives 1 and 2) include the impacts of construction and operation of acclimation sites and fish culture facilities, as well as biological and ecological impacts on the aquatic ecosystem. Project impacts for the No Action Alternative are also discussed, as well as cumulative impacts.

4.1 Direct and Cumulative Impacts

4.1.1 Water Resources

4.1.1.1 Alternatives 1 and 2

The proposed project would affect both water quality and quantity in the Yakima River basin. A combination of surface and ground water would be used for the proposed facilities. Both water quantity and water quality impacts are discussed below for both alternatives.

Surface Water Resources

Water Quantity

Low or, at times, insufficient instream flows for fish passage, spawning, and rearing result from irrigation diversions and currently affect fish production in the Yakima River Basin. Efforts are underway to correct some of these problems (see discussion in Section 3.9.2); however these efforts are independent of the Yakima Fisheries Project, and the facilities proposed for the YFP are designed to operate with or without increased instream flows. All YFP facilities are designed to be "water neutral": that is, operation of project facilities would not affect the existing instream flow levels in adjacent streams (except in short bypass sections) or the delivery of water to irrigation districts, canal companies, and individual farms. Operation of these facilities would be consistent with the existing pattern of water deliveries and water management in the Yakima River Basin. Project operation would require withdrawal of water from surface resources during certain times of the year. All facilities, however, are designed to be nonconsumptive: the water would be returned back to the source after it flows through the facility. Consequently, operation of the facilities would not adversely affect surface water supplies available for other uses. BPA or the project managers would apply for a permit for non-consumptive appropriation of surface waters from the WDOE for each of the sites.

Section 3.2.1.1 presents information on flows for the stream segments that would be tapped to supply surface water to YFP facilities. Given the nonconsumptive use of water, and the timing and amount of withdrawals, hatchery and acclimation site

operation and maintenance are not expected to affect flows adversely. The acclimation sites would be operated only from January through June, when surface water flows are typically greatest. At the Cle Elum site, water would be required year-round, but surface water would be supplemented by groundwater, and surface water withdrawals would be reduced during periods of river flows less than 350 cfs (9.8 m^3s). Water for facility sites would be pumped from an adjacent location on the river or stream and returned directly to it.

Except for the Keechelus site, streamflows for facility sites are adequate to support operations without affecting aquatic resources in the bypassed reaches of the source stream. Distances between the diversion (intake) and return (outfall) points would be minimized to reduce adverse effects on aquatic life in the source streams. At the *Keechelus* site, streamflows would not be available at those times when the reservoir releases are stopped to allow refill. The possibility of using water piped directly from the reservoir is being explored.

At the *Jack Creek and North Fork Teanaway* sites, low flows in the Teanaway River downstream of the sites near the confluence of the Teanaway and the Yakima Rivers during the late summer and fall months might affect upstream migration and spawning of spring chinook salmon. Water conservation measures (such as converting irrigation from surface to groundwater use) are being studied to see whether they could improve flows in this reach.

Water rights in the Yakima River Basin, including rights for instream flows, are the subject of a general stream adjudication begun by the State of Washington in 1977 (see Section 3.9.2.2). The adjudication process is a means by which instream flow rights would be established in the basin. Furthermore, project facilities are designed to operate under current water management practices and would be reviewed in light of any future changes in water management. The adjudication process will proceed totally independently of the YFP. BPA is not a participant in the adjudication process, and project facilities would not affect that process in any way.

Increased instream flows would benefit fish resources in the Yakima River Basin, regardless of the future of the YFP. Attempts are being made to address instream flow needs through legislation, cooperation, or other means. BPA and the project managers support such efforts and encourage all entities in the Yakima River Basin to pursue such measures. In the meantime, however, the YFP is designed to operate with existing instream flows, and would obtain the non-consumptive water use permits required by the State of Washington for the hatchery and acclimation site facilities. **In summary, operation of project facilities would not affect existing water rights in the Yakima River Basin.**

Several members of the public expressed concern about YFP fish moving into tributaries that currently do not support anadromous fish, and consequently increasing the demand for instream flows in these tributaries for fish. BPA recognizes that future

conflicts regarding water availability for fish and irrigation diversions may arise when adults return to the basin. It is not possible to estimate the nature or extent of any potential conflicts at this time. As is mentioned in the paragraphs above, the State of Washington adjudication process is the forum for dealing with these conflicts, if they should occur.

The water supply depends on uncontrollable forces such as weather patterns, problems with water delivery systems, and effects of water conservation innovations. Water availability would also be affected by the actions of other diverters in the vicinity. Also, an increase in the numbers of fish returning to the Yakima River Basin may not be attributable solely to the Yakima Fisheries Project. Other activities may affect numbers, such as the following:

- future habitat maintenance and improvement efforts in the Yakima,
- water flow conditions in the mainstem Columbia River,
- bypass and screen projects to protect outmigrating smolts at mainstem dams,
- juvenile screening improvements with the Yakima basin,
- ESA-related protection measures,
- CRFMP reprogramming efforts, and
- other related habitat or fish production activities

All these share the potential and, in most cases, the intent to return more adult salmon to the Yakima basin.

The YFP fish production activities would be conducted within the complex network of these existing and planned fish productions and habitat improvement efforts. Any mix of these activities in concert with future weather and environmental conditions could combine to influence the number of fish in the Basin and the availability of water.

Water Quality

The construction and operation of the proposed project facilities might result in impacts on surface water quality. Construction can cause erosion, which can result in increased turbidity in receiving streams. A General Permit issued by the WDOE is required for construction on 2 or more ha (5 or more ac.) that result in discharge of storm water offsite, unless they are covered under an individual permit. Some construction activities would unavoidably violate state water quality standards on a short-term basis. In such cases, a Water Quality Modification would be obtained from the WDOE, as required.

Primary effects from operation of the facilities might include impacts on receiving streams from nutrient loads coming from the various fish hatchery, rearing, and acclimation facilities. This movement of nutrient load into receiving streams can result in excessive algal growth. However, no definitive information exists concerning impacts of this type under the operating conditions planned for this project. Potential

effects would be largely mitigated by hatchery management practices, dilution in receiving waters, and natural processes, including degradation. National Pollution Discharge and Elimination System (NPDES) permits would be obtained from EPA Region 10 for the discharge of any pollutant regulated under the Clean Water Act, and all facilities would operate within the parameters permitted.

The approach used for assessing potential cumulative impacts of the YFP on water quality was based on flow volumes and nutrient concentrations of both the facility effluents and the receiving water. Estimated concentrations of nutrients in the receiving water were then compared with levels known to produce changes in receiving ecosystems. "Worst-case" scenarios (when effluent contributions are greatest, usually during periods of lowest river flow) were developed to calculate "worst-case" impact. Since resulting concentrations were below problem levels, no further calculations were made for other times of the year.

In the analysis, predicted nutrient levels were compared against the following criteria (EPA, 1986; Rinella et al., 1992):

- Maximum nitrate levels should not exceed 1 to 2 mg/L.
- Upper critical level of phosphate is 0.1 mg/L.

A discussion of the calculations for the planned facilities and an estimate of the potential impacts are presented below for Alternatives 1 and 2. Flow conditions and estimated nutrient concentrations are summarized for the Cle Elum hatchery in Table 4.1 (below).

Cle Elum Hatchery facility. Discharge from this site would be near the upper end of the oxbow ponds located at the site (Figure 2.5). In order to reach this discharge point, approximately 300 m (1,000 ft.) of new stream channel would be created between the hatchery and an isolated pond. The pond would be reconnected to the rest of the oxbow system through 90 m (300 ft.) of former river channel that is currently dry. Approximately 300 m (1,000 ft.) of the oxbow pond system would be converted back into a riverine condition by the effluent flows from the hatchery. The discharge from the hatchery of 2.0 m^3s (72 cfs) would be 5 to 12 times greater than the existing flows through the oxbow system, and would increase the flushing rate of the lower two oxbow ponds ten-fold or more.

The effluent would be discharged back to the Yakima River through a modified outlet structure at the location of the existing oxbow pond outlet. Retention time of the effluent in the oxbow ponds would be less than 12 hours.

The maximum concentrations of the nutrients nitrogen and phosphorus from the hatchery would occur during August through October (Table 4.1). Calculations were based on a production level of 810,000 fish and the scheduled feeding rates shown in Appendix A of the Preliminary Design Report (BPA, 1990b). The flow through the oxbow pond system would be 80 to 90 percent hatchery effluent, so it is appropriate

to compare the effluent nutrient concentrations with the target concentrations for avoiding excessive plant growth of 1 to 2 mg/L of nitrogen and 0.1 mg/L of phosphorus. Maximum concentrations of nutrients in the hatchery effluent (Table 4.1) would range between one-fifth and one-tenth the target values for flowing waters (USEPA, 1986; Rinella et al., 1992), and should not cause excessive plant growth in the oxbow ponds.

Further dilution of the effluent would occur after discharge from the oxbow ponds to the Yakima River. Historic low flows during September through November have been very low in some years. However, under current management agreements, the minimum flow at the Cle Elum site has been set at 325 cfs (9.1 m^3s) for protection of spring chinook eggs in the river. Return of the hatchery flow of 2.0 m^3s (72 cfs) to the river would result in a 3.5-fold dilution of the effluent at the 9.1 m^3s (325 cfs) total flow.

Table 4.1 Maximum Nutrient Discharge from the Cle Elum Hatchery (Concentrations as mg/L Nitrate-Nitrogen and Total Phosphorus)[a]

	Month		
	August	**September**	**October**
NO_3-N	0.10	0.13	0.11
Total P	0.014	0.016	0.015

[a] Assuming background concentrations in the source water (Yakima River) of 0.03 mg/L nitrate-N and 0.01 mg/L phosphorus

Acclimation Sites. Nutrient loading to tributary streams from operation of acclimation raceways were estimated using an effluent volume of 0.24 m^3s (8.7 cfs) and lowest stream flow values in March, April, and May. Nitrogen and phosphorus concentrations for effluent from the acclimation raceways were based on fish feeding rates at full production capacity and over an average of known water temperatures during the acclimation period (H. Senn, Fish Management Consultants, pers. comm.). These values are 0.30 mg/L nitrogen and 0.021 mg/L phosphorus for each acclimation site.

Estimated concentrations in receiving waters were based on previously measured values: 0.03 mg/L nitrogen and 0.01 mg/L phosphorus for the Yakima River and tributaries. Based on these values, none of the sites was estimated to exceed recommended levels for nitrogen or phosphorus. Thus, it is highly unlikely that any problems involving excessive nutrients and resulting algal growth would be encountered in receiving waters as a result of discharges from acclimation raceways.

Cumulative Surface Water Quality Effects

The additive effects of effluents from the fish culture facilities on the Yakima River and its tributaries were analyzed to determine the potential for cumulative effects for both alternatives. Total cumulative nutrient discharge to the Yakima River system from the hatchery and acclimation sites would be highest during March and April when nitrate-N concentrations would be 0.22 to 0.30 mg/L in a total effluent of 65 cfs. However, these discharges would be distributed throughout the upper Yakima basin.

Results of these calculations indicate that hatchery effluents under either alternative would not adversely affect the aquatic ecosystem as a result of increased nutrient loading. For small streams, any increase in nutrient would be localized and of short duration. Additionally, nutrient inputs for low-nutrient headwater streams might increase primary production, leading to increased potential for fish production.

Groundwater

Yakima River Basin floodplain soils and sediment are highly permeable. Consequently, its groundwater resources are susceptible to contamination from pesticides, fertilizers, and animal and human wastes. Project managers would implement measures to ensure that project facility construction and operation do not adversely affect groundwater quality, including treatment of runoff from access roads and other impervious surfaces. Operation of acclimation sites is not expected to alter local groundwater conditions because small volumes of water would be used. No adverse effects on shallow groundwater aquifers are expected from the construction and operation of the acclimation sites.

The Cle Elum central facility would obtain groundwater from wells in a confined aquifer that is hydraulically isolated from other Yakima River Basin water resources. To determine whether pumping of this aquifer would affect existing wells, well logs of 44 existing wells in the vicinity of the site were investigated. Of the 44 logs, only one showed characteristics indicating that the well might be drawing from the same aquifer as the hatchery site wells. Computer simulations show that the hatchery wells are sufficiently separated in distance from this residential well that it would not be affected by pumping at the hatchery wells.

Groundwater resources at the acclimation sites have not yet been investigated. However, due to the small amounts of water (0.06 m3/s or 2 cfs) necessary and to the limited period of use (January to May), groundwater depletion if not anticipated to be a problem at these sites.

Floodplain/Wetlands Assessment

In accordance with the Department of Energy regulations on Compliance with Floodplain/Wetlands Environmental Review Requirements (10 Code of Federal Regulations (CFR) 1022.12), BPA has prepared the following assessment of the impacts of the Yakima Fisheries Project on floodplains and wetlands. A notice of floodplain/

wetlands involvement for this project was published in the Notice of Intent to prepare the EIS. The paragraph below on floodplain effects also serves as the Floodplain Statement of Findings required by 10 CFR 1922.15(6).

Three alternatives for the project, including the No Action Alternative, are described in Chapter 2 of this EIS. The floodplain and wetlands locations are described in Section 3.2.3. Since no additional facilities would be constructed under Alternative 2, there would be no difference in floodplain/wetlands impacts between the two alternatives. The No Action Alternative would not affect floodplains or wetlands.

Floodplain effects

Under Executive Order 11988, Federal agencies must avoid or minimize adverse impacts associated with short-term or long-term modification and occupancy of floodplains. Modification and destabilization of the floodplain could have potentially adverse effects not only near the disturbance, but in the stream channel and floodplain great distances downstream. Adverse impacts include the potential for flood damage to the facilities, increased flooding due to displacement of water from the normal floodplain by the construction of the facilities, and increased potential for erosion of floodplain soil and sediment near the construction sites.

After detailed studies of the site, CH_2M Hill determined that the river pump station at the Cle Elum hatchery site would be the only facility located in the 100-year floodplain for the Cle Elum site (Weigum, 1994). Detailed studies have not yet been conducted at the acclimation sites; development and operation of these facilities would occur outside the floodway but possibly within the defined 100-year floodplain. County authorities and the Federal Emergency Management Agency would be contacted to ensure that any new construction would not alter floodplain characteristics or channel flow capacity. Certain design restrictions or limitations may apply. If facilities were located within the floodplain, they would be designed to withstand flooding. Construction impacts within the 100-year floodplain would be mitigated by ensuring that construction would not raise the expected level of the 100-year flood and would include minimal use of impervious surfaces. Overall, the proposed project activities would not adversely affect human life, property, or natural floodplain values.

Wetland effects

Wetland vegetation was observed near the Cle Elum hatchery facility and Clark Flat, North Fork Teanaway, and Jack Creek acclimation sites (see Section 3.2.3). The proposed Cle Elum hatchery is sited on a terrace above the oxbow ponds, in an area that has previously been disturbed, to minimize loss to any wetlands in the area. Wetland delineations conducted by CH_2M Hill in 1994 indicate that impacts on wetlands would occur from the siting of the water discharge structure and the access road. Total wetland impacts at these two areas would be 0.1 ha (0.24 ac.). The discharge of hatchery water through the oxbow ponds might result in inundation of wetland vegetation, decreased flushing time for nutrients in the wetlands, higher channel velocities, and increased siltation and sedimentation. The current site of the

proposed interpretive center facilities could potentially affect adjacent wetlands through septic system and parking lot drainage. These impacts would be mitigated through careful design and siting of the facilities, which would take place during the Corps wetlands permitting process. The loss of 0.1 ha (0.24 ac.) of riparian wetland at the site would be mitigated by constructing 0.2 ha (0.54 ac. or 1,000 lineal feet) of outflow channel to the oxbow system with 0.14 ha (0.34 ac.) of fringing riparian emergent wetland, and by constructing an additional 0.06 ha (0.14 ac.) of isolated emergent wetland.

Detailed delineations of the acclimation sites have not yet been completed, but preliminary characterizations were considered during selection of the sites. Delineations would be completed before facility final design, siting, construction and operation to avoid impacts on wetland habitat. Information from delineation surveys would be used during final design to develop mitigation measures, if necessary, to ensure that the project would result in no net loss to wetlands. Review and concurrence through the Corps permit process would be completed as necessary before site development. Disturbance of wetlands during construction activities would be avoided whenever possible. If disturbance could not be avoided, the area of disturbance would be minimized to the extent practicable. Most disturbance would be temporary and would not constitute any net loss to wetlands. Upon completion of construction, excavated areas would be backfilled, and disturbed land restored to its previous condition wherever possible.

4.1.1.2 No Action Alternative

Under the No Action Alternative, current surface and groundwater resources practices would continue, including the water rights adjudication process and legislative efforts to improve instream flows. Some measure of habitat enhancement (through increased flow, improved water quality, or physical habitat changes) would be implemented through the Council's Columbia Basin Fish and Wildlife Program.

Since no project facilities would be constructed under this alternative, there would be no impacts on surface or groundwater resources from the use of these resources. Water quality would not be affected by the release of nutrients from the facilities. Floodplains and wetlands also would not be affected under the No Action Alternative.

4.1.2 Fisheries Resources

4.1.2.1 Alternatives 1 and 2

Introduction

Several concerns were raised in the YFP EIS public scoping meetings and on the DEIS about potential project impacts on existing fisheries resources. Major concerns included

genetic and ecological risks to wild fish populations and potential impacts on resident trout resources upstream from Roza Dam.

The hatchery-released fish and naturally produced offspring of returning adults from the YFP could interact genetically and ecologically with existing naturally spawning fish populations. In some cases, potential impacts could be considered adverse (for example, could result in decreased growth rate or numbers for existing resident trout populations). In other situations, however, existing populations might increase in response to increased natural production of chinook fry that could serve as prey for resident trout or squawfish populations (Martin et al., 1992).

At present, estimation of the actual effects of proposed supplementation activities on Yakima River fish populations (both resident and anadromous species) must be largely speculative because applicable data is scarce, and the field of study has limitations, as do theoretical analytical approaches needed for accurate predictions. However, it is likely that the released supplementation fish themselves, coupled with a possible increase in natural production (approaching the carrying capacity of the basin) from returning adult hatchery spawners, would affect pre-existing fish populations to some extent. This section of the EIS discusses the risks identified and other potential impacts of both Alternatives 1 and 2 and summarizes the results of recent studies that address them.

Risk Analysis

As a part of the adaptive management framework adopted for this project, the potential impacts mentioned above and others were addressed in risk analyses (see Section 2.2 for a discussion of adaptive management as it applies to this project). The risk analyses systematically examined the objectives, strategies, assumptions, and uncertainties for the proposed actions. They also addressed the risks of the project not meeting its objectives. While these analyses do not directly address the risks of the project on the Yakima River Basin ecosystem, the objectives that have been adopted for the project do address these risks. A risk analysis was prepared for upper Yakima spring chinook supplementation as proposed in both Alternatives 1 and 2 in 1993 (Mobrand, 1993), and a risk analysis for the coho study as proposed for Alternative 2 was prepared in 1995 (see Appendix B).

Project objectives for the YFP spring chinook program were identified in four categories: genetics, natural production, harvest, and experimentation. Accordingly, the spring chinook risk assessment document discussed in detail the risks of not meeting the objectives in all four of these categories, as described below:

- *Experimentation risk* - the risk of not being able to meet the experimentation objectives for the project, which are to learn how to use supplementation as a strategy to increase natural production and harvest opportunities.
- *Harvest risk* - the risk of not being able to meet the harvest objectives for the project, which are generally defined as increasing the harvest opportunities for all

anglers consistent with the requirements of the genetic, natural production, and experimentation objectives.

- *Genetic risk* - the risk of not being able to meet the genetic objectives for the project, which are generally defined as maintaining the long-term fitness of the target populations while keeping the ecological and genetic impacts on non-target populations within specified biological limits.
- *Natural production/ecological interaction risk* - the risk of not being able to meet the natural production/ecological interaction objectives for the project, which are generally defined as optimizing natural production while managing adverse impacts from interactions between and within species and stocks.

The coho study is much simpler than the spring chinook program. Since it is solely a monitoring effort, its objectives can be most concisely summarized in one category: experimentation. Specifically, the experimentation objectives of the coho study are:

- to determine the feasibility of returning natural production of coho salmon to the Yakima River Basin;
- to determine the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin; and
- to determine the predation impacts of releasing 700,000 acclimated coho smolts on fall chinook populations in the Yakima River Basin.

The purpose of the coho risk analysis, then, is to evaluate and discuss the risk of the coho program not being able to meet these experimentation objectives.

To address the identified risks, three different approaches were used. Monitoring measures were identified; objectives were refined; and/or alternative strategies were selected. Not all of the identified monitoring measures were feasible; these would be considered for future research and development. Feasible measures were incorporated into a monitoring plan. The monitoring plan for upper Yakima spring chinook is discussed in Section 2.3.3, and the plan for coho monitoring in Section 2.4.3.2.

Experimentation Risks and Impacts

The experimentation risks were identified as the risks of not meeting the experimentation objectives for the project. Since the objectives of the spring chinook program and coho study are different, their experimentation risks are discussed separately below.

Upper Yakima Spring Chinook. Two types of experimentation risks were identified for this program:

- the risk of not being able to test that (1) production levels have increased in sections of the river where supplementation has occurred or (2) there are significant differences between the Optimal Conventional Treatment and the New Innovative Treatment; and

- the risk of not learning about the quality of the supplemented fish and about their impacts on the ecosystem.

The first risk addresses the success of the supplementation project in terms of numbers of fish returning to spawn. The second risk addresses the quality of the supplemented fish, as judged on the basis of four categories: survival of the fish after they are released until they return to spawn; reproductive success of the fish (number of offspring produced per spawner); long-term fitness of the fish (genetic diversity and long-term productivity); and ecological interactions of the fish with the existing ecosystem (as measured by population abundance and distribution, growth rates, carrying capacity, survival rates, transfer of disease and gene flow). The second type of experimentation risk is based on the assumption that the naturally spawning fish represent the best quality for the system. Therefore, in order to determine the success of this aspect of supplementation, the supplementation fish would be compared with the naturally spawning fish to determine whether the YFP has reached the goal of creating fish as close as possible to the naturally spawning fish, as judged by the four categories listed above.

In order to address these risks for supplementation of upper Yakima spring chinook under Alternatives 1 and 2, an experimental design has been developed. No new or refined strategies were proposed by the risk assessment, but several measures were identified to be incorporated into the monitoring plan.

Lower Yakima River Coho Salmon. For the coho study under Alternative 2, the experimentation risks have been defined as the risk of not being able to meet the experimentation objectives for coho, which are listed above.

Coho are currently considered to be extinct in the Yakima River Basin, but approximately 700,000 hatchery-spawned yearling coho have been released there since 1982 (except in 1984), as part of the *US v. Oregon* CRFMP. Before 1994, these released coho were not acclimated, and their survival rate from smolt to returning adult has been about 0.04% (Watson, 1993), or about 280 fish from a release of 700,000. Strategies to meet the first two objectives are based on the detection and counting of returning adults from the annual smolt release of 700,000. Clearly, knowing the survival rates of these fish is essential to meeting these objectives, so understanding the overall survival picture is a key element of the risk analysis.

Several factors potentially affecting the survival of coho have changed since the 1993 estimates, which may lead to increased survival in the future. First, the acclimation of the smolts definitely resulted in an increase in their survival from the time of their release to their passage through the smolt monitoring facility at Prosser Dam. A recent 3-year study comparing survival of acclimated and nonacclimated early stock coho in the Umatilla River demonstrated that

acclimation increased survival by 50% (Technical Advisory Committee, 1995). Second, the ocean and river harvest of coho was greatly reduced in 1994, due to the poor returns of adult fish throughout the Columbia River Basin. Third, the NMFS is reviewing a petition to list coho as an endangered species coastwide. If this occurs, there could be a substantial reduction in the ocean and river harvest quotas in the future.

On the other hand, there is considerable uncertainty in predicting survival rates to adulthood of any fish in the Columbia basin. Major factors influencing survival include survival through outmigration in both the Yakima and Columbia Rivers, ocean survival, future harvest levels for both sport and commercial fisheries, and upstream migration survival of adults returning to the Yakima basin. All of these factors are outside the control of the project.

Risks to Research Objective 1 - determining the feasibility of returning natural production of coho salmon to the Yakima River Basin. The risk of most immediate concern is that the survival rate to adulthood will be so low as to preclude sufficiently precise estimation of survival rates. Imprecise estimates are likely to give an unduly pessimistic view of survival to be expected from a potential future expansion of the coho program.

The second major risk to this objective is the inability to evaluate the reproductive success of the returning adults. This is a very real risk in that the coho smolts are currently being acclimated in areas that would not support natural production of coho (due to low flows and high temperatures in summer). If coho adults return to spawn near their acclimation release site, the resulting progeny would either have to migrate out of the Yakima basin or die during the summer rearing period. Estimates of natural production from returning adults would clearly be better if the fish were released in areas that are determined to be good coho spawning and rearing habitat, but this is not possible under the current release program.

Both of these risks could be reduced substantially by the release of larger numbers of smolts, but at this time the potential increased risk to other species due to interactions seems too great to permit these larger releases.

Risks to Research Objective 2 - determining the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin. Estimation of potential harvest benefits from releasing coho depends entirely on the rate of return of adult fish to the local fisheries, so the risks to this objective are identical with the first risk listed for objective 1. If accurate information on the number and rate of returning adult coho salmon cannot be obtained, the ability of the managers to make an informed decision on whether or not to expand coho releases would be impaired. An incorrect decision has obvious consequences for the long-term objective of increasing coho salmon harvest opportunities for all anglers.

Risk to Research Objective 3 - determining the predation impacts of releasing 700,000 acclimated coho smolts on fall chinook populations in the Yakima River Basin. Coho releases have been approached cautiously because of the possibility that coho smolts may prey upon juvenile fall chinook as the coho migrate through fall chinook production areas in the lower reaches of the Yakima River Basin. Objective 3 calls for a monitoring program designed to resolve this question of predation. Since the research would be carried out entirely on the released smolts before they leave the basin, survival to adulthood is not a factor here. Risks to objective 3 all relate to the possibility that sufficiently precise estimates of the predation impact from coho releases cannot be obtained through the monitoring. The consequences of this are clear. The managers could decide to expand coho program when expansion would depress fall chinook production, or they could decide not to expand (and thus forego) production and harvest opportunities when expansion is warranted.

Development of a sufficiently extensive and powerful research program to obtain the necessary information on coho predation is a difficult task. Therefore, the study would occur in stages. The first stage would essentially be a feasibility study conducted during the first year of the program. During this stage, preliminary data would be collected and used to design a more sophisticated second-stage study that would yield the desired information needed to decide upon expanded coho releases. Even with the benefit of the first-stage preliminary information, there could still be a risk of not gaining the information needed to determine precisely the predation impact of coho on the fall chinook population. However, this risk cannot be evaluated until the first stage work is completed. It is important to understand that the staging of the research is a risk reduction strategy. The first stage work would be used to reduce the risk of the full study.

Harvest Risks and Impacts

The harvest risks identified in the risk analyses are defined as the risks of not meeting the harvest objectives for the spring chinook and coho programs.

Upper Yakima Spring Chinook. Two types of harvest risks were identified in the risk assessment:

- the risk of not being able to control harvest access that could affect long-term sustainable harvest yields through harvest policy and regulations; and
- the risk of not obtaining accurate data on harvest by stock in order to estimate harvest rates that will be sustainable in the long term.

The first risk addresses the expectation that a regulatory package and complementary policy can be put in place that will ensure implementation of the harvest strategy. The assumption is that fisheries in the basin can be managed and regulated and that laws can be enforced. A functional regulatory presence can be

effective in supporting project objectives only if certain underlying assumptions are effective and in place to guide and support regulatory management:

- Spawner recruit or stock productivity relationships must be developed to establish appropriate harvest rates for each stock component.
- A status-indexed or selective harvest policy must be described in sufficient detail to allow effective implementation.
- Methods to develop pre-season forecasts and in-season updates of run size and composition must be available.

The second risk addresses the necessity to secure accurate information about harvest numbers so managers can evaluate the impacts of harvest on each stock to assess strategies that assure long term sustainability of harvest while achieving complementary project objectives. Some fundamental assumptions must be in place to facilitate collection of pertinent information. Most importantly, the project would supply the following:

- All first-generation adult fish resulting from the supplementation project would be readily identifiable by origin for selective harvest purposes.
- All harvest of Yakima spring chinook would be monitored through catch sampling.

The project monitoring plan (Section 2.3.3) would include a harvest monitoring program designed to detect specific levels of harvest impacts. A monitoring program sufficient to address each element of risk and to verify assumptions would include adult monitoring to determine the timing and identification of:

- marks on fish in a test fishery;
- adults returning to Prosser;
- fish in the harvest; and
- adults returning to Roza.

It should be noted that the YFP Policy Group does not exercise control over harvest regulations. The assumptions and monitoring plan would provide necessary data to assess project strategies and would be a primary source of information for managers to implement harvest policy. A current Memorandum of Understanding between the YIN and the WDFW captures the manager's intent to coordinate project objectives with harvest management functions.

Lower Yakima River Coho Salmon. The harvest risks for the coho program are discussed under the experimentation risks and impacts section, above.

Genetic Risks and Impacts

Four types of genetic impact/risk are relevant to YFP planning (Busack, 1990; Busack and Currens 1995 (in press)):

1) extinction,
2) loss of within-population variability,
3) loss of between population variability, and
4) domestication selection.

Extinction represents the most extreme type of risk. Once a population is extinct, all its genetic variability is irretrievably lost. Extinction can be caused by any activity that reduces a population below a minimum viable level. Although extinction is a genetic impact, it typically has demographic rather than direct genetic causes.

Loss of within-population variability is commonly associated with hatchery production. Loss can be due to genetic drift as a consequence of small population size or to non-random selection of hatchery broodstock. Since genetic variability is the raw material upon which selection acts, this loss in variability may manifest itself as a decreased responsiveness to natural selection, with a resulting drop in fitness.

Loss of between-population variability is also called loss of population identity. If two populations are mixed, there may be no loss of genetic material overall, but the genetic distinctness of the two populations will be lost. The mixing will cause a recombining of genes that had formerly occurred in combinations called "coadapted complexes." Particular desirable genotypes distinguishing a population, such as run timing or body size, might become absent or less frequent. The new combinations of genes might result in lower fitness in the mixed population, a phenomenon called "maladaptation." The most extreme form of this type of impact is genetic extinction: the fish are still present, but their genetic distinctness is lost.

Domestication selection needs to be considered in assessing the impact of hatchery operations on salmon and steelhead. Hatcheries, despite careful attempts to avoid causing genetic change, may impose new selection regimes on the fish in the course of standard fish culture techniques, causing increased fitness in the hatchery environment, but decreased fitness in the wild.

The four types of genetic risk differ widely in theoretical basis, difficulty of measurement, and empirical evidence in salmonids. Thus, opinions vary widely among geneticists and managers as to the extent to which a population is damaged by sustaining a specified level of impact. Domestication selection is the most controversial; loss of within-population variability, the least. Intermediate in controversy is the importance of loss of between-population variability. Extinction risk, the most theoretical and thus least amenable to evaluation at the project level, is difficult to rank in this context. At this point, the project managers have not conducted population viability analysis to analyze extinction risk, and have made the

simplifying assumption that, by minimizing type 2, 3 and 4 genetic impacts, extinction risk is adequately controlled. For purposes of this discussion, any severe type 2 impact should also be considered a type 1 impact.

Quantifying genetic risks and impacts of salmon production programs currently is a crude art. Potential impacts can be described in genetic terms (e.g., percentage loss of variability). Predicting the consequent reduction in fitness, however, is very tenuous, in part because a genetic impact's severity is determined not only by magnitude and duration of a hazard, but probably also by the initial condition of a population, which geneticists have only a limited ability to measure. Nevertheless, it is possible to identify potential genetic risks, and to rate the relative reduction or increase in risk of alternatives. It is also possible generally to rank risk types in terms of probable effect on fitness. Although the ranking could be changed by relative magnitude, type 2 impacts probably have the largest effect on long-term fitness of the population and type 4 the smallest effect. Type 3 is again intermediate.

In order to address these risks for the YFP, a genetic inventory of the stocks to be supplemented in the Yakima River Basin has been prepared, as well as genetic guidelines for hatchery operations. Genetic risks have been addressed in two risk assessment documents which discuss both upper Yakima spring chinook and coho (Busack, 1990; Currens, 1993); and in the overall risk analysis prepared for upper Yakima spring chinook (Mobrand, 1993). The risk analysis for upper Yakima spring chinook identified four new or redefined strategies for meeting the genetic objectives. Genetic risks were also addressed in the monitoring plans for each stock. These activities were conducted by geneticists at WDFW, in cooperation with consulting academic geneticists, and are characterized below.

Genetic Inventory. Genetic research has been conducted since 1989 to enumerate and characterize the salmon and steelhead stocks in the basin. With completion of spring chinook sampling and lab work in 1993, a full generation of data is available. Three spring chinook stocks--American River, Naches, and upper Yakima--have been identified.

Genetic Hatchery Guidelines. Several aspects of hatchery operations, such as broodstock selection and mating protocols, can have profound impacts on the maintenance of genetic diversity. Given the overall genetic conservation goal of the project, a comprehensive set of hatchery operational guidelines must be developed and designed to minimize genetic risks. A draft genetic guideline document for the YFP was completed in 1993 (Kapuscinski and Miller, 1993). These guidelines, developed in consultation with several geneticists, rely heavily on the hatchery guidelines being developed in the Council's genetic workshop program. They provide hatchery personnel with specific recommendations or guidelines for hatchery personnel in making operational decisions in a genetically sound manner. All aspects of hatchery production from broodstock collection to release are addressed.

Genetic Risk Assessment. Project planners have called for two levels of risk assessment: level I for a general statement of risk, and level II for a detailed operational assessment. Level I (also called the *qualitative* genetic risk assessment) was developed to outline the potential genetic risks of the project (Busack, 1990). This document first described the four categories of genetic risk, and described the risks posed by the full project as it was understood at that time. This was the first risk assessment in the basin, and has been used as a model for other assessments.

The level I assessment addressed the features of the project designed to minimize genetic risk, including extensive substock identification work, separate culture of substocks and release into natal areas only, complete tagging of hatchery releases for assessment and control of straying, and a variety of broodstock management practices to maximize effective population size and limit the effects of domestication selection. The adaptive management strategy outlined in Section 2.2 would be used to ensure that methods and research are continually reviewed and refined as the project progresses. A long-term genetic monitoring program would also be implemented to evaluate changes in within- and between-population variability, as well as changes in variability in quantitative fitness-related traits. A level II document (or *quantitative* risk assessment) was produced for the project in 1993 (Currens, 1993). This document linked genetic risk assessment to other types of biological risk assessment, clarified terminology, and went much farther in quantifying risk than the 1990 document. It emphasized the importance of a management structure in controlling risk, but dealt in much less detail with specific risks posed by specific actions in the project.

An overall risk analysis which included all four types of risk (experimentation, genetic, harvest, and natural production/ecological interaction) was also prepared in 1993 (Mobrand, 1993), as discussed above. This analysis deals with the specific risks posed by the supplementation of upper Yakima spring chinook, and builds upon the previous two risk assessments.

The genetic risk assessment/analysis results for upper Yakima spring chinook supplementation under Alternatives 1 and 2 and for the coho program under Alternative 2 are summarized below (Busack, 1993).

Upper Yakima Spring Chinook. The spring chinook program under both Alternatives 1 and 2 (supplementation of the Upper Yakima stock by annual release of 810,00 smolts, but no supplementation of the Naches or American River stocks) poses genetic risks to all three stocks.

The types and magnitude of risk vary with success of the program in returning adult fish to the basin. If the program were to return fewer adults than are taken as broodstock (i.e., "mining" broodstock), the genetically effective size of the population would be reduced. Assuming a *worst-case scenario* of no returns at all,

and current mean population levels, each full generation of the program would decrease the population by 50 percent. The population could withstand one generation of this activity without incurring serious genetic impacts, but type 2 impacts would become serious in the second generation. No type 3 or 4 impacts would be sustained by the population, as the assumption is that very few adult hatchery fish would return to spawn.

The two unsupplemented stocks (Naches, American River) could also be reduced in size as an indirect effect of the reduction of the Upper Yakima stock if effective in-river harvest rates for them were increased substantially. However, for this to happen, smolt-to-adult survival of Upper Yakima hatchery fish would have to be close to zero.

In summary, the Upper Yakima supplementation effort could perform very poorly for a full generation without serious genetic impacts, assuming current average escapement levels were maintained for all three stocks.

Under an assumption of a *successful* Upper Yakima supplementation program (i.e., project returns more spawners than are taken as broodstock), the risk picture is quite different. Type 2 risks to the Upper Yakima stock diminish with increasing program success, but the risk of domestication selection, inherent in all hatchery programs, increases. The magnitude of this type 4 impact depends on the intensity of the selective forces present, and the exposure of the population to them. The latter factor is a consequence of what proportion of time, on average, a gene in the population spends in the hatchery environment. This risk would be limited by the strategies of using only naturally spawning fish as broodstock, by limiting the percentage of wild or native fish removed for hatchery broodstock, and by managing the percentage of hatchery fish on the spawning grounds.

As the success of the Upper Yakima spring chinook supplementation program increases, type 3 risk to the other spring chinook stocks would increase if the effective stray rates into them were to increase, either as a result of a greater tendency of hatchery fish to stray or as a result of increased numbers of Upper Yakima spring chinook straying into these populations at current rates. Domestication selection could also spread into these stocks as Upper Yakima fish stray in. Current stray rates among the three stocks are unknown; however, spring chinook appear, from the limited data available, to have very low straying rates (0-5%), especially when they have been acclimated.

Straying to other basins could also increase because of the causes mentioned above. However, acclimated spring chinook have very low straying rates. There are no known incidences of spring chinook straying from the Tucannon hatchery into other watersheds (Busack and Hopley, pers. comm. 1994).

The increased Upper Yakima spring chinook stock poses another type of risk. As that stock becomes more numerous, the American River and Naches stocks make up a smaller percentage of the in-river mixed-stock fishery. Type 2 impacts could occur if the fishery were not managed for acceptably high minimum escapements of these stocks. For the YFP, however, it is anticipated that moderate harvest levels can be monitored and regulated closely enough to reduce this risk.
The situations above assume a model of three independent stocks. The spring chinook natural production modeling exercise described in Section 2.3.1 took a different approach, considering that a key feature of spring chinook juvenile mortality may be density-dependence due to a type 3 functional predator response. This means the three stocks are linked because juvenile mortality (from predation) in a given stock is determined not only by its abundance but also by the abundance of the other stocks.

Modeling the spring chinook stocks this way changes the risk picture considerably. It is theoretically possible, then, to achieve substantial production *increases* in the two unsupplemented stocks as a result of the Upper Yakima stock supplementation, because the unsupplemented stocks would make up a smaller percentage of the mixed group, therefore lowering the potential for them to be preyed upon. More of the unsupplemented fish would survive and return to spawn and produce more offspring. This would allow higher harvest rates on the Naches and American River stocks, greatly reducing the potential of type 2 impact from mixed-stock fisheries.

Lower Yakima River Coho Salmon. As discussed in the introduction to the risk analysis section, there are no genetic risks imposed on the project, or the Yakima River ecosystem, from the proposed monitoring of the existing coho acclimation and release project.

Genetic Monitoring. Several measures for monitoring genetic risk were proposed in the risk assessment for upper Yakima spring chinook. These were incorporated into the overall monitoring plan (see Section 2.3.3).

Genetic monitoring of coho is not necessary; there are no genetic risks to coho since the original coho stocks are extinct in the Yakima and surrounding basins. Measures to monitor the genetic impact of the coho program on other stocks are being developed along with the study to determine the predation impact of coho on these stocks.

Natural Production/Ecological Interaction Risks and Impacts

Two main types of natural production/ecological interaction risk were identified in the risk analysis:

- *Limitations of abiotic (non-living) and biotic (living) components of the environment:* There are factors (e.g. inadequate passage conditions, poor water quality, and limited over-wintering habitat) that limit the production of

upper Yakima spring chinook and coho in the Yakima River Basin. The risk lies in either not recognizing these limitations and attempting to increase production without removing them, or attempting to remove these limitations without understanding the structure and function of the environment and its role in production of upper Yakima spring chinook and coho, thereby either making things worse (less production) or wasting resources.

- *Adverse ecological interactions:* There is a potential risk of affecting wild and native populations of fish in the Yakima Basin through an increase of upper Yakima spring chinook and/or coho production. This risk might occur through several mechanisms, including an increase in competition for limited resources or an alteration in the behavior of these other species.

Environmental Limitations. The abiotic and biotic limitations of the Yakima River Basin are being addressed in the context of the habitat improvement and passage improvement activities that are ongoing in the Yakima River basin (discussed in Section 1.4). They are not directly a part of this proposal; however, YFP scientists and managers are involved in coordinating the planning for many of these activities with those of the YFP.

Ecological Interactions. The possibility exists that hatchery and resident salmonids may interact through several mechanisms, including the following:

- hatchery and resident fish might compete directly for food and space during the freshwater rearing phase (Bachman, 1984; Vincent, 1987; Irvine and Bailey, 1992);
- they might prey on one another (Cannamela, 1992; Martin et al., 1993);
- hatchery fish might alter migratory responses of non-target fish (Steward and Bjornn, 1990);
- hatchery fish might alter habitat use, thereby making non-target species more susceptible to predators (Hillman and Mullan, 1989);
- hatchery fish might alter movement patterns of non-target fish (Hillman and Mullan, 1989);
- hatchery fish might increase transmission and susceptibility to disease of non-target fish (Krueger and May, 1991; Pearsons et al.; 1993); and
- hatchery fish might interbreed with non-target fish (Krueger and May, 1991; Pearsons et al., 1993).

Specific examples of possible species interaction scenarios for Alternatives 1 and 2 include, but are not limited to, the following:

- Hatchery fish *might not readily disperse* from the acclimation site, possibly increasing the potential for competitive and predatory interactions with resident salmonids. A rapid dispersal and outmigration of hatchery fish following their release would reduce the potential for these interactions.

- An *increase in the overall standing crop* of introduced salmonids might result in a reduction in the population of resident species. This could occur as natural production approaches stream-carrying capacity and as density-dependent mechanisms (e.g. competition) affect one or more species. This impact springs from the differences in the relative amount of time the two groups would share common food and space resources. Compared to project smolts, naturally produced offspring of project adults might share resources with resident fish during one or more life history stages. The greatest impact on resident fish might not occur immediately following release of project smolts from acclimation sites, but after YFP-produced adults have returned to spawn naturally and their progeny have emerged. The extent of impacts would be expected to increase as overall production reaches or exceeds the carrying capacity of the habitat.

- *Residualism* is the tendency of hatchery smolts to delay or avoid what would otherwise be normal outmigration in the spring. The spatial and annual incidence of residualism is typically highly variable. When fish residualize, they become a part of the stream-reared fish community, competing with resident fish for resources such as food and space, and becoming potential predators (or prey). However, based on work of Cannemela (1993) and Martin et al. (1992), the natural occurrence of residualism in spring chinook salmon has been found to be low, particularly in the headwater areas, and is not expected to pose a significant risk to resident fish. Residualism for coho has not been reported in the literature.

- Hatchery fish may cause *premature or involuntary migration* of other salmonids if the project smolts that migrate downstream create a "pied piper" condition whereby resident or other wild anadromous salmonids migrate downstream with them (Kuehn and Schumacher, 1957; Hansen and Jonsson, 1985; Hillman and Mullan, 1989). This condition could prove to be detrimental to resident fish that would not otherwise migrate or to anadromous fish that would not normally migrate at that time.

- *A positive or negative change in the growth and condition of resident fish* through a change in their diet or feeding habits could occur following the introduction of hatchery fish. Effects on target populations would depend on the degree of dietary overlap, food availability, size-related differences in prey selection, foraging tactics, and differences in microhabitat use (Steward and Bjornn, 1990).

Potential species interactions among fish in the Yakima River are summarized below (Table 4.2) for Alternatives 1 and 2. This table is not intended to reflect the full range of possibilities for species interactions under these alternatives; however, the combinations listed are generally indicative of potential interactions anticipated. The table lists target vs. non-target species combinations and also identifies interspecific target vs. target species combinations where the potential for their occurrence exists.

Table 4.2 Species Interaction Considerations Among Fish Potentially Present in the Upper and Lower Yakima River Basin Under the Yakima Fisheries Project

General Location	Species Assemblage (target vs. non-target)	Interaction Potential [a]
Upper basin	Spring chinook vs. steelhead[b]	competition, predation
	Spring chinook vs. resident salmonids[b]	competition, predation
	Spring chinook vs. nonsalmonids[b]	competition, predation
	Hatchery-produced vs. naturally produced Spring chinook	competition, predation
Lower basin	Spring chinook vs. fall chinook[b]	predation
	Spring chinook vs. coho[b]	predation
	Spring chinook vs. steelhead[b]	competition
	Spring chinook vs. resident salmonids[b]	competition
	Spring chinook vs. nonsalmonids[b]	competition, predation
	Hatchery-produced vs. naturally produced Spring chinook	competition, predation
	Coho vs. spring chinook	competition, predation
	Coho vs. fall chinook	competition, predation
	Coho vs. steelhead	competition, predation
	Coho vs. resident salmonids	competition, predation
	Coho vs. nonsalmonids	competition, predation

[a] Potential mechanisms of interaction

b Species combinations for Alternative 1. All combinations apply to Alternative 2.

To describe quantitatively the competitive interactions and actual impacts between fish populations is extremely difficult, and requires rigorous monitoring and evaluation. For this reason, a baseline species interaction study has been started for the YFP. As project activities were initiated, they would be monitored closely and modified (if necessary) to better understand and contain the risks of ecological interactions between target species and other species of concern.

Investigations of species interactions above Roza Dam were initiated by the WDW in September 1989, and have continued to date (Hindman et al., 1991; McMichael et al., 1992; Pearsons et al., 1993; Pearsons et al. 1994). This work, funded by BPA, has emphasized potential interactions involving resident trout, but has also included work on spring chinook and other species of concern in the area above Roza Dam. Major objectives of this research have been as follows:

- to characterize the spatial and temporal distribution of rainbow trout spawning;

- to characterize movement patterns of rainbow trout (e.g. within and between mainstem and tributary areas);
- to characterize the distribution and abundance of rearing rainbow trout, and the species associated with them (e.g. spring chinook) during this period; and
- via experimentation, to increase understanding of potential interactions among target and non-target species, to aid development of methods to assess and monitor interactions following implementation of the YFP.

Part of the species interactions study involves experiments designed to examine interactions among target and non-target species. In 1991, a field experiment to assess basic aspects of interactions among hatchery-reared steelhead and naturally rearing fish was begun in the North Fork of the Teanaway River (McMichael et al., 1992; Pearsons et al., 1993; Pearsons et al., 1994). Approximately 33,000 hatchery-reared steelhead were released into a small tributary of the North Fork Teanaway River. The number of steelhead released and release location were selected to reflect the YFP plans existing at the time (Appendix A of BPA, 1990b). Hatchery steelhead smolt release experiments continued over a total of 4 years, with final smolt releases occurring in 1994 and final data collection in 1995. The work aims to develop assessment procedures and experimental designs for long-term monitoring and to learn as much as practicable about potential interactions prior to implementation of the YFP. In addition, small-scale competition experiments between various groups of salmonids have been conducted in the North and Middle forks of the Teanaway River during 1993 (Pearsons et al,. 1994) and 1994. To the extent that these studies pertain to Yakima River spring chinook and coho, a summary of information is provided below.

Upper Yakima Spring Chinook. The distribution of upper Yakima spring chinook overlaps that of three other species of concern (resident rainbow/steelhead, cutthroat, and bull trout) above Roza Dam, which suggests that interactions might occur. Spring chinook juveniles are generally found in the mainstem of the Yakima River and in low elevation portions of some tributaries (Pearsons et al., 1993; Pearsons et al., 1994). Two species of concern, cutthroat and bull trout, inhabit parts of the range of spring chinook, although they are generally found in clear, cold, high-elevation streams (Pearsons et al., 1993). Little information is available about the intensity and outcome of juvenile interactions among these species in the areas of overlap (Martin et al., 1992). The other species of concern, rainbow trout (both anadromous-steelhead, and resident forms) has a wider distribution than spring chinook (Hindman et al., 1991; McMichael et al.,.1992; Pearsons et al., 1993; Pearsons et al., 1994) that overlaps the distribution of spring chinook above Roza Dam entirely.

Interactions between migrating hatchery spring chinook and resident salmonids appear to be minimal, based on two small-scale releases of hatchery spring chinook

(WDFW, unpubl. data). Most previous work examining interactions between juvenile chinook salmon and rainbow and steelhead trout suggests that interactions are minimal because coexisting fish of different species spawn at different times and occupy different microhabitats. This differentiation occurs because of differences in total length and body morphology between species (Everest and Chapman, 1972; Hillman et al., 1989a, 1989b). However, environmental conditions and an overlap in rainbow trout, juvenile steelhead, and spring chinook sizes in the upper Yakima River might force these species to use similar microhabitats, leading to unusually high levels of interaction. Releases of water from reservoirs during the summer months means that discharge in the upper Yakima River is substantially higher than that under natural conditions. High discharges produce high water velocities, which might limit the availability of habitat for small fish. Small fish such as young salmon, resident trout, and steelhead might be forced to occupy the limited amount of slow water habitat available and compete for food and space. However, preliminary results do not support this hypothesis (WDFW, unpubl. data). Spring chinook and rainbow trout were most closely associated with each other during the fall, when water levels were relatively low.

Observations and experiments in the North and Middle forks of the Teanaway River and upper Yakima River mainstem (McMichael et al., 1992; Pearsons et al., 1993; Pearsons et al., 1994) indicate that aggressive social interactions occur between wild juvenile spring chinook and steelhead and rainbow trout, but that interactions may not greatly affect the growth of certain size classes of trout, at least in the studied tributaries. Juvenile spring chinook dominated approximately half of the observed interactions with rainbow trout in the Middle Fork of the Teanaway River and slightly more than half of the observed interactions with rainbow trout in the mainstem Yakima River. Results from competition experiments (Pearsons et al., 1994) in small enclosures in Teanaway River tributaries suggest that the presence of juvenile spring chinook did not significantly alter growth of the slightly larger-sized age 1+ and age 2+ trout (Pearsons et al., 1994), or of smaller-sized 0+ to 1+ age trout (WDFW, unpubl. data).

Hatchery-reared spring chinook salmon and their naturally spawned offspring may interact with pre-existing naturally produced spring chinook salmon. For example, releases of hatchery spring chinook smolts have been shown to alter the movement patterns of naturally produced spring chinook in the Wenatchee River system (Hillman and Mullan, 1989). Competition for food or space may be particularly intense among members of the same species because of their similar ecological requirements at corresponding life history stages. If the juvenile hatchery-reared spring chinook are larger than their naturally produced counterparts, then the hatchery chinook may dominate behavioral interactions and force naturally produced fish to occupy less optimal habitats. Studies of species interactions in the Middle Fork of the Teanaway River have documented aggressive social interactions among juvenile spring chinook salmon, with larger fish generally

predominating (McMichael et al., 1992; Pearsons et al., 1993; Pearsons et al., 1994). Residual hatchery spring chinook significantly affected growth of naturally produced spring chinook in small-scale competition experiments (WDFW, unpubl. data). Residualism by hatchery spring chinook juveniles is known to occur, but generally at low levels. In the Tucannon River residual spring chinook juveniles dominated interactions with their naturally produced counterparts (Steven Martin, WDFW, pers. comm.).

In summary, based on the information available, it appears probable that spring chinook produced from the YFP would compete with pre-existing naturally produced fishes, particularly spring chinook salmon and perhaps rainbow and steelhead trout. The specific outcome of this competition is largely unpredictable at this time, but it is reasonable to expect that growth, abundance, and/or distribution of affected stocks would be altered to a small extent. Also, even minimal interaction impacts on steelhead may be significant to the population at large because steelhead numbers in the upper Yakima River Basin are currently very low. The risks posed by these interactions would be monitored and controlled through the implementation of the adaptive management process.

Lower Yakima River Coho Salmon. Coho salmon juveniles in the lower Yakima River might interact ecologically with fall chinook, spring chinook, steelhead, and resident fishes. During their period of stream residence (for hatchery coho releases, generally in the spring outmigration phase), coho juveniles may prey upon newly emerged spring chinook, summer steelhead, and particularly fall chinook. Stream-reared juvenile coho salmon may compete for food and space with these other species as well. However, these interactions result from the ongoing coho acclimation and release program, and the proposed coho study would not change these interactions. There would be no increased ecological interaction risk posed by the coho study under Alternative 2.

In fact, under the coho program proposed under Alternative 2 for the YFP, the interactions of hatchery coho with other fishes would be closely monitored to determine the rate at which released hatchery coho smolts prey on the others. The study would emphasize juvenile coho interactions with recently emerged fall chinook, ranging primarily in the lower Yakima River. The following information on coho interactions is provided as background for understanding the need for the monitoring proposed under Alternative 2 for the YFP.

The ongoing coho acclimation and release program has the potential to affect the survival of juvenile fish of *other* target and/or non-target stocks. The coho could conceivably be eating a sizable proportion of the juvenile fall chinook production. The current status of the mainstem fall chinook stock is unclear, but the Marion Drain stock appears to be at a low-enough population level that a 20-30 percent reduction in juvenile survival could result in a type 2 genetic impact on that stock.

A small-scale investigation was conducted in 1992 to obtain preliminary information on the occurrence of predation on fish by juvenile hatchery coho, and to assess options for future studies. The stomach contents of 323 coho smolts sampled at the Chandler Juvenile Collection Facility during the spring were examined (James, 1992). No fish were positively identified in the stomach contents, but the capture methodology may have biased the results, since much digestion had occurred prior to stomach content analyses.

Juvenile coho salmon are known to be highly aggressive compared to other juvenile salmonids; thus they may compete with hatchery or naturally produced spring and fall chinook, steelhead or rainbow trout, and resident fishes under certain conditions. For example, in a study conducted by Stein et al. (1972) in an artificial stream, coho socially dominated fall chinook, and fall chinook grew faster alone than with coho present. Lister and Genoe (1970) suggested that coho and fall chinook do not interact because of size-related differences in microhabitat selection. Coho salmon displaced spring chinook from preferred microhabitats in the Wenatchee River drainage but did not affect their growth or density (Spaulding et al., 1989). In the same study, steelhead occupied different microhabitats than salmon. Other workers have documented interactions between coho and steelhead/rainbow trout (Fraser, 1969; Allee, 1974).

In summary, it appears that hatchery coho pose the greatest interaction risk as potential predators on naturally produced fall chinook. If naturally reproducing coho become established in the Yakima River, then a broader range of species interactions would be expected. The risks of these interactions could be limited through the proposed monitoring of predation by coho under Alternative 2 and through monitoring the status of these other species.

Other Species of Concern. The potential for interactions involving other fish species of concern exists and will be subject to continual review by project managers. Bull trout, redside shiner, sculpins, northern squawfish, smallmouth bass, largemouth bass, and mountain whitefish have been identified as resident fish that may interact with spring chinook and coho in the Yakima River Basin.

Data exist but are limited on the distribution and abundance of bull trout in the Yakima River basin. Bull trout are a sensitive species receiving increasing attention, as exemplified by the recent determination by the USFWS that their listing was "warranted but precluded" under the Endangered Species Act. Little is known about the likelihood or outcome of their interactions with fish potentially produced by the YFP. Further information on bull trout in the upper Yakima basin is found in Section 3.4.2 of this FEIS. Smallmouth bass, largemouth bass, and mountain whitefish also are abundant sport fish in the Yakima River and may interact with or prey on anadromous populations.

Northern squawfish are known to be dominant predators on juvenile salmonids, and have been the subject of considerable research with regard to predator control in the reservoirs of the Columbia River system (Willis and Nigro, 1993). As mentioned earlier in this EIS, no work has been done in the Yakima River Basin to ascertain the abundance and distribution of the squawfish population, particularly the segments of the Yakima mainstem below Roza Dam where mortality of outmigrating salmonids is known to be high. Similarly, no research has been conducted in the Yakima River to assess predator consumption rates and the actual relationship of predators to prey (e.g. spring chinook) density, including the associated impact of this relationship on the YFP. However, natural production modeling activities described in Chapters 2 and 3 (Watson et al., 1993) incorporated reviews of available information on predator-prey relations and developed assumptions amenable to risk analysis and hypothesis testing in the context of the YFP monitoring and evaluation plan. This review and modeling effort indicated that up to 240,000 smolts (27 percent of estimated carrying capacity) could be lost to density-dependent mortality in the Yakima River subbasin. (See also discussion in Chapter 2, Section 2.2.3.) Research to assess the occurrence and extent of non-salmonid predation on target species as it relates to specific modeling parameters and the density of prey (i.e., predator swamping) would be highly valuable; however, no research is currently planned to address these issues.

The ecological interaction risks identified above can be addressed through monitoring. However, the risk analysis points out that a monitoring plan to contain or manage the risks of adverse ecological interactions on non-target species can only be developed after specific objectives for these species have been defined or identified. The project managers are in the process of identifying objectives for management of the key non-target species and developing comprehensive monitoring plans. Without monitoring and implementation of the adaptive management process, impacts on non-target species from ecological interactions with the supplemented species could be high.

Transfer of Disease. Another concern identified for the YFP is the transfer of disease through ecological interactions between hatchery and wild fish. The introduction of artificially propagated salmonid stocks to the Yakima River Basin under either alternative poses risks to the health of wild fish in the basin. Hatchery practices increase the risk of disease, which may be transmitted to wild populations after the hatchery fish are released into the natural environment. Generally, artificially propagated fish are more prone to contracting diseases and parasites because they live under unnaturally crowded conditions. Thus, transmission of disease and parasites is easier in the hatchery environment. Hatchery rearing conditions may also adversely stress and affect the physical condition of the hatchery fish and their resistance to disease organisms. Despite the comparatively high incidence of disease in hatchery stocks, however, there is relatively little

evidence that diseases or parasites are routinely transmitted from hatchery fish to wild fish.

Both Alternatives 1 and 2 pose some degree of risk to existing stocks through the potential for transfer of diseases through the use of the hatchery to propagate upper Yakima spring chinook. This risk would be minimized by the use of local broodstock. The possible introduction of non-indigenous strains of pathogenic organisms under either alternative would be minimized by stringent inspection and quarantine procedures. This section discusses diseases of concern to salmonid resources, the use of preventative measures, and the potential risks associated with the YFP to existing populations.

Bacterial kidney disease is a particular concern because the causative bacterium (*Renibacterium salmoninarum*) is transmitted in the eggs from infected females to offspring. The disease is considered a significant hazard to cultured salmonids, and is a primary health concern of the YFP. Bacterial kidney disease is often diagnosed as a cause of mortality in fish that are reared for more than a year under hatchery conditions (i.e., spring chinook salmon, coho salmon, and steelhead). This chronic disease may be responsible for mortality at any time during the freshwater rearing of salmon and steelhead, and is also known to affect survival after seawater entry. Bacterial kidney disease can be controlled by antibiotic treatment of female salmonids and avoiding the use of heavily infected fish as broodstock. Preliminary evidence suggests that these husbandry methods may increase survival of fish during culture and result in a reduction of infectious bacterial kidney disease organisms available for dissemination to future generations of hatchery and wild fish.

Project managers are also concerned about *infectious hematopoietic necrosis* and *infectious pancreatic necrosis*. Infectious hematopoietic necrosis can cause mortality in rainbow trout, steelhead, sockeye salmon, and chinook salmon; losses due to the disease usually occur in juvenile fry. Mortality resulting from infectious pancreatic necrosis disease(s) is limited to rainbow trout and steelhead fry; both diseases are most often manifest in hatchery situations. Both viruses have been isolated from maturing wild chinook salmon and hatchery steelhead in the Yakima River system, but an actual occurrence of viral disease has not been observed. As with bacterial kidney disease, acclimation of wild fish to the hatchery environment may eventually lead to the occurrence of viral disease and mortality. The relative risk of transfer of infectious hematopoietic necrosis or infectious pancreatic necrosis virus from diseased hatchery fish to wild salmonids is unknown; however, the relatively low-density fish rearing facilities planned for the YFP would probably reduce these risks.

Finally, hatchery-reared fish are prone, through proximity, to contract *parasitosis.* Fungal, protozoal, and helminth parasites are relatively easy to diagnose, and chemical treatment of the holding water is normally effective. The risk of

extension of most internal and external parasites of salmonid fish from hatchery to wild situations is confined to the brief period during outmigration and is therefore limited.

A recent literature review by Miller et al. (1990) found that, in spite of the comparatively high incidence of disease among hatchery stocks, there is little evidence that diseases or parasites are routinely transmitted from hatchery to wild fish. This review found a number of studies indicating that infectious pancreatic necrosis and bacterial kidney disease were *not* transmitted from infected hatchery outplants.

All phases of artificial propagation, fish transfers, and supplementation procedures for both Alternatives 1 and 2 would follow the fish health policy documented in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT, 1994). Rigorous sanitation and use of disinfection procedures combined with optimum husbandry, isolation and quarantine practices and a strong diagnostic and therapeutic program would minimize fish health concerns and reduce the potential for adverse impacts on wild and hatchery-reared fish from disease during operation of the YFP under either alternative.

4.1.2.2 Cumulative Fishery Resource Impacts

Regulations implementing NEPA require Federal agencies to consider the cumulative impacts of their proposed actions. 40 CFR § 1508.25(c)(1991). The regulations define cumulative impacts as follows:

> "The impact on the environment which results from the incremental impacts of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." 40 CFR § 1508.7 (1991)

As described in Chapter 1, the YFP is part of an unprecedented effort by the Council, the BPA, the project managers, and other state and Federal agencies and Indian tribes to rebuild salmon and steelhead runs on the Columbia River. The YFP, together with other supplementation, rebuilding, and mitigation projects, would contribute to this effort and to the Council's goal of doubling current runs while maintaining the genetic diversity of the Columbia River anadromous fish stocks. As mentioned in Section 1.4, commenters on the original draft of this EIS suggested that a comprehensive EIS should be prepared on all of the salmonid restoration and mitigation efforts in the Columbia River Basin, including the Council's Columbia River Basin Fish and Wildlife Program. This comment is being addressed in part by the *Interactions of Hatchery and Naturally Spawning Salmon and Steelhead in the Columbia River Basin Programmatic EIS* currently being prepared by the USFWS, NMFS, and BPA. A draft of the Programmatic EIS is anticipated in early 1996.

The Programmatic EIS will address the cumulative impacts of salmon and steelhead hatcheries and supplementation projects in the Columbia River Basin on wild and naturally-spawning stocks. Nevertheless, the YFP is independently justifiable because it is an experiment employing the scientific method to test supplementation as a fish mitigation tool. It is the only supplementation project planned or implemented that is committed to monitoring and evaluation of different rearing strategies in an attempt to methodologically determine how best to preserve and improve naturally spawning and wild stocks. The YFP action alternatives would release a total of only 810,000 spring chinook smolts. This is an extremely small percentage (0.4%) of the 197.4 million smolts released in 1994 in the Columbia River system. Consequently, the project managers do not anticipate impacts on species of salmon listed under the ESA, impacts in the migration corridor, increased harvest of sensitive stocks, or straying. Predation on listed smolts is unlikely, because the Yakima spring chinook smolts would lack sufficient size to prey on smolts of listed salmon species. The YFP would not begin showing results until 2000, so it would not prejudice the ultimate decisions made in the Programmatic EIS.

The YFP would be designed to be consistent with and be evaluated along with all other artificial propagation and supplementation facilities being addressed in the comprehensive analysis. While this FEIS specifically addresses the impacts of the YFP, it includes the following cumulative impact analysis that considers the impacts of this project on the overall Columbia River Basin fishery.

Increasing Supplementation Knowledge

The YFP aims to develop knowledge about how supplementation techniques can be applied to anadromous fish stocks in the Yakima River Basin. This knowledge may be applicable throughout the Columbia Basin. The stock-by-stock adaptive management approach and flexible physical design proposed for the YFP facilities would provide a robust and unique platform for supplementation research. When taken in combination with other current and future supplementation activities within the region (and regardless of the actual outcome of the YFP in terms of the degree of success achieved in stock rebuilding), the cumulative effect of the YFP would be to increase the chances that other supplementation projects would succeed, and that concomitant resource risks would be reduced. The YFP research, monitoring, and evaluation facilities would serve to answer critical uncertainties associated with future supplementation activities approved by the Council and funded by the BPA.

In addition, the experimental, stock-by-stock adaptive management approach of the proposed YFP alternatives would allow project managers to discover and correct impacts resulting from the supplementation of one stock and possibly apply this knowledge to other stocks before supplementation is initiated on them. Also, the adaptive management approach would result in constant monitoring, review, and revision of the supplementation program, which could help prevent some cumulative impacts from occurring.

Genetic Fitness

If successful, the YFP would help maintain long-term genetic fitness for Columbia River salmonid resources. The project would track genetically distinct populations; it includes a goal to protect each stock. The project would help to rebuild weak stocks, reducing the threat of extinction, and would sustain the diversity of stocks in the basin. Furthermore, the supplementation approach would test a mitigation alternative that could minimize or control adverse impacts on the genetic composition of supplemented natural stocks, when compared to potential risks posed by traditional mitigation hatcheries. It is expected that the cumulative effect of a successful YFP, taken together with other ongoing and future projects in the Columbia Basin, would be to further protect and maintain within- and among-stock genetic fitness.

If the YFP were unsuccessful for one or more stocks, however, the YFP would add nothing to the genetic fitness of Columbia River salmonid resources. Furthermore, if unforeseen adverse genetic impacts were realized and not contained, and if project operations were continued, the net result would be increased erosion of genetic fitness and greater probability of extinction of affected stocks. The adaptive management process for the YFP has been developed to prevent this through ongoing monitoring and feedback into the management process on an annual basis.

Straying of supplemented Yakima Basin fish into other basins and dilution of their gene pools by these fish is not considered to be a problem for upper Yakima spring chinook, as discussed in the section above on genetic risk analysis. Straying of coho is not considered to be a problem because there are no wild stocks remaining in the Yakima or surrounding basins.

Production and Habitat

In Section 7 of the 1994 version of the Columbia River Basin Fish and Wildlife Program, the Council reiterated its determination that implementation of production and habitat actions be fully coordinated (NPPC, 1994). Relevant Yakima Basin production and habitat measures in the 1994 Program include construction and evaluation of a supplementation hatchery for the Yakima Basin (Section 7.4K), additional water storage (7.11A), construction of fish passage projects (Section 7.11B), flows to protect spawning and incubation (Section 7.11C), and production and habitat projects developed through subregional planning (Section 7.0B).

The YFP, if successful, would integrate hatchery and natural production and increase stock abundance, productivity, and use of available habitat. However, results would be amplified when coupled with environmental improvements. The cumulative effect of the YFP with ongoing habitat improvement projects in the Yakima River Basin would be to increase the chances for recovery of salmonid resources in the basin. Successful supplementation would be expected to accelerate the population-rebuilding process and ensure that improved habitat is fully used and runs are restored to harvestable levels. On a

regional basis, successful supplementation and other artificial production projects, together with habitat and passage improvements, would help to achieve the full natural and hatchery production potential of the Yakima Basin and the Columbia River system in general. The cumulative effect would be to amplify the basin-wide shift toward optimum habitat utilization and reduced reliance on traditional hatchery production.

Efforts to protect fish produced in supplementation facilities could have side benefits for wild stocks. For example, management actions taken in the past to improve the survival of hatchery fish have not been effective for wild fish, due to differences in life history patterns induced by hatchery rearing. Water management decisions often have been influenced by the timing of peaks in total juvenile abundance in the mainstem. The peaks in abundance frequently represent mass movement of hatchery-released fish and not necessarily the timing of wild juveniles. Fish produced by successful supplementation projects, however, should better reflect the behavioral and biological characteristics of wild progenitor stocks. To the extent that supplementation projects produce fish with characteristics similar to those of wild fish, efforts to improve survival of supplementation fish can be expected to benefit wild fish as well.

If the YFP were unsuccessful for one or more stocks, and hatchery and/or natural production increases were not realized, then the rate of stock rebuilding in the Yakima River Basin would remain at levels consistent with ongoing habitat improvement efforts and other external management actions. If the YFP were unsuccessful in increasing natural production in the Yakima Basin, releases of artificially produced fish from the project would still increase the potential for adverse ecological interactions and disease transfer to naturally reproducing fish in the Yakima and Columbia River systems. The Project's hatchery operational procedures, monitoring plan, and adaptive management process have been designed to identify and contain such risks in the Yakima River Basin. The *Interactions of Hatchery and Naturally Spawning Salmon and Steelhead in the Columbia River Basin Programmatic Environmental Impact Statement* will address cumulative impacts of all Columbia River Basin hatcheries on naturally spawning stocks migrating in the Columbia River mainstem. As an experimental hatchery that would add only 810,000 smolts to the nearly 200 million smolts already being released into the Columbia River system, the YFP is not expected to have adverse cumulative effects or influence the outcome of the Programmatic EIS.

Harvest

The cumulative impacts of the YFP and other similar projects outside the Yakima River Basin may be adverse for some unsupplemented wild stocks. If the YFP and other supplementation projects were successful, the relative proportion of fish from supplementation facilities in aggregate runs returning to the Columbia Basin would increase, and the runs would provide more harvestable fish. Under the CRFMP, catch ceilings in Columbia River fisheries are adjusted in response to observed total run sizes. If supplementation produces more fish, and thus expanded harvest opportunities, harvest pressure on unsupplemented wild stocks in mixed-stock fisheries might proportionally

increase. Increased harvest pressure triggered by larger aggregate run sizes might incidentally result in overharvest of less productive stocks within stock mixtures (Walters, 1988). Columbia River Harvest Managers, using the flexibility provided by the CRFMP, have been able to reduce impacts significantly on endangered Snake River chinook stocks by reducing overall harvest rates in the mixed stock fishery. This flexibility has allowed harvest of abundant stocks while affording protection to the weaker stocks.

If successful, the YFP would be expected to produce significant numbers of returning spring chinook annually to the aggregate upper Columbia River run. Depending on several factors, these increases have the potential to alter current harvest regimes. Contributions of adult fish from other proposed supplementation programs currently are unknown. Consequently, it is impossible to project the cumulative impacts of the YFP with other proposed supplementation projects on Columbia River runs and fisheries.

Conceivably, the YFP and other regional supplementation projects could also result in positive cumulative benefits for some weaker stocks. Mixed-stock fisheries can be managed so as to protect such stocks. When stock-specific differences in run timing, geographic distribution, or other characteristics are known to exist, fisheries can be structured by regulatory measures (collectively termed "time-area-gear restrictions") to increase harvest pressure selectively on stronger stocks and to reduce pressure on weaker stocks. Controlled harvest rates have also been successful in protecting Columbia River weaker stocks. Such measures currently are applied to commercial and sport fisheries. Cumulatively, successful supplementation production might lower the harvest rate on weak stocks due to a proportional dilution of weak stocks in the aggregate stock mixture.

If the YFP were unsuccessful for one or more stocks, and increases in harvest benefits were not realized, there would be no positive or negative harvest-related cumulative impact on existing Yakima and Columbia River stocks.

Estuary and Nearshore Habitat

It has been suggested that increases in certain runs could also result in anadromous fish populations that cumulatively tax the carrying capacity of the Columbia River estuary and nearshore marine habitats. Excessively large smolt populations could have adverse consequences for survival and for the ecology of the estuary generally. The project managers agree with NMFS that there is considerable speculation, but little scientific information available, concerning the overall effects of hatchery fish in the Columbia river migration corridor and estuary. (NMFS 1995a, 1995b in the draft YFP Biological Assessment). This information is unavailable because it would cost millions of dollars over many years to study a large geographic area using highly sophisticated equipment. Such information would be valuable in managing fisheries and promoting the recovery of ESA-listed stocks. Without information on the carrying capacity of the estuary and nearshore habitat, there is a risk that over-utilization of such habitat might ultimately contribute to the extinction of some specific stocks and to reduced numbers of returning adults generally, as well as possibly contribute to reduced-size adults that are less fit to

survive upriver migration. There is so little accepted research on estuary carrying capacity that further discussion of the consequences of estuary over-utilization would be pure conjecture.

The Council has identified the need to conduct a carrying-capacity study that will include estuary research (Columbia River Basin Fish and Wildlife Program Section 7.1A.2; 7.1A.1, 1994). The Council has called for a preliminary evaluation of tributary, mainstem (including reservoirs), estuary, plume, nearshore ocean and marine salmon survival, ecology, carrying capacity and limiting factors. The evaluation would include analysis of existing data, identification of critical uncertainties and research needs, and estimates of incremental gains from improvements in each area.

The Council expects a draft carrying-capacity study plan based on critical uncertainties and research needs to be presented in early 1996, with a final plan due in spring of 1996. Currently, however, the means to obtain information on the cumulative impacts of supplementation projects on carrying capacity is unknown. The carrying-capacity study itself will be extraordinarily complex and is expected to be a long-term activity. In the meantime, information to conduct a more intensive cumulative impacts analysis of these issues is unavailable.

If the YFP were unsuccessful for one or more stocks, and increases in the production of either artificially produced or naturally produced juvenile salmonids emigrating from the Yakima River to the estuary were not realized, there would be no adverse cumulative impacts on the carrying capacity of the Columbia River estuary and nearshore habitat.

4.1.2.3 No Action Alternative

Impacts on Supplementation Knowledge

The No Action alternative would not allow fish managers to test the principles of supplementation in the Yakima basin. Knowledge about how supplementation can be used to reestablish naturally producing fish populations in both the Yakima basin and the Columbia River basin would not be gained. This lack could affect fish restoration and recovery goals throughout the Columbia River basin by delaying much-needed research into useful fish management tools at a time when populations are rapidly dwindling.

Production and Harvest Impacts

Without supplementation and the much larger outmigrations necessary to absorb large losses while still leaving a substantial number of survivors, the situation in the Yakima River would remain essentially as it is today. The Yakima River spring chinook would most likely remain at current population levels without achieving their production potential. That failure would have two causes: existing patterns of water management in the Yakima River Basin compromise rearing habitat throughout much of the mainstem Yakima River, and more important, they substantially depress smolt-to-smolt survival in

the mainstem Yakima River below Sunnyside Dam. Providing better juvenile and adult passage through diversion dams would help, but recent Court decisions may guarantee that no more water than the present amount would be available for fish production. If the estimated current losses of outmigrating smolts are correct, predation would play a significant role in population dynamics. Small returns generate small outmigrations, which suffer proportionately high losses, thereby resulting in small returns and the perpetuation of the current, depressed cycle. In turn, low returns would continue to affect harvest levels for the terminal fishery.

Yakima River spring chinook would make no contribution to the Council's goal of increased production and associated harvest benefits from the Columbia Basin. Coho production, however, would continue at its present level under the No Action alternative. Constrained by passage mortality, the full natural spawning and rearing potential of spring chinook would not be realized in the Yakima River. The alternative of doing nothing would substantially delay critical learning about methods to increase naturally reproducing fish populations in the Columbia or Yakima Basins.

Genetic Impacts

Hatchery operations present some genetic risk. Consequently, the decision not to construct and operate YFP facilities would, by definition, eliminate certain potential genetic risks. Such a decision, however, would increase other risks. A population with a chronically low escapement because of habitat loss, harvest pressure, and passage impediment might be at substantial risk of severe genetic drift, inbreeding, or extinction. A carefully designed supplementation program could potentially rescue such a population. The Yakima chinook salmon and steelhead populations are at depressed levels, and recent years have seen a pronounced downward trend in the runs. It is unclear whether this is just a fluctuation or the start of a long-term decline.

Another concern is the effective population sizes of the substocks. A more complete picture of the genetic health of the substocks of the Yakima River Basin in terms of probable effective population size is still being developed. If research should show that the Yakima River substocks were not in immediate danger, and harvest management could be guaranteed to keep them out of danger, taking no action to supplement healthy stocks would be a viable alternative.

Under the No Action Alternative, all risks described earlier (as directly related to operation of the hatchery) would not exist, but neither would any of the potential benefits. However, some improvements in production would likely be realized in the near future from the completion of the Phase II screening of irrigation canals and other habitat improvement work now underway in the Yakima River Basin. The ESA recovery efforts now underway for listed Columbia River salmon stocks may also benefit Yakima River salmon stocks.

Despite their depressed condition relative to historic levels, the spring chinook stocks in the Yakima basin appear to be genetically healthy. Procedures for estimation of effective population size are still being developed, but preliminary results indicate that the effective size of all three stocks is adequate for conservation of within-stock genetic diversity. There is no evidence to suggest that they are being affected by gene flow from other stocks. However, recent downward trends in abundance, if not reversed within the next 2 or 3 years, could put the stocks at risk of losing genetic diversity due to low effective size. As population size decreases, there is also a greater risk of extinction. Thus, without a reversal of current downward trends in abundance, the No Action alternative could pose more risk to the spring chinook than the supplementation alternative.

The only genetic risk associated with coho production is the risk to other species through ecological interactions. Coho production under the *U.S. v. Oregon* CRFMP will exist in the basin no matter which alternative is adopted, so this risk will always be present. Alternative 2, because it includes monitoring the ecological impacts of coho production, and thus allows for changes to reduce these interactions, therefore involves less risk than either Alternative 1 or the No Action alternative.

Species Interactions Impacts

There would be no increased risk from direct or indirect impacts, or impacts on long-term natural production on current populations of trout, steelhead, and salmon under the No Action Alternative.

Transfer of Disease

The risk of impact on salmonid populations from the introduction of non- indigenous strains of pathogens would not be increased under the No Action Alternative.

4.1.3 Other Aquatic Resources

It is highly unlikely that the proposed project would result in adverse impacts on other aquatic organisms. A detailed analysis of the potential for wastewater to enter the Yakima River from the hatchery and rearing facilities to enhance algal growth indicated that the resulting concentrations of nitrates and phosphates would not enhance algal production. Further, effects would be short-lived because of rapid dilution in the Yakima River.

Dominant invertebrates identified in the Yakima River include insects belonging to the orders Diptera and Trichoptera. The dipterans are mainly black flies, and the trichopterans are caddisflies. Both of these groups obtain their food by filter-feeding, removing suspended fine particulate organic matter (FPOM) from the water column. Because there is no indication that FPOM concentrations would be increased by the proposed action, there is no indication that these groups would be affected by project operations. Higher numbers of salmonids produced by the project could, however, result in increased predation of invertebrates used as food.

Given that it is unlikely that the lower trophic levels of the Yakima River aquatic ecosystem (algae and invertebrates) would be affected by project operations, it follows that there would be no reason to expect that overall ecosystem processes within the Yakima River would be altered by operation of facilities as part of the proposed project.

4.1.4 Vegetation Resources

4.1.4.1 Alternatives 1 and 2

YFP facilities would be located in a variety of habitat types, including those that support riparian and wetland plant communities, forested zones; and agricultural areas. Construction of the Cle Elum hatchery site would require clearing of approximately 6 ha (15 ac.) of vegetation for the acclimation site, the main hatchery facilities, the access road, the water intake structure, and the interpretive center facilities. Construction of the acclimation raceways and pipelines to deliver water to the raceways at the three acclimation sites would also destroy existing stands of vegetation. The total disturbed area would be approximately 0.4-0.8 ha (1-2 ac.) at each site. Surveys of the sites revealed that no unusual or rare habitat types would be affected as a result of these activities. Some of the proposed sites, especially along the Yakima River, have been previously disturbed or developed. Vegetation removal impacts would be the same for both Alternatives, since no additional facilities would be constructed under Alternative 2.

Impacts on wetlands are addressed under the **Floodplain/Wetlands Assessment** in Section 4.1.1.1, and impacts on special status plant species are addressed in Section 4.1.6.1.

4.1.4.2 No Action Alternative

There would be no potential impacts on vegetation under the No Action Alternative.

4.1.5 Wildlife

4.1.5.1 Alternatives 1 and 2

Construction of the Cle Elum hatchery facilities and acclimation site would affect wildlife at the site. Species observed using the area (see Section 3.4.1) would be temporarily displaced during the period of construction. Permanent loss of wildlife habitat would occur on 4-6 of 200 ha (10-15 of 500 ac.) at the site. However, the remaining acreage is proposed to be managed for wildlife mitigation for both the YFP and possible inclusion in the CRBFWP. The facilities would be located more than 610 m (2000 ft.) away from the ponds and osprey nests at the northeast end of the site, and therefore would not affect them. The riparian area created by the constructed discharge channel to the oxbow system would increase the habitat available for riparian wildlife at the Cle Elum site.

The acclimation sites would be constructed in or immediately adjacent to disturbed areas that, in most cases, receive unregulated use by humans. About 1.2 ha (3 ac.) of potential wildlife habitat would be disturbed by construction at the three acclimation sites (about 0.4 ha (1 ac.) at each site). Because the acclimation sites would receive only seasonal use and low levels of human activity, potential operational impacts on wildlife would be relatively minor. Wildlife impacts resulting from Alternatives 1 and 2 would be the same. Impacts on special status wildlife species are addressed in Section 4.1.6, below.

4.1.5.2 No Action Alternative

There would be no potential impacts on wildlife under the No Action Alternative.

4.1.6 Threatened, Endangered, and Special Status Species

4.1.6.1 Alternatives 1 and 2

Federal agencies are required to consult regarding effects of proposed actions on listed threatened and endangered species under Section 7 of the Endangered Species Act. The NMFS is consulted regarding impacts on marine animals and anadromous fish, while the USFWS is consulted on all non-marine plants, animals, and resident fish.

Informal consultation with NMFS was initiated in December 1992, regarding project effects on listed Snake River chinook salmon. Issues that NMFS raised included potential interactions of YFP fish with listed Snake River salmon in the Columbia River corridor (competition, disease transmission, and predation); the potential for returning adult YFP fish to stray into the Snake River basin; and the potential for taking listed adult Snake River salmon while collecting broodstock for this project.

It is unlikely the listed Snake River salmon would be significantly affected by the proposed project. The best available information indicates that spring chinook have very low straying rates, so it is very unlikely they would stray into the Snake River basin. For the same reason, it is also very unlikely that adult Snake River salmon would be collected in the upper Yakima basin while collecting broodstock for the YFP. Interactions of YFP fish with listed Snake River salmon in the Columbia River corridor through competition, disease transmission, and predation are possible, but the relatively low numbers of upper Yakima spring chinook being added to the system would make the probability of these interactions occurring with any frequency very low.

NMFS is currently completing stock status assessments for chinook, sockeye, steelhead, and coho salmon throughout the ranges of these species. Chinook and summer steelhead in the Yakima River might be indirectly and adversely affected through competition, predation, or disease transmission from project fish. Since sockeye and coho are extinct in the Yakima River basin, there would be no adverse impact expected on them under the YFP. Possible indirect risks to sockeye and coho include interactions (competition) in the Columbia River corridor and straying of YFP coho into streams other than the Yakima

River. Before the ROD, BPA will complete consultation with NMFS on all currently listed anadromous fish species that might be affected by the project. Subsequent listings may require additional consultation.

As discussed in Section 3.4.2, bull trout, a candidate species for which the USFWS has determined that listing was "warranted but precluded" under the ESA, exist in various parts of the Yakima River Basin as does another Federal candidate species, the westslope cutthroat trout. To the extent that the YFP leads to increased natural production of target species and their expanded use of available habitat, it is possible that spatial and temporal overlaps with bull and cutthroat trout would increase. Increased abundance and distribution of target species would heighten the probability that adverse competitive interactions with bull and cutthroat trout would occur. Proposed acclimation facilities have been sited to minimize the potential for adverse interactions, while still achieving natural production objectives for target species. If and when the USFWS should decide to list bull or cutthroat trout as a threatened or endangered species, the project managers would perform all appropriate environmental surveys and biological assessments. Pacific lamprey and other candidate species are also known to be in the Yakima Basin.

In 1989, BPA prepared and submitted a BA to the USFWS, to evaluate potential effects on wintering bald eagles in the Yakima River Basin as a result of construction of proposed YFP central and satellite facilities. BPA determined in the BA that construction of these facilities would have no adverse effect on wintering bald eagles (BPA, 1990a). Later, additional information was requested from the USFWS on the presence of Federally listed threatened and endangered species that may occur in the vicinity of the proposed acclimation sites. Six listed threatened or endangered species may be present--bald eagle, northern spotted owl, peregrine falcon, marbled murrelet, grizzly bear, and gray wolf. Consultation with the WDFW and the USFWS is ongoing, and a new BA, summarized below, is being submitted to USFWS for the following listed species.

- **Bald eagle.** Pacific Northwest Laboratories began surveys of wintering bald eagles in December 1991 for all proposed project sites. No nest sites were observed near any of the proposed acclimation or facility sites. Project activities would increase numbers of anadromous fish in the Yakima River Basin, a benefit in terms of increased prey base for wintering bald eagles. Thus, results indicate that there would be no adverse effect on the bald eagle as a result of either alternative. However, wintering bald eagles might be disturbed at the Clark Fork acclimation site, through increased human activity around project facilities.
- **Northern spotted owl.** The USFS and WDFW were contacted regarding the historic occurrence of spotted owls and the distribution of suitable spotted owl habitat in the vicinity of the acclimation sites. Historic accounts of spotted owls at the Keechelus site warranted a survey of that site. A one-year calling survey conducted by the Pacific Northwest Laboratories in 1993 did not elicit responses from owls. The Keechelus, Cle Elum, North Fork Teanaway, and Jack Creek sites occur within the 2.9- and 4.3-km (1.8- and 2.7-mi.) median home range for spotted owls (WDFW 1994). However, none of the proposed sites is located

within suitable owl habitat or contains trees suitable for spotted owl nesting. The Keechelus, North Fork Teanaway, and Jack Creek sites are proximal to suitable owl habitat; however, there is a very low probability that construction would affect owls at these sites because no trees suitable for use by owls would be affected by site development. As a precaution, pre-construction surveys would be conducted at these two sites. If nesting owls were found within 0.8 km (0.5 mi.), additional consultation would be completed before construction.

- **Peregrine falcon.** There are no suitable nesting sites (cliffs) for peregrine falcons near any of the project sites. Construction and operation of the proposed hatchery and acclimation ponds is unlikely to alter the use of the area by falcons, will not decrease the prey base for this species, and will not disturb any potential nesting habitat.

- **Marbled murrelet.** Surveys for marbled murrelets were not conducted at the project sites. Murrelets require old-growth habitat within 80 km (50 mi.) of saltwater. The Keechelus site may be on the margin of a known murrelet territory; however, there is a very low probability that construction would affect murrelets at these sites because no suitable trees used by murrelets would be affected. As a precaution, construction at the Keechelus site would be timed outside the murrelet breeding season (April 1 to September 15), if necessary, to minimize the potential for impact on murrelets in the vicinity.

- **Grizzly bear.** Surveys of grizzly bear habitat in the vicinity of the acclimation sites were conducted during spring 1992. No definitive sightings of grizzly bear have been reported in the vicinity of the sites. The home range of the grizzly bear sighting near Teanaway Butte in 1989 would overlap the Cle Elum, North Fork Teanaway, and Jack Creek sites. However, characteristics essential to grizzly bear habitat (Craighead et al., 1982)--isolation, space, denning, and safety--would not be met within the Cle Elum site. Also, although riparian and upland vegetation would provide forage for grizzly bears at these three sites, none of the sites is typified by species that constitute primary forage of grizzly bears (i.e., huckleberries, kinnickinnick, sedges) (Servheen, 1992). The potential for grizzly bears to use any of these three sites is likely limited.

- **Gray wolf.** Pacific Northwest Laboratories conducted surveys of gray wolf habitat in the vicinity of the proposed project facilities during spring 1992. USFS also conducted surveys in the vicinity of the Cle Elum site in 1989 and 1990. Responses were received during the USFS surveys in the vicinity of Matthews Creek, about 6.4 km (4 mi.) northwest of Jack Creek. An unconfirmed siting of a gray wolf was reported for the vicinity of the North Fork of the Teanaway River during 1992. One adult and two juvenile gray wolves were confirmed about 3.2 km (2 mi.) from the proposed Keechelus site during 1992. More recent surveys have not been completed. The construction of the facilities would only temporarily alter gray wolf habitat, and would not affect denning or wolf prey base.

Specific surveys for the Federal candidate fish and wildlife species were not conducted at each site; however, during field reconnaissance, none of the species or signs of them were observed. The proposed activities are not anticipated to affect Federal or state monitor or candidate wildlife species. The potential for impacts on bull trout have been minimized through careful siting of proposed acclimation facilities, and impacts on other candidate fish species are not anticipated. If necessary, sites would be resurveyed prior to construction and/or a biologist would be on site to monitor construction of the facilities.

Surveys were conducted for Hoover's tauschia, a Federal candidate plant species, and for the state-listed threatened plant species at suitable sites during May and June 1992. None were found. Proposed activities are not anticipated to affect these species.

4.1.6.2 No Action Alternative

No adverse impacts are expected on threatened and endangered species under the No Action Alternative. However, there would be no potential benefits to bald eagles from increased foraging opportunities resulting from increased numbers of adult fish. Ongoing recovery planning for the listed species would continue, and proposed species would continue to be reviewed and listed as warranted.

4.1.7 Air Quality and Noise

4.1.7.1 Air Quality

Building the fish hatchery and satellite facilities proposed under either alternative would result in periodic short-term local increases in the vehicle exhaust emissions of vehicle exhaust associated with site clearing and excavation. Dust could also be generated. Site clearing would be minimized to reduce the potential for these impacts. Major earthmoving and heavy construction activities would be completed in 4 to 6 months. Completion of construction and the operation of facilities should have negligible effects on local air quality, and air quality standards would not be exceeded. No significant health-related air pollution problems are anticipated to result from construction activities.

Operation of the facilities proposed under either alternative would continue air pollutant emissions primarily associated with vehicle exhaust (carbon monoxide, volatile organic compounds, nitrogen oxides, sulfur oxides, and particulate matter). However, emissions would be minor, and no significant impacts on air quality of the surrounding region are anticipated.

There would be no potential impacts on air resources under the No Action Alternative.

4.1.7.2 Noise

The effect of Alternatives 1 and 2 on noise levels would be largely limited to the construction phase. The use of heavy equipment during site preparation and construction

might temporarily produce elevated noise levels, but these would not affect residential areas. For most sites, construction impacts on wildlife would be minimal because of the lack of noise-sensitive species in the vicinity of the proposed sites. Noise effects during operation of the proposed facilities would be the result of occasional traffic to and from facilities, and from the operation of electrical pumps at some sites. Because activities at the proposed facilities would be low in intensity, these impacts would be minimal and not exceed State of Washington noise guidelines.

No noise impacts would result from the No Action Alternative.

4.1.8 Socioeconomics

An economic impact analysis was conducted in order to show the total employment and income impacts that would result from direct expenditures made during various stages of YFP development and operation. The study prepared as part of the Operating Plan for the project (Mack et al., 1989) was updated in 1995 (Mack and Robison, 1995) to reflect the changes made to the proposed project. Economic expenditures arising from project construction, operations and maintenance, monitoring and evaluation, and harvest were analyzed; impacts were then projected from 1996 to the project maturity year of 2010. Yakima spring chinook supplementation and evaluation comprised Alternative 1; coho monitoring and evaluation activities were added to Alternative 1 to comprise Alternative 2. This section reviews the analytic procedures, assumptions and findings of the impact analysis.

4.1.8.1 Analytical Procedures

The analysis used BPA cost estimates for project activities to estimate the employment and income impacts of both initial and subsequent rounds of spending (see Tables 4.3 and 4.4). For initial spending, models were developed that allocated direct expenditures by function for specific years.

Table 4.3 Estimates of Construction Costs for Both Alternatives for the YFP (in thousands of dollars)

FACILITY	COST
Cle Elum Hatchery (upper Yakima spring chinook)	12800
Acclimation sites (upper Yakima spring chinook - 3 sites)	2500
Total construction Cost	**15300**
Engineering/Legal/Administration (25% of total)	3825
Land Acquisition	1450
Grand total cost	**20575**

Table 4.4 Annual Project Costs of the YFP (in thousands of dollars)

	Alternative 1	Alternative 2
Operations and Maintenance		
Labor	128	128
Transportation	12	12
Fish Food	76	76
Power	52	52
Supplies	12	12
Subtotal Operations and Maintenance	280	280
Monitoring and Evaluation	1500	2000
Total Annual Cost	1780	2280

The USFS's IMPLAN input-output economic model was used to estimate the secondary effects upon the economy when direct expenditures cause additional rounds of economic activity in an economy. The IMPLAN model also used the direct expenditures to estimate the induced impacts which would result when the project expenditures were respent in the study area. The sum of direct expenditures plus indirect impacts plus induced impacts equaled total impacts, which were measured as potential increases in jobs and income. The total impacts were then added to a baseline model, a projected portrayal of the economy of the impact area from 1995 to 2010 as it would have developed without the project. The baseline model was developed around the county level projections made by the Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce.

The designated two-county impact area was comprised of Yakima and Kittitas counties, since all structures and activities for the two alternatives would be situated within this area. Although some project expenditures and impacts would occur outside the study area, the vast majority would occur within it. Special consideration was made of the impacts upon the Yakama Reservation, an area comprising almost two-thirds of Yakima County. The YIN would be the Lead Agency for managing operations and maintenance as well as monitoring and evaluation activities. As the YIN is also expected to account for half of the harvest of fish from the project, it is appropriate to separate the effects on the Yakama Reservation from the overall effects on the Yakima-Kittitas County areas.

The modeling was also broken down by activities into construction, operations and maintenance, monitoring and evaluation, and harvest. Figure 4.1 shows how the individual activities fit into the time lines of the project lifetime.

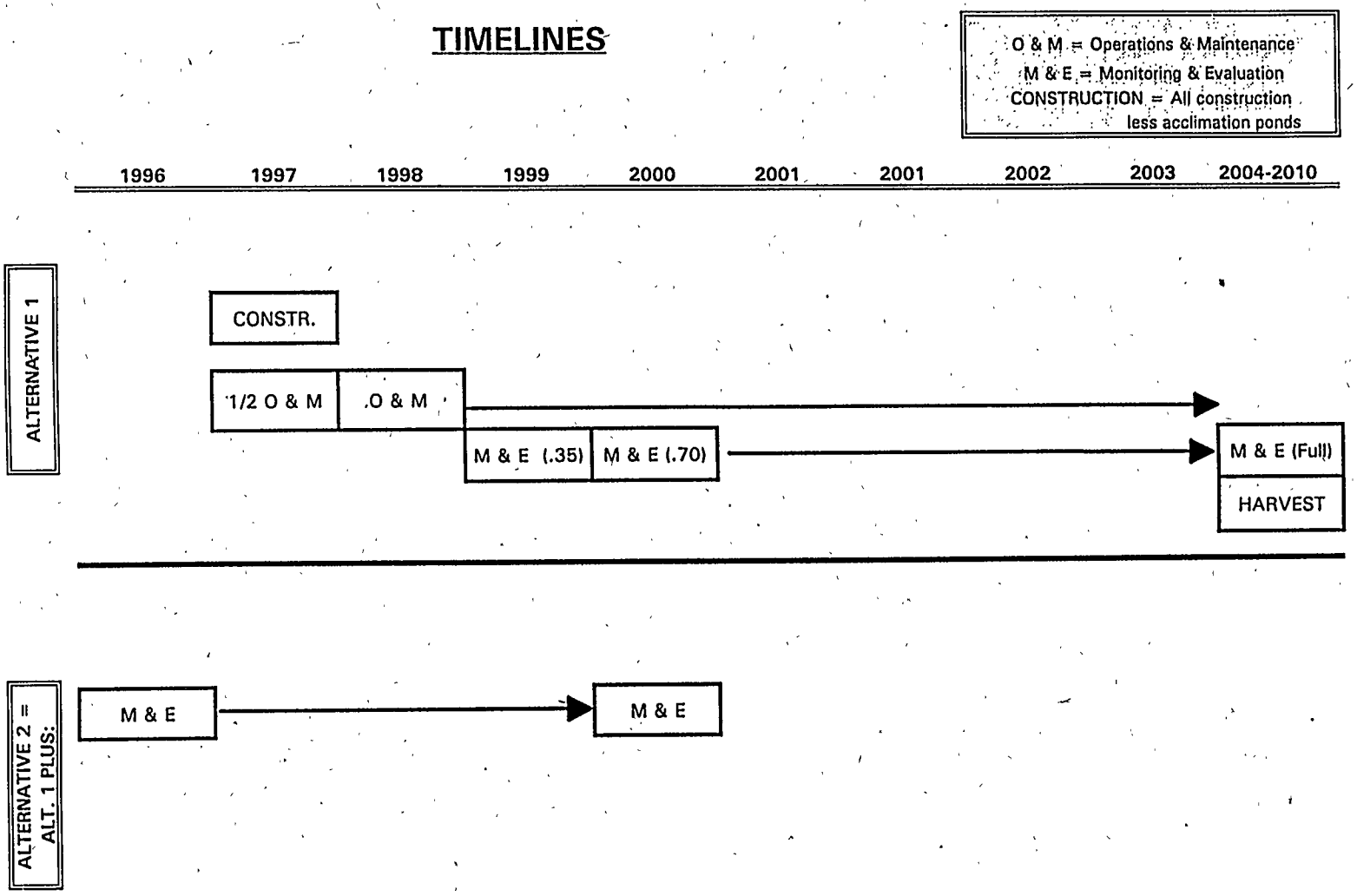


Figure 4.1 Timelines for Socioeconomic Study

4.1.8.2 Assumptions Behind Direct Expenditure Models

Construction

BPA was the primary source for construction costs in aggregate. Aggregated costs were broken down into 22 industrial sectors according to expenditures made on similar hatchery-related construction over the last decade. Twenty-five percent of total construction costs were allocated to Engineering, Legal, and Administrative activities.

Local capacity factors were developed, based upon the scenario that the construction contract would be awarded to an out-of-area contractor. A 1-year construction period (June 1996 to May 1997) was assumed. Although some acclimation sites would be built later in 1997, their expenditures would be minor compared to the bulk of 1996 expenditures.

Operations and Maintenance

Detailed operations and maintenance expenditures were obtained from BPA and disaggregated into seven sectors based upon operations and maintenance expenditures of similar projects. It was assumed that operations and maintenance expenditures begin upon completion of construction. The YIN would be the lead agency for operations and maintenance of the facilities.

Monitoring and Evaluation

Aggregated monitoring and evaluation costs obtained from BPA were broken down into line-item expenditures on a basis of cost allocations recorded in similar programs over the past decade. Historically, a significant portion of monitoring and evaluation contracts was issued to consultants residing outside the region. Accordingly, impacts were generated by these consultants' in-region expenditures plus the expenditures of in-region monitoring and evaluation staff and contractors. Monitoring and evaluation expenditures for Alternative 1 were assumed to begin in 1999, reach their maturity level by 2000, and continue through 2010. Monitoring and evaluation activity by in-region staff was assumed to displace consultant activities as the activities proceeded. For Alternative 2, monitoring and evaluation activities were assumed to begin in 1996 and continue through 2010.

Harvest Expenditures

The harvest model, which apportioned harvestable fish by harvest methods and then into expenditures, was based upon a number of assumptions: (1) a 50/50 Native American to recreational split; (2) an 80/20 recreational boat/ bank angler split; (3) catch rates of .19/.09/2.2 salmon per trip for boat/bank/native anglers, respectively; and (4) 50 percent of recreational anglers coming from outside the study region. Expenditures per trip was an eclectic compilation of findings from a number of parallel studies. It was assumed that the spring chinook harvest would begin in 2004. No coho harvest was attributed to the YFP.

4.1.8.3 Findings

Tables 4.5 and 4.6 summarize the annual results obtained by running the model under the previously listed assumptions. The baseline column of Table 4.5 portrays the employment levels with no additional fishery activities. Columns 4 and 5 show the absolute and percentage increases in employment that Alternative 1 and Alternative 2 activities would add to the baseline employment for the construction year (1996-1997) and the maturity year (2010). Table 4.6 portrays the same impacts in terms of baseline incomes and additional income.

Table 4.5 Summary of Annual Employment Impacts for Alternatives 1 and 2, for the Two-county Impact Area

Year	Alternative	Baseline Employment	Change over Baseline	% Change over Baseline
1996-1997	1	119,245	386	0.32%
1996-1997	2	119,245	400	0.34%
2010	1	124,426	76	0.06%
2010	2	124, 426	76	0.06%

Table 4.6 Summary of Annual Income Impacts in Thousands of 1995 Dollars for Alternatives 1 and 2, for the Two-county Impact Area

Year	Alternative	Baseline Employment	Change over Baseline	% Change over Baseline
1996-1997	1	5,164,534	10,686	0.21%
1996-1997	2	5,164,534	11,229	0.22%
2010	1	5,731,259	2,085	0.04%
2010	2	5,731,259	2,085	0.04%

In the construction year, Alternative 1 would generate annually $10,686,000 of additional earnings, and 386 new jobs. When coho monitoring and evaluation activities, concomitant with the spring chinook construction activities, are added to the impacts for the construction activities, the total construction year effects are 400 new jobs and $11,229,000 in additional annual income. Not shown in these summary tables are potential sub-sector impacts of the construction period. The sectors with the greatest impacts would be construction and services. Although the greatest income and employment effects ($3,837,000 and 145 jobs) would occur in the construction sector, the second greatest income and employment changes would accrue to the service sector in the form of $2,451,000 of new income and 105 additional jobs. Because the service sector requires more employment per dollar of output, more new jobs would be generated by the service sector per dollar of income.

Projected annual results for the 2004-2010 maturity period are also summarized in Tables 4.5 and 4.6. These total impacts are comprised of the impacts of O & M, monitoring and evaluation, and harvest expenditures. In 2004, the beginning of the maturity period, the project would produce annual impacts of $2,085,000 in income and 76 jobs. As compared to the construction period expenditures, maturity period expenditures have relatively more impact on the service and trade sectors.

Taken on a basis of the impact area as a whole, even the largest of these impacts (for the 1997 construction year) amount to a maximum of one-third of a percent of either total employment or total income for the area. However, the impacts upon the Native American population of the area are considerable. Table 4.7 details the estimated impacts upon the Native American population in the construction and the maturity period.

Table 4.7 Summary of Annual Income and Employment Impacts upon the Native American Population, in Jobs and Thousands of 1995 Dollars

Year	Employment	Income
1996-1997	26	$754,100
2010	34	$1,041,900

The considerable impacts upon Native American employment and income in the maturity period stem from the role of the YIN as Lead Agency in operations, maintenance, monitoring, and evaluation activities. In summary, the employment impacts upon this relatively small population (8420) and labor force (3886) are significant.

The study also indicates the following:

- The project would increase employment in an area that generally suffers from high unemployment and youth out-migration.
- The project would stimulate some entrepreneurial activities in the study area.
- There would be no construction boom and bust, but a slight increase in jobs and income relative to the size of the study area economy.
- The new jobs would bring a mixed quality of employment to the region: high-income employment would be associated with construction, operations and maintenance, and experimentation and monitoring, while lower income employment would stem from service sector and trade activities during the harvest period.
- The project would aid in the structural evolution of the study area's economy.

- Even during the construction phase, the impacts would represent less than 1% of total area employment and income; there would be less than a 3% change in these variables for the construction sector itself.
- Although the impacts would be small relative to the two-county study area, the impacts would be far more significant to the Yakama Indian Reservation, a sub-area of low incomes and high unemployment rates.

4.1.9 Recreation Resources

4.1.9.1 Alternatives 1 and 2

Resident Trout Fishery

Potential impacts on resident trout are discussed under in Section 4.11, under **Species Interactions**. Since it appears that the YFP might affect resident trout to some extent, it is likely that the resident trout fishery would also be affected. Potential impacts include reduced size, reduced catch rates, and reduced angler satisfaction.

The risk of impacts on the resident trout fishery (particularly in the upper Yakima River) would be similar for both alternatives, since no additional coho would be released under Alternative 2. Also, coho released under the current YIN program are being released only in the lower Yakima River, outside the primary area of the resident trout fishery. Successful supplementation of Upper Yakima spring chinook would increase the rate at which the natural carrying capacity of the river in areas of species overlap would be reached or exceeded. Consequently, the likelihood would increase of adverse ecological and genetic interactions that could affect positive attributes of the resident trout fishery.

The resident trout fishery in the upper Yakima River is managed under year-round catch-and-release and selective fishery regulations (retention of caught fish is prohibited; only artificial flies or lures with a barbless hook are allowed). If returns of YFP fish were to jeopardize this fishery seriously, additional resource protection measures might be applied. These might include closing areas now open to fishing, imposing restrictions or reducing the time periods open to angling. Project managers would use the YFP adaptive management process (see Section 2.2, Adaptive Management) to identify unforeseen and unacceptable adverse impacts on resident trout populations and associated fishery attributes. As a part of that process, potential adjustments in YFP objectives and strategies which might reduce such impacts to acceptable levels would be considered, and adjustments would be made as appropriate.

Although there is a risk of adverse impacts on the resident trout fishery from successful supplementation under the YFP, positive impacts on resident trout might occur. If successful supplementation resulted in increased abundance of spring chinook, it is possible that resident trout populations would benefit from the increased prey base afforded by increased abundance of chinook fry or smolts. To the extent that successful supplementation results in positive impacts on resident trout populations, the resident

trout fishery might also benefit. Such benefits might include increased trout size and abundance, increased catch rates, and increased angler satisfaction.

Esthetics and Visual Resources

Since most of the project facility sites are located in natural-appearing settings, the facilities would alter the visual settings of the sites. Except for the Cle Elum hatchery, however, the facilities would be on a small scale, and several of them would be located near diversion dams, fish screens, and other man-made facilities. The Keechelus Dam site is located in a scenic highway corridor designated by the WDOT, but the site would be overshadowed by the dam and screened from the highway by trees. The Easton site options are also located in the scenic highway corridor, but both sites have been previously disturbed. The Easton gravel pond site is located next to the freeway, but has been highly disturbed by the asphalt batch plant and excavation of gravel, and is screened from the highway by trees. The Easton Dam site is surrounded by the diversion dam, fish screens, railroad, and a gravel access road. It is not visible from the freeway. The visual impacts of the sites would be mitigated by facility design, minimizing ground and plant disturbance during construction, and providing vegetative screening around the facilities.

Other Recreational Resources

The project facilities are not located near, nor would they affect, any National Trails, Wilderness areas, state-designated parks, or natural areas. The Cle Elum hatchery facility, North Fork Teanaway, and Jack Creek acclimation site might displace some dispersed recreational and hunting use. The remaining sites identified for facilities currently have little or no recreational use.

Impacts on winter snowmobiling could occur at the Jack Creek and North Fork Teanaway acclimation sites because the North Fork Teanaway Road would need to be plowed for access to the Jack Creek site, and both the North Fork Teanaway Road and USFS Road 9737 would need to be plowed for access to the North Fork Teanaway site. Currently, these roads are designated groomed snowmobile trails north of a parking area at Lick Creek. Project personnel have worked with the U.S. Forest Service, Cle Elum Ranger District, to develop an access plan for the Jack Creek and North Fork Teanaway sites that is compatible with winter recreation use. The USFS District Recreational Director has consulted with local snowmobile groups and has proposed that the project construct a snow park near the Jack Creek site, and create a snowmobile trail parallel to the portion of USFS Road 9737 that would need to be plowed for the North Fork Teanaway site.

BPA is discussing the possibility of allowing the Mountains to Sound Greenway Association to construct a trail that would cross the Cle Elum site on the south side of the river. The trail would connect the John Wayne Trail with a new trail to Roslyn.

Pump stations and outlet pipes on the banks of the river are the only in-river structures proposed as part of this project. Therefore, impacts on recreational boaters would be limited to minor, temporary construction activities.

Interpretive facilities are being planned for the Cle Elum site in conjunction with a group of interested agencies including the U.S. Department of Agriculture - Forest Service and the City of Cle Elum. The interpretive information would contribute to public education as to how the facilities work and their contribution to fishery resources. A public use policy for the undeveloped portions of the site would be initiated as a part of the wildlife management plan. Plans for minimizing impacts on recreational resources at the Jack Creek site would be developed in consultation with the landowners.

4.1.9.2 No Action Alternative

Potential impacts on the resident trout fishery from No Action would depend on management policies implemented in the Yakima River Basin. Recreational opportunities for anadromous sport fishing might be affected if the stocks continued to decline. Visual resources would not be affected, because no supplementation facilities would be built and operated.

4.1.10 Archaeological, Historical, and Cultural Resources

Archaeological, historical, and cultural resources are protected through a number of Federal regulations, including the National Historic Preservation Act, the Archaeological Resources Protection Act, and the American Indian Religious Freedom Act. (See Section 5.7.) These regulations safeguard historical and archaeological resources from damage or removal from Federal lands, and ensure that Federal activities do not impair access to Native American religious sites. In addition, the National Historic Preservation Act requires that the effects of any Federal or Federally assisted undertaking affecting cultural, historic or prehistoric resource be evaluated before project inception.

4.1.10.1 Alternatives 1 and 2

An analysis of potential impacts at the proposed facility sites for both alternatives resulted in the following conclusions:

- No impacts would occur on cultural resources at the Cle Elum, Easton, or Clark Flat sites.
- Prehistoric lithic materials were found in one area at the Jack Creek site. If possible, this area would be avoided in siting the acclimation facilities. If avoidance is not possible, further testing would be conducted to determine NRHP eligibility, and the Tribe and SHPO would be consulted.
- The extensive prehistoric cultural materials at the North Fork Teanaway site are potentially eligible for NRHP listing. If this site were to be selected for the acclimation facilities, extensive consultation and mitigation would be required.

- The pony-truss bridge at the alternate Keechelus acclimation site is potentially eligible for inclusion in the NRHP. Should the need arise to exceed the posted tonnage (10 tons) or to replace or alter the bridge, a determination of eligibility for the NRHP would be prepared for the bridge, or alternative access would be explored.

If, after construction has started, BPA should discover the project would have an effect on a previously unidentified but eligible property, BPA would fulfill its responsibilities under 36 CFR 800 of the National Historic Preservation Act by suspending work in the area of the impact, consulting with the SHPO and other involved agencies to assess the significance of the resource, and developing mitigation measures if warranted. Should human remains be discovered, work would stop, and the SHPO and the YIN would be notified. If human remains are discovered on Federal or Indian land, work must be suspended for a minimum of 30 days, as required by the Native American Graves Protection Act (1991), and appropriate mitigation measures adopted.

4.1.10.2 No Action Alternative

No impacts on cultural resources are expected from the No Action Alternative.

4.1.11 Resource Management

The fisheries, land use, and water management actions described in Sections 3.9.1, 3.9.2, and 3.9.3 would not change under the YFP. The state and Federal fisheries agencies and the YIN are responsible for anadromous fish habitat protection. The authorities for habitat protection in the Yakima River Basin include the YIN Treaty-reserved rights, and state and Federal laws and regulations. The basic laws that govern protection of fisheries habitat are adopted by either the Washington state legislature or the US Congress. Existing laws and regulations dealing with habitat protection will not be modified by the YFP, nor will the YFP create new regulations.

The YFP is being proposed and reviewed as a measure under the Council's Fish and Wildlife Program. BPA would use its authorities under the Northwest Power Act to implement the project if an action alternative is adopted in the Record of Decision. Section 10(e) of the Act requires that "[n]othing in this act shall be construed to affect or modify any treaty or other right of an Indian tribe." Under its treaty of 1855, the Yakama Indian Nation has fishing rights in the project area.

Under its treaty rights and the provisions of the CRFMP, a Court order in the case of *U.S. v. Oregon* D. Or. Cause NO. 68-531, the Yakama Nation is making releases of coho in the Yakima Basin. While BPA is not a party to *U.S. v. Oregon* or the CRFMP, it is contemplated that these same fish would be the subject of studies funded by BPA under YFP, alternative 1. These studies would be experiments under the Northwest Power Act. Neither the studies nor the funding would in any way alter the Yakama's Treaty rights, the CRFMP, or BPA's obligations under the Northwest Power Act.

4.1.11.1 Alternatives 1 and 2

Land Use Policies, Plans, and Procedures

Construction and operation of the proposed YFP facilities under either alternative would have minor impacts on existing land uses. Some impacts on dispersed recreation would occur at the Cle Elum, North Fork Teanaway, and Jack Creek sites (see Section 4.1.9.1). Each acclimation site would use less than 0.8 ha (2 ac.) of land (including access roads). Consistency with local land use plans is addressed in Section 5.2, and farmlands are addressed in Section 5.10 of this EIS.

Solid Waste and Hazardous Materials

Solid Waste

Each YFP facility is anticipated to generate solid waste requiring disposal. For the purposes of this analysis, three types of solid waste were considered: refuse generated by the residences at the Cle Elum hatchery facility, refuse resulting from daily facility operations, and fish carcasses resulting from seasonal fish processing operations. The volume of waste generated by the residences would depend on the number of persons in each household, and could vary seasonally. Based on data from a number of rural counties in Washington State, a generation rate of between 1.8 and 2.7 kilograms (kg) (4 and 6 pounds (lb.)) per person per day can be used to estimate the amount of refuse generated. Actual refuse generation would be likely to vary somewhat from this estimate. The amount of solid waste generated by employees depends on the number of full-time equivalent (FTE) staff employed at each facility, and would vary seasonally with changing operations at the hatcheries. The amount of this waste could range from 2.7 to as much as 3.2 kg (3 to as much as 7 lb.) per day per FTE employed. It is anticipated that approximately 13.4 metric tons (14.8 short tons) of fish carcasses would be generated annually at the Cle Elum hatchery facility under either alternative.

Solid waste collection, transport, and disposal services are available for the Cle Elum hatchery facility from Waste Management of Ellensburg. Wastes would be transferred to a baling operation near Ellensburg and disposed of at a landfill 27 km (17 mi.) east of Ellensburg. For the disposal of fish carcasses, specific disposal arrangements would be required annually. Fish carcasses could also potentially be incorporated into local composting programs or used as fertilizer, rather than disposed of by conventional means. Contracts would be arranged with local solid waste disposal companies for disposal of the small amounts of wastes generated at the other project facilities.

Facility operation would also generate domestic sewage. Septic tanks and drainfields would be constructed for each residence and main buildings to dispose of domestic sewage. Contents of the septic tanks would be periodically pumped out by a licensed contractor and disposed of at a local sewage treatment plant.

Routine facility operations would result in generation of fish feces and unconsumed fish food. Most of these fish wastes would settle to the bottom of the rearing tanks and raceways, with a small percentage remaining suspended and discharged. Through routine cleaning practices, waste products accumulating in rearing structures would be pumped to the facility settling basins. The basins would detain raceway cleaning effluent and allow fish wastes to settle out of the water column. Wastes that accumulate in the settling basins would undergo biological degradation, but might require periodic removal and disposal every 5 to 10 years. This waste material might be suitable for agricultural fertilizer, and could be offered to local farms or applied to facility land. It could also be placed in a certified landfill.

The project managers would develop and implement a recycling policy, which would clearly state the type and quantities of products to be procured by the program or facilities. In addition, source separation of recyclable products would be practiced onsite by using separate containers for aluminum, glass, paper, and other recyclable materials. The appropriate recycling or solid waste collection company would then be contacted for materials pickup.

Hazardous Materials and Waste

Normal facility operation under both alternatives might require the use of several chemicals classified as medicines for fish disease prevention and control. These substances include fish disease chemotherapeutants such as acetic acid, Diquat, Epsom salts, formalin (a saturated formaldehyde solution), iodophor (Betadine, Wescodyne, Argentyne), potassium permanganate, quaternary ammonium compounds, and sodium chloride and antibiotics such as oxytetracycline HCl (Terramycine) and oremetroprim (Romet). Several of these chemicals can be applied by a licensed operator only.

Tricaine methane sulfonate (MS-222), a fish anesthetic, and chlorine (sodium hypochlorite or HTH) also are likely to be used at project facilities. MS-222 is approved by the Food and Drug Administration (FDA) and is used primarily during transport of fish. MS-222 would be used in accordance with FDA requirements to calm fish and reduce stress during their transport from the central or satellite facility to the acclimation facility. Chlorine is likely to be used on a limited basis, primarily for disinfecting equipment.

Of the specific materials identified above, only formalin is considered a potentially dangerous waste. The formalin would probably be considered a listed hazardous waste as formaldehyde and classified as a U122, EHW (extremely hazardous waste) dangerous waste. Project facilities must comply with the dangerous waste generator requirements of WAC 173-303-070(8) if it becomes necessary to dispose of more than 1 kg (2.2 lb.) of formaldehyde at one time. Because the formalin is expected to be used up by the facility during operations, the facility is not expected to be a dangerous waste generator.

Because of their associated hazard, several of the compounds identified above are listed in 40 CFR 302 as requiring a report to be filed with the National Response Center within 24 hours if a spill above a certain amount (or reportable quantity) occurs. These compounds and their reportable quantities are listed below:

Compound	Reportable Quantity
acetic acid	2268 kg (5,000 lb.)
Diquat	453.6 kg (1,000 lb.)
formalin (formaldehyde)	45.4 kg (100 lb.)
potassium permanganate	45.4 kg (100 lb.)

The amount of these chemicals present at any of the facilities at any one time is expected to be below these reportable quantities, except for formalin.

Chemicals applied in project facilities would be handled, applied, and disposed of in accordance with FDA, EPA, and the WDOE regulations. Consequently, project managers do not anticipate adverse environmental effects from chemical use at project facilities.

Facility operations would not likely require the use of herbicides and pesticides for terrestrial applications. Mechanical eradication of nuisance species (for example, weeds, mice) is preferred; only in extreme cases would pesticides be used. If use of such a herbicide or pesticide were required at the facilities, a readily available EPA-approved product (for example, Monsanto's Roundup™) would be used. The use, storage, and disposal of these products and their containers would be in accordance with EPA or FDA regulations and the instructions on the product labels.

Limited use of lubricant oils and greases is expected to occur at the facilities. Use of these materials would be limited to maintenance of pumps and other moving equipment that might need to be lubricated periodically. These materials would be stored in an area such as a storage locker for flammable materials, away from the hatchery waters and storm drains. Maintenance of vehicles used by the facility would be contracted out and would not occur onsite. Thus, it is not expected that oil and/or grease would have an adverse effect at any of the facility sites.

4.1.11.2 No Action Alternative

Land use and resource management policies would not be expected to change in the Yakima River Basin as a result of the No Action Alternative. State and Federal fisheries agencies and the YIN are currently involved in implementation of several habitat protection laws and regulations. It should be noted that, while implementation of these laws and regulations may have been uneven over recent years, they pre-date the YFP and implementation would not be avoided if the YFP is not constructed. Fisheries habitat protection laws include the following: Water Resources Act of 1971, Revised Code of Washington (RCW) 90.54; Hydraulic Approval Act, RCW 75.20; Minimum Water Flows

and Levels, RCW 90.22; RCW 90.03.247; and RCW 90.03.345. Federal laws which may apply include: Endangered Species Act of 1973; Clean Water Act; Fish and Wildlife Coordination Act; National Environmental Policy Act of 1969; and Section 10 of Rivers and Harbors Act of 1886.

Land uses at the proposed facility sites would not change under the No Action Alternative. The proposed facilities would not be built, and the sites would remain in their current condition unless developed in the future. No generation of solid or hazardous waste or use of hazardous materials would result under the No Action Alternative.

4.2 Mitigation Measures

4.2.1 Management of Biological and Ecological Risk

The biological and ecological effects of the YFP or any other supplementation program are a function not only of the direct hazard (e.g., straying, disease transmission, competition), but also of the entire risk management structure of the project. Key elements of the risk management structure are a monitoring program and an adaptive management process for responding to results from the monitoring. While an effective risk management structure cannot promise to avoid fully all possible risks posed by a project, it would significantly reduce the intensity and duration of impacts.

The YFP has a well developed risk management structure, described in Section 2.2. The risk analyses presented in Section 4.1.2.1 describe the potential risks arising from operation of the project according to the objectives developed for the project. The monitoring plans described in Sections 2.3.3 and 2.4.3.2 will provide feedback for the adaptive management process.

4.2.2 Specific Mitigation Measures

The mitigation measures below have been identified by the various resource specialists working on this EIS; the impact analyses are based on implementation of these measures. If an action alternative should be selected for the YFP, BPA would detail in the Record of Decision which of these measures would be implemented. BPA and the project managers would work with the regulating agencies and affected parties to develop detailed plans for implementing these or similar measures. All measures apply to both Alternatives 1 and 2, unless otherwise specified. See also discussions under regulatory compliance in Chapter 5.

- Water withdrawals from the Yakima River for the Cle Elum hatchery would be reduced during periods of river flow less than 350 cfs (9.8 m^3s).
- Surface water withdrawals would be nonconsumptive; water would be returned to the source stream or river after it flows through the facility. BPA or the project managers would apply for a permit for nonconsumptive appropriation of surface

waters from the WDOE for each of the sites, and comply with the conditions of the permits.

- If the alternative Keechelus acclimation site were used, the possibility of using water piped directly from the reservoir would be explored to avoid further dewatering of the Yakima River during extreme low flow periods when the reservoir is being refilled.
- Project managers would implement measures to ensure that project facility construction and operation do not adversely affect surface or groundwater quality, including treatment of runoff from access roads and other impervious surfaces.
- County authorities and the Federal Emergency Management Agency would be contacted to ensure that any new construction would not alter floodplain or floodway characteristics or channel flow capacity. Certain design restrictions or limitations may apply. If facilities were located within the floodplain, they would be designed to withstand flooding. Construction impacts within the 100-year floodplain would be mitigated by ensuring that construction would not raise the expected level of the 100-year flood, and would include minimal use of impervious surfaces.
- The loss of 0.1 ha (0.24 ac.) of riparian wetland at the Cle Elum hatchery site would be mitigated by constructing 0.2 ha (0.54 ac. or 1,000 lineal feet) of outflow channel to the oxbow system with 0.14 ha (0.34 ac.) of fringing riparian emergent wetland, and by constructing an additional 0.06 ha (0.14 ac.) of isolated emergent wetland.
- To avoid impacts on wetlands at acclimation sites, delineations would be completed before final facility design, siting, construction, and operation. Information from delineation surveys would be used during final design to develop mitigation measures, if necessary, to ensure that the project would result in no net loss of wetlands. Review and concurrence through the Corps permit process would be completed as necessary before site development. Disturbance of wetlands and buffers from construction activities would be avoided whenever possible. If disturbance could not be avoided, the area of disturbance would be minimized to the extent practicable. Upon completion of construction, excavated areas would be backfilled, and disturbed land restored to its previous condition wherever possible.
- The project managers will define or identify objectives for management of the key non-target species before the project is implemented, so that an effective monitoring plan can be developed and implemented.
- The possible introduction of non-indigenous strains of pathogenic organisms under either alternative would be minimized by stringent inspection and quarantine procedures.
- All phases of artificial propagation, fish transfers, and supplementation procedures for both Alternatives 1 and 2 would follow the fish health policy documented in

Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT, 1994). Minimal use of surface water, rigorous sanitation, and use of disinfection procedures combined with optimum husbandry, isolation and quarantine practices, and a strong diagnostic and therapeutic program would be incorporated into the project operations.

- Specific recommendations for wildlife mitigation at the Cle Elum hatchery site have been prepared as a result of consultations with the WDFW (Renfrow, 1994) and the YIN, and would be reviewed for applicability and modified as necessary for implementation during site development. Mitigation plans for the net loss of riparian and other wildlife habitat at the acclimation sites would be developed and implemented in consultation with WDFW and YIN personnel. For the purposes of the YFP, and to be consistent with the CRBFWP, wildlife mitigation is defined as achieving and sustaining the levels of habitat and species productivity for the habitat units lost as a result of the construction and operation of the YFP facilities and interpretive trails. Habitat Units, as defined under the Habitat Evaluation Procedure, would be the preferred unit of measurement for wildlife mitigation accounting. The mitigation obligation would be considered as met only when the effects are fully addressed, i.e., when mitigation actually offsets the loss caused by a YFP facility.
- Any loss or unavoidable disturbance of riparian habitat would be compensated for by either acquisition or mitigation of other riparian habitat in the Yakima River basin.
- BPA would complete consultation with the NMFS and USFWS under Section 7 of the ESA before implementing the project.
- In the spring, before construction at the Jack Creek, North Fork Teanaway, or Keechelus sites, surveys for nesting spotted owls would be conducted. If owls are nesting within 0.8 km (0.5 mi.) of the sites, formal consultation with USFWS would be initiated.
- As necessary, the acclimation sites would be resurveyed for special status species before construction and/or a biologist would be on site to monitor construction of the facilities.
- Site clearing would be minimized to reduce the potential for air quality impacts during construction due to dust and vehicle exhaust.
- The visual impacts from the sites would be mitigated by minimizing ground and plant disturbance during construction, and providing vegetative screening around the facilities.
- Interpretive information has been proposed for the Cle Elum site to help the public understand how the facilities work and their contribution to fishery resources. A public use policy for the undeveloped portions of the site might be developed as a part of the wildlife management plan. Plans for minimizing impacts on recreational

resources at the Jack Creek or North Fork Teanaway sites would be developed with the landowners.

- The pony-truss bridge at the Keechelus Dam site is potentially eligible for inclusion in the NRHP. Should the need arise to exceed the posted tonnage (10 tons) or to replace or alter the bridge, a determination of eligibility for the NRHP would be prepared for the bridge. Alternative access might be investigated.
- The extensive prehistoric cultural materials at the North Fork Teanaway site are potentially eligible for NRHP listing. If this site were to be selected for the acclimation facilities, extensive consultation and mitigation would be required.
- Prehistoric lithic materials were found in one area at the Jack Creek site. If possible, this are would be avoided in siting the acclimation facilities. If avoidance were not possible, further testing would be conducted to determine NRHP eligibility, and the Tribe and SHPO would be consulted on an Historic Property Management Plan.
- The project managers would develop and implement a recycling policy, which would clearly state the type and quantities of products to be procured by the program or facilities. In addition, source separation of recyclable products would be practiced onsite by using separate containers for aluminum, glass, paper, and other recyclable materials. The appropriate recycling or solid waste collection company would then be contacted for materials pickup.
- Chemicals applied in project facilities would be handled, applied, and disposed of in accordance with FDA, EPA, and WDOE regulations.
- Where possible, an attempt would be made to locate facilities out of the 60-m (200-ft.) State shoreline area of the Yakima and North Fork Teanaway Rivers. The following measures would be taken, when practicable, to assure consistency with the Kittitas County's Shoreline Master Plan.
    1) Location of structures within the identified shoreline would be avoided if possible. If locations within the shoreline area could not be avoided, BPA would consult with the appropriate state and local agencies to determine the best placement of the structure.
    2) In shoreline areas, disturbed land would be restored as closely as possible to pre-project contours and replanted with native and local species. However, there might be locations where site topography would require near-bank disruption. A restoration and monitoring plan would be prepared before shoreline areas were disturbed.
    3) Erosion control measures would be implemented within the 60-m (200 ft.) shoreline area.
- Construction equipment exhausts would meet applicable regulatory requirements. Any fugitive dust caused by construction would be mitigated by water sprinkling, as necessary.

- A new snow park would be plowed near Jack Creek to provide access for snowmobiling along the North Fork Teanaway Road in winter, and a snowmobile trail would be created parallel to the portion of USFS Road 9737 that would need to be plowed for the North Fork Teanaway sites.

4.3. Unavoidable Adverse Effects

Implementation of the YFP as proposed under Alternatives 1 or 2 in this FEIS would result in the unavoidable adverse effects discussed below.

Dewatering of the Yakima River below Keechelus Dam would occur if this alternative site were chosen, minimum flow agreements for protection of fishery resources were not maintained, and alternative water sources were not found for the raceways at this acclimation site. Some construction activities would unavoidably violate State water quality standards on a short-term basis as erosion from the construction site entered nearby water bodies. Construction of pipelines and other facilities would disturb floodplains and small amounts of riparian habitat. Small amounts of wetlands would be lost, but would be mitigated through replacement.

Construction of the facilities for the YFP would result in the destruction of approximately 8.5 ha (21 ac.) of vegetation and wildlife habitat, including potential habitat of two endangered species: grizzly bear and gray wolf. However, there is no known use of the habitat by grizzly bears or wolves. Some disturbance of wintering bald eagles at the Clark Flat acclimation site would result from increased human activity in the vicinity of project facilities. Some disturbance of nearby nesting Northern spotted owls could result from construction of the Jack Creek or North Fork Teanaway sites.

The project would increase the likelihood of ecological and genetic interactions that could affect positive attributes of the wild trout fishery. The facilities would alter the visual settings of the sites. Some impacts on dispersed recreation would occur at the Cle Elum, Jack Creek, and North Fork Teanaway sites. Each YFP facility is anticipated to generate solid waste requiring disposal.

Cultural resources at the Jack Creek or North Fork Teanaway sites could be disturbed, depending on which site were chosen and the exact location of the facilities. The materials at the North Fork site are so extensive and significant that they would not be avoided through siting. Avoidance might be possible at the Jack Creek site, however, since the materials appear to be localized.

The following biological risks to fish have been identified for the project. While an effective risk management structure would greatly minimize these risks, it cannot promise to fully avoid all possible adverse effects that might result from implementing the project. Therefore, these risks are included here. The project managers believe that, with the implementation of the risk management structure outlined in Section 2.2, the benefits of the YFP would greatly outweigh the potential adverse effects of these risks. The Upper

Yakima spring chinook program poses genetic risks to all three spring chinook stocks in the basin. The amount and effect of straying of Upper Yakima hatchery fish on other stocks cannot be predicted and could genetically affect the other stocks, both in the Yakima River Basin and in other basins. Spring chinook produced from the YFP would compete with pre-existing naturally produced fishes, particularly spring chinook salmon and perhaps rainbow and steelhead trout. The specific outcome of this competition is largely unpredictable at this time, but it is reasonable to expect that growth, abundance, and/or distribution of affected stocks would be altered to some extent. The likelihood or outcome of interactions between fish produced by the YFP and wild and native non-anadromous fish is unknown. The fish produced by the YFP pose a low degree of risk to existing stocks through the potential for transfer of disease. The increased number of YFP fish available for harvest might result in increased harvest of unsupplemented wild stocks. The cumulative impact of the YFP and other supplementation projects on the carrying capacity of estuary and nearshore habitat is unknown and unavailable at this time (see discussion in section 4.1.2.2).

4.4. Relationship of Short-Term Uses and Long-Term Productivity

One of the goals of the YFP is to increase the long-term productivity of anadromous fish in the Yakima River Basin and, ultimately, in the Columbia River Basin, by providing knowledge about the use and application of supplementation theories. In the short term, the YFP would cause relatively minor impacts on water quality, quantity, vegetation and wildlife habitat, wetlands, and possibly the wild trout fishery. Yakima River Basin fisheries could also be negatively affected by genetic and ecological interactions that could result from implementation of the project. However, the commitment of the project managers and BPA to the use of the adaptive management process, including systematic risk assessment and monitoring, should minimize long-term genetic and ecological impacts. In fact, implementing the YFP through an adaptive management process may result in less impact on the long-term productivity than the No Action alternative, especially if the current decline in anadromous fish populations should continue.

4.5. Irreversible and Irretrievable Commitments of Resources

The YFP would result in the irreversible and irretrievable commitment of the materials needed for the construction of the facilities, although some of the materials would be recyclable after they complete their useful lives. Fuel used to construct and operate the project would not be renewable. Depletion of groundwater resources might occur, depending on the rate of recharge of the aquifer being used to provide water for the project. However, the most significant commitment of resources would be that of the genetic resources of the wild and native Yakima River Basin spring chinook stocks. The genetic makeup of the three stocks, especially the Upper Yakima stock, could be irreversibly and irretrievably altered by the implementation of the project. While all practicable means to minimize this impact would be taken by the project managers, there

is no way to eliminate this risk totally. The project managers and BPA, as a first priority, will consider the risks of this commitment in making decisions on this project.

5. ENVIRONMENTAL RULES, REGULATIONS, AND PERMITS

This chapter discusses laws, regulations, and permits that may apply to the Yakima Fisheries Project. Regulatory citations are in parentheses. As lead Federal agency for the EIS, BPA would take the lead role, as appropriate, in acquiring all necessary permits.

5.1 Environmental Policy

The proposed project would be developed in a manner consistent with the National Environmental Policy Act, following the "Regulations of Implementing the Procedural Provisions of the National Environmental Policy Act." These rules were issued by the President's Council on Environmental Quality. It would also be consistent with the Department of Energy National Environmental Policy Act Implementing Procedures (10 CFR 1021).

5.2 State, Areawide, and Local Plan and Program Consistency

No unresolvable conflicts with state, areawide, or local plans are anticipated. The project would be coordinated with State and local government agencies to ensure that all applicable requirements are met.

5.2.1 State and Areawide Clearinghouses

BPA distributed the RDEIS to the Washington clearinghouse for State and local agency review and consultation, as required by Executive Order 12372. The clearinghouse was notified when the RDEIS was ready for review, and clearinghouse comments were addressed in the FEIS. The clearinghouse will also be informed of the availability of the FEIS and the Record of Decision.

5.2.2 Local Plans

BPA's proposed activities would be located in areas covered by the 1993 Kittitas County Comprehensive Plan. The comprehensive plan is a declaration of policies, and as such, contains no regulations or minimum standards.

The Cle Elum hatchery site, acclimation site, caretakers' residences, most of the wells and water transmission pipelines, and access roads are located in an area designated as *Forest Multiple Use* on the Upper Kittitas County Comprehensive Plan Map. The purpose of this designation is to protect and conserve natural resources, provide appropriate areas for residential and recreational development, and promote development in harmony with the natural environment. The pump station, one or more wells, and portions of one or more water transmission pipelines are located in an area designated *Floodplain*. The purpose of the floodplain designation is to minimize flood damage, reduce the need for flood control

structures, assist the unhindered flow of flood waters, and limit costs of recovery from flooding.

The acclimation sites have the following Comprehensive Plan designations:

Easton acclimation site	
Gravel Pond siting option	Forest Multiple Use
Easton Dam siting option	Forest Multiple Use
Jack Creek acclimation site	Forest Resource/Forest Multiple Use
North Fork Teanaway acclimation site	Forest Resource
Clark Flat acclimation site	Open Range
Cle Elum acclimation site	Forest Multiple Use/Floodplain
Keechelus acclimation site	Forest Multiple Use

The purpose of the *Forest Resource* designation is to focus on the importance of sustained yield forestry and associated forest values including watershed, wildlife, mining and recreation. The open range (rangeland) designation objective is to follow a policy of encouraging low intensity uses and activities on range lands. Where heavier land uses can be supported, such uses might be allowed following environmental review.

5.2.3 Zoning

Current zoning and comprehensive plan designations are not always consistent with each other. Work underway for the Washington Growth Management Act would correct that.

The proposed and alternative YFP facilities would be located within the following Kittitas County zoning districts:

Cle Elum hatchery site	Forest and Range
Easton acclimation site	
Gravel Pond siting option	Forest and Range
Easton Dam siting option	Rural - 3
Jack Creek acclimation site	Commercial Forest
North Fork Teanaway acclimation site	Commercial Forest
Clark Flat acclimation site	Agricultural (A20)
Cle Elum acclimation site	Forest and Range
Keechelus acclimation site	Commercial Forest

Fish hatcheries or aquaculture facilities are not addressed in the Kittitas County Zoning Code as either permitted or conditional uses under any of the county's zone designations. BPA and its consultants have and would continue to coordinate the proposed actions with the County planning department to address any zoning concerns.

5.3 Water Quality and Water Appropriation

Several regulatory requirements apply to water quality, water appropriation, and to work in stream beds and on shorelines.

5.3.1 Water Appropriation

BPA would secure permits from the Washington Department of Ecology as required for the nonconsumptive appropriation of river water required for the YFP (RCW 90.03). Permits would also be secured from the WDOE for the appropriation of groundwater in amounts over 18,927 liters (5,000 gallons) per day (WAC 173-160). The necessary notifications for water-well drilling (WAC 173-160) would be provided.

5.3.2 Permits for Discharges Into Waters of the United States

The Clean Water Act (CWA) regulates discharges into waters of the United States. (See Section 5.3.3 for compliance with Section 404 of the CWA (33 U.S.C. 1344)).

BPA would acquire National Pollutant Discharge Elimination System (NPDES) permits from the WDOE, as required, for the point discharge of any pollutant regulated under the CWA (33 USC 1251 et seq.) to the Yakima River or its tributaries from YFP facilities. Under Section 401 of the CWA, a Federal permit to conduct an activity that results in discharges into navigable waters is issued only after the affected State certifies that existing water quality standards would not be violated if the permit were issued. Some construction activities would unavoidably violate state water quality standards (particularly the turbidity criteria) on a short-term basis. In such cases, a Water Quality Modification may be required by the WDOE (Chapter 90.48 RCW, Chapters 173-201; 173-222 WAC).

Section 402 of the CWA authorizes storm water discharges associated with industrial activities under the NPDES. For the State of Washington, the EPA, Region 10, has a general permit (# WA-R-10-000F) authorizing Federal facilities to discharge storm waters from construction activities disturbing land of 2 or more ha (5 or more ac.) into waters of the U.S., in accordance with various set conditions. BPA would comply with the appropriate conditions for this project at all sites meeting this criterion, such as issuing a Notice of Intent to obtain coverage under the EPA general permit and preparing a Storm Water Pollution Prevention (SWPP) Plan.

The SWPP Plan helps ensure that erosion control measures would be implemented and maintained during construction. The SWPP Plan would address Best Management Practices for stabilization practices, structure practices, stormwater management, and other controls.

5.3.3 U.S. Army Corps of Engineers Permits for the Discharge of Dredged or Fill Material

Minor amounts of dredged or fill material may be discharged to the Yakima River, its tributaries, or wetlands during construction or operation of the YFP. These activities would most likely be authorized by Corps nationwide permits (number 14 for access roads and number 7 for intake and outlet structures) under CWA Section 404 (33 CFR 320-330). As in the case of NPDES permits, certification (that the discharge would not violate State water quality standards) is required from the State of Washington. Other conditions may apply to the nationwide permits.

5.3.4 State Permits for Work in Stream Beds

Hydraulic project approval from the WDFW would be obtained to construct any form of hydraulic project or perform other work that would use, divert, obstruct, or change the natural flow of the Yakima River or its tributaries (RCW 75.20.100, WAC 220-110). The WDFW would also require that water-diversion devices be equipped with a fish screen to prevent fish from entering the diversion device (RCW 75.20, Chapter 77.16 WAC).

5.3.5 Coastal Management Program Consistency

The Coastal Zone Management Act of 1972 requires that Federal actions directly affecting the coastal zone be undertaken in a manner consistent, to the maximum extent possible, with the State's coastal zone management program. Washington's coastal zone management program is implemented through the provisions of the State Shorelines Management Act, including shoreline management programs developed/administered by the counties. The Coastal Zone Act Reauthorization Amendments of 1990 also require that proposed Federal facilities fully comply with Federal consistency requirements as determined by and through consultation with a designated coastal zone management agency.

BPA and the WDOE have a Memorandum of Agreement (MOA) that provides a process for State and local review of BPA projects in and directly affecting shoreline areas in the State. BPA would fully meet its obligations under the MOA, but no permit would be required.

The State's Shoreline Management Act (Chapter 90.58 RCW) identifies "Shorelines of Statewide Significance" and "Shorelines of the State" near the proposed project. In addition, the Kittitas County Shoreline Master Plan regulates development in areas 60m (200 ft.) landward of the Ordinary High Water Mark of the Yakima and North Fork Teanaway Rivers, including the floodway and associated wetlands. Facilities at the Cle Elum hatchery and all of the acclimation sites may be located within the 60-m (200-ft.) jurisdictional area on the Yakima River and North Fork Teanaway River for the Shoreline Management Act and Shoreline Master Plan.

The Cle Elum hatchery would have an intake structure and pump station located at river mile 184.7 and an outfall structure located at river mile 183.3. In addition, the oxbow system at the Cle Elum hatchery site is considered to be an associated wetland of the Yakima River, so the discharge from the constructed outflow channel would be located in the shoreline zone. The portions of the Cle Elum hatchery site that fall under the jurisdiction of the Kittitas County Shoreline Master Plan are designated Conservancy Environment. Aquaculture (including fish hatcheries) is a permitted use in the Conservancy Environment, provided operation does not involve major construction or other activities that would substantially change the character of the area.

Actual structure locations for the acclimation facilities would not be finally determined until the detailed design stage of project development (after the final EIS). Where possible, BPA would attempt to locate structures out of the 60-m (200-ft.) jurisdictional area. Also, BPA would take the following measures, when practicable, to assure consistency with the county's Shoreline Master Plan.

1) Location of structures within the identified shoreline would be avoided if possible. If locations within the shoreline area could not be avoided, BPA would consult with the appropriate state and local agencies to determine the best placement of the structure.
2) In shoreline areas, disturbed land would be restored as closely as possible to pre-project contours and replanted with native and local species. However, there might be locations where site topography would require bank disruption. A restoration and monitoring plan would be prepared before shoreline areas were disturbed.
3) Erosion control measures would be implemented within the 60-m (200 ft.) shoreline area. (See Section 4.2, **Mitigation.**)

5.3.6 U.S. Army Corps of Engineers Permits for Structures or Work in Navigable Waters

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) requires permits for structures potentially affecting navigation on waters of the United States. The Rivers and Harbors Act requires the applicant to prevent the obstruction or alteration of a navigable water without the specific authorization from the Corps. The Corps has identified navigable waterways and issues permits for actions affecting them (33 CFR 322). This project would not require any structures in a navigable waterway because the Yakima River and its tributaries above the city of West Richland are not classified as navigable waters according to the Corps definition in 33 CFR 329.

5.4 Recreation Resources - Wild and Scenic Rivers, National Trails, Wilderness Areas, Parks

A review of the Wild and Scenic River inventory of listed and proposed rivers (16 U.S.C. Sec 1273 (b)) shows no rivers or portions of rivers qualifying for Wild, Scenic, or Recreation River status within the study area. The Pacific Crest National Scenic Trail, inventoried in the National Trail System (16 U.S.C. Sec. 1242-1245), passes within several miles of the Keechelus and Easton acclimation sites, but these sites would not be visible from the trail. No designated wilderness or parks are located near the facility sites.

5.5 Permits for Rights-of-Way on Public Lands

BPA would secure necessary use permits from the USBR for the Keechelus and Easton Dam acclimation sites. A use permit may be required for the Easton Gravel pond site from the WDOT.

5.6 River-Bottom Leases

Leases of the state-owned aquatic lands are administered by the Washington Department of Natural Resources. If necessary, a lease to use these public lands would be issued by the Department's Aquatic Lands Division (Chapter 79.90 RCW, Chapter 332.30 WAC).

5.7 Heritage Conservation

Federal historic and cultural preservation acts include the National Historic Preservation Act (16 USC 470-470w-6), the Archaeological Resources Protection Act (16 USC 470aa-470ll), the Archaeological and Historic Preservation Act (16 USC 469-469c), the American Antiquities Act (16 USC 431-433), and the American Indian Religious Freedom Act (42 USC 1996).

5.7.1 Current Status

The National Historic Preservation Act requires that Federal agencies review the consequences of an activity on property that may be listed on the National Register of Historic Places (NRHP) or eligible for listing. The State Historic Preservation Officer (SHPO) of Washington has been contacted regarding the presence of properties currently listed in the NRHP. At this time, no previously identified NRHP properties are located within BPA's area of potential effect. However, historic and previously reported, potentially eligible NRHP properties are known to exist in the vicinity of the Keechelus site (see Section 3.8). Surveys have been completed at all sites, and no other historic or prehistoric resources were discovered. Historic or prehistoric sites identified have been inventoried on the appropriate Washington State Cultural Resource Inventory Form, and Determinations of Eligibility have been prepared for potential NRHP properties. The

Washington SHPO has been consulted for findings of effect to the resources in question, and has concurred regarding their eligibility. BPA has also consulted with the YIN to ensure that none of the project activities would affect sites that have religious or cultural significance to them. The YIN is a proponent of this project, and a cooperating agency for the preparation of this EIS.

5.7.2 Discovery Situations

If, during construction, previously unidentified cultural resources are identified which would be adversely affected by the proposed project, BPA would follow the procedures set forth in the following regulations, laws, and guidelines: Section 106 (36 CFR Part 800) of the National Historic Preservation Act of 1966, as amended (16 U.S.C. Section 470); the National Environmental Policy Act of 1969 (42 U.S.C. Sections 4321-4327); the American Indian Religious Freedom Act of 1978 (PL 95-341); the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470a-470m); and the Native American Graves Protection and Repatriation Act of 1990 (PL 101-601).

1) To the maximum extent possible, BPA would redirect work so that it would not affect the resource. Other work or work in areas that would not affect the resource may continue.
2) BPA would immediately obtain from BPA's contract cultural resource specialist an evaluation of significance for the site and determination of potential impacts on eligible properties.
3) BPA would immediately initiate consultation with the Washington SHPO and other Federal/state agencies that may be involved in the project regarding the eligibility of the site to meet specific NRHP Criteria. Such consultation would be initiated by telephone or in person, and corroborated with written documentation.
4) If the SHPO and BPA both agree that the site is not eligible, BPA would document this decision and construction may proceed.
5) If BPA, the SHPO, or both consider the site NRHP-eligible, that determination shall be documented and BPA would proceed with protection and mitigation. BPA would further consult with SHPO on the determination of effect as follows:
    a. If BPA and SHPO agree that there would be no effect, construction may proceed.
    b. If BPA, SHPO, or both consider that the project would affect an eligible property, they would confer to identify appropriate mitigation measures. Recommended mitigation measures would then be provided to the ACHP.
    c. If the ACHP agrees with the proposed mitigation, then a Memorandum of Agreement addressing mitigation of the affected resource would be drafted, and the project may proceed.

5.8 Threatened and Endangered Species

The Endangered Species Act requires that Federal agencies review the consequences of an activity on threatened and endangered species and the ecosystem on which these species depend; it also gives review authority to USFWS and NMFS. In their letter of October 7, 1994, the USFWS identified the bald eagle (*Haliaeetus leucocephalus*), Northern spotted owl (*Strix occidentalis caurina*), gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos = U. a. horribiliis*), marbled murrelet (*Brachyramphus marmoratus marmoratus*) and Peregrine falcon (*Falco peregrinus*) as the threatened and endangered species in the area.

Two Biological Assessments have been prepared and are included in Appendix D of this FEIS. The BAs have been submitted to USFWS and NMFS, and informal consultation will be completed prior to the ROD. NMFS has been consulted regarding impacts on any listed anadromous fish species. While none of the listed species are present in the Yakima River Basin, several species in the basin are under review for listing.

Should any changes that might affect a species occur to the proposal, or if any other species known to occur in the close vicinity of the project becomes officially listed before completion of the project, BPA would reevaluate its activities to ensure that its actions do not "jeopardize the continued existence of any endangered species or threatened species," and are in compliance with Section 7(a) of the Endangered Species Act.

State-listed special status species will be addressed under the SEPA guidelines. The State program and SEPA guidelines were developed to improve quality and consistency in and validate methods for evaluating impacts of development on wildlife. The Final EIS, along with the Biological Assessment for Federal threatened and endangered species, will be adopted under SEPA regulation to comply with SEPA requirements.

5.9 Fish and Wildlife Conservation

Provisions of the Pacific Northwest Electric Power Planning and Conservation Act (16 U.S.C. 839 *et seq.*) are intended to protect, mitigate, and improve fish and wildlife of the Columbia River and its tributaries. This project is proposed as a part of the Columbia River Basin Fish and Wildlife Program to fulfill these obligations.

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 *et seq.*) encourages Federal agencies to conserve and to promote conservation of nongame fish and wildlife species and their habitats. Measures proposed to mitigate potential impacts on wildlife and on vegetation do this to the maximum extent possible within BPA's statutory responsibility.

The Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) requires that Federal agencies consult with the USFWS whenever an agency plans to conduct, license, or permit an activity involving the impoundment, diversion, deepening, control, or modification of a stream or body of water. BPA is coordinating potential changes in bodies of water with

the USFWS to ensure species protection as required by this act by providing the USFWS with a copy of this FEIS.

5.10 Farmlands

Section 154 (a, b) of the Farmland Protection Policy Act requires BPA to identify and quantify adverse impacts of the proposed action on farmlands. The location and areal extent of Prime and other important farmlands as designated by the Natural Resource Conservation Service NRCS; formerly Soil Conservation Service (SCS)) were obtained from NRCS soils surveys for the Kittitas County area. The Clark Flat and Easton Dam acclimation sites are the only project sites that would affect potentially prime farmland soils. However, since these sites are not irrigated, they are not considered to be Prime farmland (Gentry, pers. comm., 1995). Approximately 0.8 ha (2 ac.) of land would be affected by construction at each site. No unique or other designated (i.e., statewide or local) important farmlands would be affected.

5.11 Floodplains/Wetlands

Both floodplains and wetlands are found in the project area. These are specially protected resources. For complete assessment of their significance and of impacts, see the floodplain/wetlands assessment under Section 4.1.1. This assessment constitutes the Federal review required by 10 CFR 1022 and Executive Orders 11988 and 11990. A statement of finding with respect to floodplains will be included in the final EIS.

Wetlands, frequently flooded areas, and riparian habitat are all designated as environmentally sensitive "critical areas" under the Kittitas County Interim Critical Areas Development Ordinance. The ordinance establishes a "zero net loss of natural wetland functions and values" approach to regulating wetlands. Wetland buffer widths and replacement ratios are designated. Frequently flooded areas are defined as the 100-year floodplain, and are protected by a "no net loss of floodplain storage" concept for new construction. Structures must be floodproofed. Riparian habitat buffers are also designated; for the Yakima River they are 12.2 to 61 m (40 to 200 ft.) from the Ordinary High Water Mark. Riparian buffers are to be retained in their natural condition; however, uses that do not cause a significant adverse impact on the habitat may be allowed in the buffer (subject to approval by the Director of the Planning Department). These requirements would be met for the YFP.

5.12 Energy Conservation and Pollution Control

5.12.1 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA provides for the registering of pesticides and regulates their use to ensure that unreasonable environmental impact does not result. Herbicides (a kind of pesticide that

kills plants) would be used for the YFP only in a very limited fashion and under controlled circumstances. Herbicides would be used to control weeds at project facilities, to control noxious weeds, and to maintain landscaping at various facilities. If herbicides were applied, the use, storage, and disposal of these products and their containers would be in accordance with EPA or FDA regulations and the instructions on the product labels. Herbicide containers would be disposed of according to Resource Conservation and Recovery Act (RCRA) standards.

5.12.2 Resource Conservation and Recovery Act (RCRA)

This act is intended to bring about:

- the recovery of useful materials which are often needlessly buried in landfills;
- the recovery of solid fuel, oil, and gas that can be converted into energy; and
- environmentally safe disposal of non-recoverable waste residues, particularly those which are toxic or hazardous.

See the discussion of these topics in Section 4.1.11 of the EIS. BPA does not anticipate that any hazardous wastes, as defined by RCRA (42 USC 6901 et seq.), would be generated by the YFP. However, any such wastes that might be generated would be manifested, packaged, and shipped offsite for disposal under the appropriate regulations (40 CFR 260-268, 40 CFR 270-272, WAC 173-303).

5.12.3 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

CERCLA was enacted and is generally employed primarily to address past contamination from past activities at inactive sites; however, it can also be used to address active sites with current releases of hazardous substances.

BPA assesses existing fee-owned properties and property planned for acquisition in order to determine the likelihood that hazardous substances may be present. All of the sites proposed for acquisition under this project have undergone an Environmental Land Audit; potential for contamination was discovered only at the Easton Gravel ponds site. If this site were selected for an acclimation site, the extent of contamination would be assessed and, if necessary, cleaned up before construction is started.

5.12.4 Energy Conservation at Federal Facilities

It is the policy of BPA to set an example in the Pacific Northwest for energy-efficient construction. All of BPA's new construction will use thermal conservation measures based on regional cost-effectiveness as well as on life-cycle costing within the region's three climatic zones. BPA will exceed the requirements of the latest version of BPA's Energy Smart Design (Commercial Model Conservation Standards) or the DOE

mandatory standards for Federal facilities for individual building components of the YFP, whichever is more stringent.

5.12.5 Noise Control Act

WDOE regulates maximum environmental noise levels (WAC 173-60). Allowable levels depend on land use of the source and receiving property. Noise levels associated with the YFP are discussed in Section 4.1.7.2. Given the low level of noise expected to be generated and the lack of nearby sensitive receivers, State noise levels would not be exceeded.

5.12.6 Safe Drinking Water Act

The Safe Drinking Water Act (42 U.S.C. sec 300f *et. seq.*) is designed to protect the quality of public drinking water and its sources. In the State of Washington, the Department of Health is responsible for implementing the rules and regulations of the Act (WAC 246-290). This project would not affect any Sole Source Aquifers or other critical aquifers, or require an underground injection well.

5.12.7 Clean Air Act

Neither construction nor operation of the YFP would result in significant air emissions that would require air quality permits under the Clean Air Act (42 USC 7401 et seq.). Construction equipment exhausts would meet applicable regulatory requirements. Any fugitive dust caused by construction would be mitigated by water sprinkling.

Chapter 6.0

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Chapter 7.0

Preparers and Reviewers of the Environmental Impact Statement

This chapter lists and presents credentials for those who prepared and reviewed this EIS.

The original DEIS (November, 1992) was prepared by staff of the Pacific Northwest Laboratory (PNL), which is operated for the U.S. Department of Energy by Battelle Memorial Institute under Contract DE-AC0676RLO 1830. Subsequent revisions were made by a group of consultants and BPA staff. Listed below are people who contributed to writing and reviewing both the original and revised DEIS, the areas in which they contributed, and their qualifications.

The revised environmental impact statement underwent a series of reviews before it was published. Reviewers included staff of the Bonneville Power Administration, members of the Yakama Indian Nation, the Washington Department of Fish and Wildlife, and various consultants to the Yakima Fisheries Project.

Table 7.1. EIS Contributors and Reviewers

Name, Affiliation	EIS Responsibility	Qualifications
Jan A. Aarts CH2M Hill	Permitting	Master of Urban Planning; 12 years experience in urban and environmental planning
David M. Anderson PNL	Socioeconomics, PNL	M.S. in forest economics; 10 years experience with environmental issues
Randall S. Anderson Anderson & Associates	Technical writing, comment analysis	M.S. in Natural Resource Management; 12 years experience in environmental research and technical writing, consultant to BPA since 1990
Robert J. Austin BPA	Project management	M.S. in biology; 17 years experience in fishery biology
Craig Busack WDFW	Genetics	Ph.D.; 10 years experience in fish genetics research
Natalie A. Cadoret PNL	Cultural Resources	B.S. in geology; 13 years experience in cultural resource evaluation
James C. Chatters PNL	Archaeology, Historic, and Cultural Resources	Ph.D. in anthropology; 25 years experience in cultural resource evaluation and management

Colbert E. Cushing PNL	Aquatic Ecology	Ph.D. in biology (limnology) 31 years expenence in aquatic ecology research
Mark Danley BPA	Public Involvement Specialist	M.S. in forestry; 8 years experience in public involvement coordination
Dennis D. Dauble PNL	EIS Management, Fisheries, Water Quality	Ph.D. in fisheries; 18 years experience in fisheries research
David E. Fast YIN	Fisheries biology, Science/Technical Advisory Committee	Ph.D. in fisheries sciences; 18 years experience in fisheries management
Richard E. Fitzner PNL	Wildlife	Ph.D. in zoology; 22 years experience in wildlife research
Carlene Fleskes BPA	Public Utility Assistant	3 years experience in environmental compliance activities and public involvement
Robert Gatton CH2M Hill	Engineering aspects	M.S. in water resources engineering/M.S. management; 20 years experience in water resources and fisheries engineering
Lauren Gaylord CH2MHill	Solid and hazardous waste	M.S. in urban planning; 5 years experience in water resources and fisheries engineering
David R. Geist PNL	Fisheries	M.S. in biology; 7 years experience in fisheries research and management
Jeff Gislason BPA	Project Manager	Ph.D. in fisheries; 15 years of experience in fisheries research and management
Robert Hagar Hatchery Operations Consulting	Fish Culture, Facility Operations	B.S. in fisheries; 32 years experience in fishery biology and fish culture
Lee Harrell NMFS	Fish health aspects	Doctor of Veterinary Medicine/M.S. in fisheries biology; 28 years experience in fisheries veterinary medicine and fish health research

Donald Heinle CH2M Hill	Water Quality	Ph.D. in zoology; 26 years experience in aquatic ecology and water quality
Craig Holstine Eastern Washington University	Archaeology, Historic, and Cultural resources	MA in history; 15 years experience in resource management and history
Karin A. Hoover PNL	Water Quality	M.S. in geological sciences; 6 years experience in water-related research
Charles (Bill) Hopley WDFW	Fisheries biology, Science/Technical Advisory Committee	B.S. and M.S. in Fisheries Science; 19 years experience in hatchery production programming and evaluations, harvest management, and supplementation research
William Koss WDFW	Project direction and management	M.S. in forest economics; 18 years experience in natural resource management, policy, and administration
Steven Leider WDFW	Species interactions; Project direction and management	B.S. in fisheries; 19 years experience in fisheries research
Susan Lewis CH2M Hill	Surface water hydrology	M.S. in water resources; 5 years experience in fisheries research
Regina E. Lundgren PNL	Technical communications	BA in scientific and technical communications; 7 years experience in risk commnunication
Duane A. Neitzel PNL	Adaptive Management	M.S. in zoology; 20 years experience in fisheries and limnology
Richard S. Mack Central Washington University	Socioeconomic study	Ph.D. in economics; 25 years experience in regional economics
Rosy Mazaika PNL	Wildlife biology	M.S. in wildlife ecology; 7 years experience in wildlife research and management
Katherine B. Miller	Recreation, PNL	M.S. in marine affairs; 4 years experience in environmental compliance

Lars Mobrand Mobrand Biometrics	Project planning	Ph.D. in biomathematics; 12 years experience in fisheries research
Judith H. Montgomery	Technical writing and editing	Ph.D. in American Literature; 15 years of experience in writing and editing environmental documents
Emmett B. Moore PNL	Regulations and permits	Ph.D. in physical chemistry; 36 years experience in govemment regulations and project management
Marvin E. Nelson BPA	Project management	B.S. in mechanical engineering; 25 years experience in engineering and management, 16 years experience in research and management
Patrick Oshie YIN	Tribal law	J.D., U. of Washington; 15 years experience in working with tribal, state, and other governments in natural resources
Steve Parker YIN	Harvest management	B.S. in fisheries; 10 years experience in harvest management
Todd Pearsons WDFW	Species interactions	PhD in fisheries science; 10 years experience in fish research
Lloyd Phinney Phinney Fish Consultants	Project management	B.S. in fisheries science; 35 years experience in fish habitat and fisheries management
William H. Rickard PNL	Vegetation	Ph.D. in botany; 42 years experience in ecosystem research
Kirk Robinson BPA	Engineering	M.S. in Civil Engineering; 14 years of experience in project engineering and management
Melvin Sampson YIN	Project direction and management	
Tom Scribner YIN	Anadromous fisheries	M.S. in fisheries; 14 years experience in fisheries research

Harry Senn Fish Management Consultants	Fish culturing	B.S. in biology; 35 years experience in fish culture practice
Patricia Smith BPA	EIS editing/NEPA compliance and Biological Assessment	Four years environmental project planning/ development; 15 years data gathering and analysis.
Lonna G. (Jodi) Stroklund BPA	Fish biology, contract management	B.S. in biology; 10 years experience teaching biology, 8 years COTR, 3 years fishery biologist
Robert L. Tuck Eco Northwest	Water issues	B.S. in biology; 14 years experience in fisheries research and management
Richard W. Wallace PNL	Land Use, Geology	Ph.D. in hydrogeology; 20 years experience in geology and hydrology research
Kevin Ward BPA	EIS development	B.S. in Resource Management; 11 years experience in NEPA/ environmental coordination
Bruce D. Watson YIN	Habitat enhancement	B.S. in fisheries biology; 20 years experience in fisheries management
Nancy H. Weintraub BPA	Technical writing and editing, NEPA compliance coordinator	M.S. in zoology; 16 years experience in NEPA compliance and aquatic ecology

Chapter 8.0

Agencies, Organizations, and Individuals to Whom This Environmental Impact Statement Was Sent

This chapter lists those to whom the draft EIS was sent. Additional businesses, organizations, and individuals will be sent copies of the RDEIS as they request it.

Federal/Regional Agencies

Northwest Power Planning Council
Portland, Oregon

Pacific Northwest Utilities Conference Committee
Portland, Oregon

U.S. Department of Agriculture Forest Service
Wenatchee National Forest, Washington

U.S. Department of Commerce/National Oceanic and Atmospheric Administration/
National Marine Fisheries Service
Seattle, Pasco, and Manchester, Washington/Portland, Oregon

U.S. Department of the Interior, Washington, DC

U.S. Department of the Interior/Bureau of Reclamation
Boise, Idaho/Yakima, Washington

U.S. Department of the Interior/Fish and Wildlife Service
Vancouver, Olympia, and Moses Lake, Washington

U.S. Department of the Interior/Environmental Protection Agency, Washington, DC

U.S. Department of the Interior/Environmental Protection Agency, Regional Office, Seattle, WA

State Agencies

State of Idaho

Department of Fish and Game

State of Oregon

Department of Fish and Wildlife

State of Washington

Department of Agriculture
Department of Community Development
Department of Ecology
Department of Ecology, Water Resources
Department of Fish and Wildlife
Eastern Washington State College, Bonneville Cultural Resources Group
Washington Sea Grant
Washington State University
Central Washington University

Tribal Agencies

Yakama Indian Nation
Fisheries Resources Management Program
Toppenish, Washington

Yakama Indian Nation
Law and Order Committee
Toppenish, Washington

Yakama Indian Nation Confederated Tribes
Tribal Council, Fish and Wildlife Committee
Toppenish, Washington

Local Agencies
City of Cle Elum, Mayor's Office
City of Yakima, Assistant City Manager
Cle Elum Chamber of Commerce
County of Kittitas Board of Commissioners
County of Kittitas Department of Planning
County of Yakima Department of Planning
Douglas County PUD No. 1
Ellensburg Water Company Board of Directors
Halverson and Applecate, Ellensburg Water Company
Roza Irrigation District
Sunnyside Valley Irrigation District
Yakima River Basin Association of Irrigation Districts

Organizations and Businesses

Burke and Sons Herefords
Cle Elum, Washington

Cascade Irrigation District
Ellensburg, Washington

CH2M Hill Northwest, Inc.
Bellevue, Washington

Chinook Engineering
Mukilteo, Washington

Clark Skamania Flyfishers Association
Vancouver, Washington

Federation of Fly Flshers
Seattle, Washington

Fiander Enterprises, Inc.
Harrah, Washington

Fisheries Resource Management
Granger, Washington

Hickey Engineering Sales, Inc.
Bellevue, Washington

Mobrand Biometrics, Inc.
Vashon, Washington

Northwest Rivcrs Council
Seattle, Washington

Oregon Step Coalition
Bandon, Oregon

Oregon Trout
Portland, Oregon

Pacific Northwest Laboratory
Richland, Washington

Pentec Environmental
Edmonds, Washington

Royal Coachman Outfitting Company
Renton, Washington

R. W. Beck and Associates
Seattle, Washington

Trout Unlimited
Yakima, Washington

Washington Cattlemen's Association
Ellensburg, Washington

Washington State Council of the Federation of Flyfishermen
Seattle, Washington

Washington Fly Fishing Club
Redmond, Washington

Washington Water Resources Association
Yakima, Washington

Yakima River Alliance
Seattle, Washington

Yakima Valley Canal Company
Yakima, Washington

Libraries, State and Federal Congressional Staff, and Private Individuals

GLOSSARY

This appendix contains a list of acronyms, abbreviations, and technical terms used in this EIS. Words that would be defined in a desk-size dictionary (for example, the College Edition of the American Heritage Dictionary) are not included.

Acronyms and Abbreviations

AHS	Archaeological and Historical Services
BPA	Bonneville Power Administration
BLM	Bureau of Land Management
CEA	Comprehensive Environmental Analysis of Anadromous Fish Production
CFR	Code of Federal Regulations
CWA	Clean Water Act
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CRFMP	Columbia River Fish Management Plan
dBA	decibels (A-weighted)
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EDTPM	Ecosystem Diagnostic and Treatment Planning Model
EIS	Environmental Impact Statement
FDA	U.S. Food and Drug Administration
FONSI	Finding of No Significant Impact
gpm	gallons per minute
ha	hectares
HTH	sodium hypochlorite
m^3/s	cubic meters per second
mg/L	milligrams per liter
MOU	Memorandum of Understanding
MS-222	tricaine methane sulfonate
NEPA	National Environmental Policy Act
NIT	new innovative treatment (one of the experimental treatments for the project)
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
Northwest Power Act	Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act).
NPPC	Northwest Power Planning Council
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
OCT	optimal conventional treatment (one of the experimental treatments for the project)

ORV	off-road vehicle
RASP	Regional Assessement of Supplementation Project
RCW	Revised Code of Washington
RDEIS	Revised Draft Environmental Impact Statement
SEPA	State Environmental Policy Act
SHPO	State Historic Preservation Office
STAC	Science/Technical Advisory Committee
TSS	total suspended solids
USBR	Bureau of Reclamation
USC	U.S. Code of Regulations
USDOE	U.S. Department of Energy
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDFW	Washington Department of Fish and Wildlife (formerly consisted of Washington Department of Fisheries and Washington Department of Wildlife; the two agencies have now merged)
WDOE	Washington Department of Ecology
WDOT	Washington Department of Transportation
YFP	Yakima Fisheries Project
YKFP	Yakima/Klickitat Fisheries Project
YIN	Yakama Indian Nation

Technical Terms

100-year floodplain. That portion of a river valley adjacent to the stream channel which is covered with water when the stream overflows its banks during a 100-year flood event. A 100-year flood event is one that has a 1 in 100 chance of happening in any 1 year.

acclimation site. Sites at which young fish are held in artificial ponds to allow them to imprint so that they return to that place to spawn.

acclimation. Allowing fish to adjust to environmental variables. Older hatchery practices resulted in high mortalities because the young fish were released directly from the hatchery, without a chance for them to adjust to the natural stream environment. Acclimation is a process which is used to allow the fish to gradually adjust to a more natural environment and imprint on the area in which the acclimation site is located, rather than on the hatchery, so that the fish will return to the area to spawn.

acre-feet. Quantity of water (43,560 cubic feet) that would cover 1 acre to a depth of 1 foot.

adaptation. Genetic change over generations through natural selection that results in a population better suited to its environment.

aggregate. Multiple fish stocks within a species or race.

anadromous. Fishes that migrate from fresh to salt water when young, spend the majority of their adult life in the ocean, and then return to their ancestral drainage to spawn.

ancestral drainage. Basin in which fish spawned, historically.

biomass. Total weight of organisms per unit volume.

broodstock. Fish that will be spawned to create hatchery stock.

carrying capacity. The average maximum level of a particular population sustainable within an ecosystem over a long period.

central facility. Fish culture facility used for incubation and rearing of salmon and steelhead.

density-dependent mortality. Predation on fish that varies depending upon their density. It is theorized that predators ignore prey species that are rare, and begin to prey on them only when they reach a certain density.

domestication selection. Natural selection for traits which affect survival and reproduction in a human-controlled environment.

donor stock. Specific stock from which broodstock are chosen.

fingerling. Juvenile salmonid; usually refers to pre-smolt fish.

floodway. A river channel active only during a flood.

fry. Juvenile salmonid life stage following absorption of yolk sac.

imprinting. The physiological and behavioral process by which migrating fish assimilate environmental cues to aid their return to their stream of origin as adults.

kelt. Spawned-out adult.

long-term genetic fitness. A measure of the ability of a population to survive natural selection over a number of generations.

maximum sustainable yield. The maximum harvest rate at which a population can remain viable over an extended period of time.

native populations. Populations of fish that have adapted to a particular habitat and that have spawned naturally in that habitat over many generations.

naturally-spawning populations. Populations of fish that spawn in the natural habitat as opposed to being spawned through a hatchery program. They may be offspring of fish spawned in either natural or hatchery environments.

new innovative treatment. A treatment that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrate, in-water structure) to produce fish that mimic attributes of naturally produced spring chinook salmon.

optimal conventional treatment. A treatment that incubates, rears, and acclimates salmonids using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin.

pH. The symbol for the chemical measurement of the acidity or alkalinity of a solution.

population. A group of individuals of a species living in a certain area.

presmolt. Juvenile salmonid before undergoing metamorphosis into saltwater fish.

predation. The harm, destruction, or consumption of a prey organism by an animal predator.

production. Number of individuals produced from natural environment or fish culture facilities.

programmatic EIS. An EIS that addresses a program, or a broad range of actions, rather than a specific project or proposal.

race. A group of individuals within a species, forming a permanent variety; a particular breed.

raceway. Holding area or rearing facility for juvenile or adult salmonids in a hatchery.

redd. A salmon nest.

reproduction. The process of forming new individuals of a species by sexual or nonsexual methods.

resident fish. Fish that spend their entire life cycle in fresh water.

riparian. Growing on or living on banks of streams and rivers.

residualism. When anadromous juveniles do not outmigrate to the ocean and instead remain in freshwater for extended periods. In some cases, they may become resident fish, and never outmigrate to the ocean.

run timing. The distinct period during which a population of anadromous fish passes through or returns to a specific location.

salmonid. Belonging to the family salmonidae, i.e., salmon, trout, steelhead, whitefish.

satellite facility. Fish culture facility used for rearing and acclimation of juvenile salmon or holding of adult broodstock.

smolt. Juvenile salmonid undergoing metamorphosis into a saltwater fish, usually during the downstream migration period.

species. A group of interbreeding individuals not interbreeding with another such group; similar, and related species are grouped into a genus.

status-indexed fishery. A fishery based upon harvest policy that determines the rate of harvest on the basis of the strength of all run components.

stock. A distinct management or genetic unit of fish.

subordination. To put the item referenced behind something else, in terms of importance.

supplementation. The use of artificial propagation in the attempt to maintain or increase natural production while maintaining the long-term fitness of the target population, and while keeping the ecological and genetic impacts on nontarget populations within specified limits. **(Regional Assessment of Supplementation Projects definition)**

terminal fishery - A fishery that occurs in a terminal area, such as a tributary, where the stocks of fish have been disaggregated so that the harvest is considered to be on a single identified stock rather than on mixed stocks of fish; fishery conducted near or in the natal stream as anadromous fish return to their point of origin.

terminal harvest rate. The proportion of a migratory population harvested in a terminal fishery.

trapping facility. Facility used to trap and handle juvenile or adult salmonids during downstream or upstream migration period.

wild population. Genetically unique populations of fish that have maintained reproduction successfully without supplementation from hatcheries.

within population variability. The quantity and variety of alleles, chromosomes, and arrangement of genes on the chromosomes that are present in populations.

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APPENDICES

Appendix A: Comments on Revised Draft EIS and Responses

Appendix B: 1995 Planning Status Report; Volume 3 Yakima Spring Chinook Salmon; Volume 5 - Yakima Coho Salmon

Appendix C: Glossary of Species' Scientific Names

Appendix D: Biological Assessments and Endangered Species Consultation

Appendix E: Harvest Management

Appendix A: Comments on Revised Draft EIS and Responses

To the Reader

This appendix contains the comments made on the YFP Revised Draft EIS published in May 1995. All letters were read and comments identified within them; similarly, all comments made at are meetings were identified for response. The body of the appendix contains the individual comments (sometimes grouped where different commenters made the same or closely related point), followed by a response. Each comment/comment group is identified by a letter/number code for easy reference. Note that some comments have been moved out of numerical order in order to group them for most effective response (e.g., comment B01-09 has been moved together with B02-02).

On the following pages, you will find (1) a table of contents listing groups of comments by subject matter; and then (2) an index to commenters, where they were identifiable (others are listed as *Anonymous* or identified by meeting and commenter number). This index will enable individual commenters to find responses to specific points they raised.

Where appropriate, changes have been made in the EIS to reflect the responses to comment. As noted in the Reader's Guide to the EIS (inside front cover), all significant additions to the EIS are double-underscored and identified with a vertical line in the margin.

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YAKIMA FISHERIES EIS
COMMENT AND RESPONSES
COMMENTER INDEX

To assist commenters in locating responses to their comments, we have prepared the index below. The number to the right of each name corresponds to the comment/response location in the FEIS Comment/Response section. Where commenters did not identify themselves, comments are listed as *Anonymous*. Comments (all anonymous) made at meetings are listed at the end of this index, and are identified by the meeting at which they occurred (Yakima (YPM) or Cle Elum (CPM).

Ahlf, Vern & Kristin	**E-08**
Anonymous, Department of Interior, F&W Service	**D05-01**
Anonymous	**A-01**
Anonymous	**B01-06**
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Anonymous	**D02-08**
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[1] Comments asterisked are grouped with category **E (Other)** in the Comment/Response section.

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CPM-28-01	**E-07**
CPM-29-01	**B03-04/05**
CPM-34-02	**D03-19/20/21/22**
CPM-38-02	**C01-23**
	D03-19/20/21/22

YPM-001-01	**B02-13**
YPM-003-02	**B06-06**
YPM-003-04	**D03-34/35**
YPM-003-05	**D03-34/35**
YPM-003-06	**C02-05**
YPM-003-07	**D03-01**
YPM-003-08	**D03-02**
YPM-003-09	**B05-02**
YPM-005-01, 006-02	**B02-14**
YPM-006-01	**C01-12**
YPM-006-03	**B02-14**
YPM-006-04	**B05-01**
YPM-006-05	**B05-01**
YPM-006-06	**C01-10**
YPM-006-07	**C01-11**
YPM-006-08	**B06-04**
YPM-006-09	**C01-08**
YPM-006-10	**D07-08**
YPM-006-11	**D07-02**
YPM-006-12	**C04-01**
YPM-006-13	**D04-05**
YPM-006-14	**D03-16**
YPM-009-01	**C01-24**
YPM-011-01	**D03-01**
YPM-011-02	**D03-32**
YPM-012-01	**E-06**
YPM-012-02	**D08-02**
YPM-012-03	**B01-13***
YPM-012-04	**B01-11***
YPM-012-05	**C03-07**

YPM-015-01	**B02-05**
YPM-019-02	**C-05**
YPM-024-01	**B02-01**
YPM-026-01	**D03-17**
YPM-026-02	**D06-04/05**
YPM-026-03	**B01-04**
YPM-026-04	**C01-12**
YPM-026-05	**C01-11**
YPM-026-06	**D06-04/05**
YPM-026-07	**B01-02**
YPM-026-08	**D06-06**
YPM-028-05	**C01-04**
YPM-028-06	**D01-05**
YPM-028-07	**C01-02**
YPM-028-08	**C01-08**
YPM-028-09	**C01-07**
YPM-028-10	**D07-06***
YPM-028-11	**C01-02**
YPM-028-12	**D07-06***
YPM-028-13	**D07-05***
YPM-03-01	**C01-10**
YPM-03-03	**C01-14**
YPM-030-01	**D02-07**
YPM-030-02	**D07-04***
YPM-032-01	**C01-07**
YPM-032-02	**C01-08**
YPM-035-01	**B05-01**
YPM-035-02	**D06-02**
YPM-035-03	**C01-14**
YPM-035-04	**C01-10**
YPM-037-01	**D03-13**
YPM-037-02	**D08-02**
YPM-037-03	**C03-06**
YPM-041-01	**E-09**
YPM-19-01	**C-05**
YPM-28-01	**C01-07**
YPM-28-02	**C01-04**
YPM-28-03	**C01-05**
YPM-28-04	**C01-03**

YAKIMA FISHERIES EIS
COMMENTS ON REVISED DRAFT EIS AND RESPONSES

A - EIS Process/General Comments

A-01
Comment: I personally think an environmental assessment of this project unnecessary.
[Anonymous 024-01]

Response: We acknowledge your comment. However, the National Environmental Policy Act and its regulations require Federal agencies to prepare a detailed statement on major Federal actions significantly affecting the environment. BPA determined in the 1990 Finding of No Significant Impact on the Yakima Fisheries Project that an Environmental Impact Statement would be necessary to consider issues relating to project management, genetic impacts, and species interactions.

A-02
Comment: Reclamation's Pacific Northwest Regional Office, Upper Columbia Area Office, and the Yakima Field Office have reviewed the subject Revised DEIS and the following comments are provided for your consideration and use in the development of the final document. Reclamation, through the Upper Columbia Area Office, has participated in Technical Work Groups involved in the development of the supplementation project and has regularly met with Bonneville Power Administration (BPA), Yakima Indian Nation (YIN) and the Washington Department of Fish and Wildlife (WDF&W) to discuss issues related to the Yakima Fisheries Project (YFP) and the operations of Reclamation's Yakima Project. We are committed to the continuation of such participation throughout the preparation of the final environmental impact statement (FEIS) and future actions and operations to ensure successful results in the Yakima River Basin.
[James V. Cole
Area Manager, Bureau of Reclamation, US Department of the Interior 048-01]

Response: We acknowledge and appreciate the Bureau of Reclamation's participation in and support of this project.

A-03

Comment: Although the DEIS mentions this issue [the likelihood of the project expanding to incorporate other fish species and/or stocks, and in what order], the FEIS should include a complete discussion of the commitment to additional planning and environmental review.

[Connie Iten
State of Washington, Department of Fish and Wildlife 040a-02]

Response: This discussion can be found in Section 1.5 (page 9 of the RDEIS, the second and third full paragraphs); and the discussion in Section 2.2 on the adaptive management process (especially the second paragraph of Section 2.2.1.1).

A-04

Comment: Since the BPA is mandated to enhance and support fish and wildlife resources adversely affected by Hydroelectric development and operation, the Yakima River system is an ideal watershed to test the Supplementation theory - to determine the effectiveness and develop the program and management procedures to ensure optimal results. If the Supplementation concept can be proven and management principles developed, Supplementation could be used as an effective recovery tool in many other areas within the region.

[J. Daniel Kinney
Yakima Valley Audubon Society 054-02]

Response: We agree. This is stated in our objective for the project; see page 5 of the RDEIS.

B - Proposed Action (General)

[No comments in this category]

B01 - Project Purpose and Need

B01-01

Comment: ***Stop your project.*** You should articulate a bonafide, justifiable reason why BPA would disrupt the status quo and put so much of the unknown at risk simply to return salmon to the Yakima River System. This is a horrible reason to embark on this project.

[Jim Carkonen 004-01]

Comment: *Some information you still need is:* a true justification and explanation of why we need to do this, more than just the weak two paragraphs under "The Need" within the ""Project Description."

[Jim Carkonen 004-03]

Response: The Purpose and Need section of the EIS succinctly expresses the need for the project as well as its goals and objectives. Decisions made by the project participants have taken into consideration known risks to the existing environment. These risks have been identified in the EIS, and project management has modified the project to reduce its potential impact on the environment. Moreover, a recent scientific study issued by the National Research Council entitled "Upstream" (Nov. 1995) recommends that hatcheries be used to help rebuild natural populations of salmon and to learn about salmon and the effectiveness of methods for improving their survival. This is exactly the purpose of the YFP.

B01-02

Comment: Supplementation is good to a point but something has to be done--water and habitat first.

[YPM-026-07]

Comment: Pg 6, 4th paragraph, last sentence. The benefits of supplementation may never become self-sustaining. The need to supplement may go away if habitat is improved.

[Lynn Hatcher
Yakama Indian Nation 049-01]

Comment: State, federal and tribal resources should be directed toward habitat improvements to prepare the Yakima River to support fish before hatcheries and other "supplementation" efforts are undertaken to reintroduce fish into the system. Even though water quality is being addressed. it is not yet on a scale to improve fish habitat on a large scale, so all efforts that are put into the system should be directed at habitat improvements.

[Barbara J. Ritchie
State of Washington, Department of Ecology 040-01]

Response: Habitat improvement projects have been ongoing in the Yakima River Basin. It is anticipated that these projects will continue in the future. While the YFP is designed to succeed under current habitat conditions, the managers recognize that supplementation efforts would be enhanced if efforts to improve habitat were also undertaken. The project managers will take habitat issues into consideration when making production decisions. Note also that habitat improvement alone would accomplish nothing toward reintroducing stocks that have been driven to extinction in the Yakima basin, such as summer chinook.

B01-03

Comment: Pg 10. If the "No Action Alternative" is chosen, then BPA's mitigation responsibilities will remain largely unfulfilled. This is a more important consequence than not realizing implementation of the Council's Program.

[Lynn Hatcher
Yakama Indian Nation 049-03]

Response: Thank you for your comment. In the event that BPA decides not to fund the project, we would seek other means of fulfilling our mitigation responsibilities. This has been clarified in the Final EIS.

B01-04

Comment: It seems that our dams are the one thing that the main blame is being leveled at. The dams were built 30 years ago and the runs were high. Why now? Is it truly the high seas fishery?

[Todd B. Smith 001-1]

Comment: What's the point of spending this money? Unless the dams are removed, very few/none of the coho will survive. Get rid of the dams, or build better fish ladders. Then introduce this program, not before.

[Michael T. Osborn 052-2]

Comment: How is down-stream dam management going to change to allow greater smolt survival?

[Vic Stacostha 015-11]

Comment: When are we going to "bite the bullet" and modify the dams to reduce fish mortality?

[Vic Stacostha 015-13]

Comment: We do not believe that hatcheries have proven reliability in restoring anadromous fish stocks -- It is time (way past time really) to fix the dams - giving equal consideration to the needs of the fish to have adequate flows for migration both to and from the ocean. In the years that fish hatcheries have been used to supplement the declining fish runs, no proven record has been established to show that they are a useful method - Stop fooling around and get as nearly back to pre-dam conditions as is humanly possible.

[William & Marjorie Hayes 013-01]

Response: We recognize that dams present and create environmental hazards to migrating anadromous fish. Improvements to the habitat within the migration corridor, including passage survival for adults and juveniles at dams, are expected to be made during the life of this project. The project managers agree that fish production, in and of itself, will not resolve anadromous fish survival issues. Supplementation and improvements to the fish migration corridor must both be implemented in order to achieve the optimal results.

B01-05

Comment: How will supplementation address what's happening on the Columbia?

[YPM-026-03]

Comment: *Some information you still need is:* what long-term changes must be made on the mainstem Columbia to allow the fish to make it back to the Yakima in the first place.

If my car leaks oil, the manner in which I put the oil in the engine does not matter. Likewise, the manner in which hatchery bred fish are introduced to the river system will not make those hatchery fish any more likely to survive the journey down too-warm rivers to the sea through poorly designed passage facilities. Use your money to address the main problems rather than spending it to produce doomed fish. Supplementation may be necessary to save the species, but without major changes elsewhere, their demise is nearly certain.

[Vance Jennings 017-04]

Response: As described within the RDEIS, one of the goals of the project is to evaluate supplementation as a production methodology that can be used in other river systems, including the Columbia mainstem. Project managers can expect increased numbers of returning adult fish to the Yakima River Basin as the physical challenges to migrating anadromous fish are diminished by the actions of dam operations. These increases would be in addition to those resulting from a supplementation program that successfully increases natural production. See also the Response to Comment B01-04.

B01-06

Comment: Why would it not be feasible to alter hydro generation during periods of migration?

[Anonymous 036-03]

Response: Alternatives to hydroelectric generation are possible and are being reviewed in other forums, such as the System Operations Review (SOR). Such alternatives are beyond the scope of this EIS. However, hydro generation is being altered during migration as a result of actions being taken by the dam operators in response to endangered species concerns.

B01-07

Comment: Let's do what is reasonable. How about a special spawning bed along the Columbia Reach. Specifically, why can't we take water from Priest Rapids and create a canal of sorts which would really be a 30 mile long spawning bed that parallels the Columbia River, off limits to all fishing!!

[Fred B___? 021-02]

Response: Thank you for your comment. This suggestion is outside the scope of this EIS. However, the entire range of approaches to increase natural production of anadromous fish in the Columbia River system will continue to be reviewed under the auspices of the Northwest Power Planning Council for possible inclusion in their Fish and Wildlife Program.

B01-08
Comment: *Your environmental study should have included:* more concern for the farmer! [There should be] a balance between fish and farming.

[Fred B____ ? 021-01]

Response: We appreciate your view that fish and farming must be balanced. We believe that the project managers have taken agricultural issues into consideration when evaluating the impacts of this project upon the environment. As the project is designed so that it would not consume water resources, its impact upon the agricultural industry is expected to be neutral.

B01-10
Comment: Let Indians harvest sea lions and seals to reestablish some control over these predators.

[Anonymous 044-07]

Response: Thank you for your comment. These activities are outside the scope of this EIS, but some Northwest tribes are actively considering such activities.

B01-12
Comment: *My environmental concerns are/Your environmental study should have included:* Solutions to the causes of fish decline not just trying to treat the symptoms of the problem:

1. Dams
2. Habitat (including physical habitat structure)
3. Water Quality

[Anonymous 009-01]

Response: Thank you for your comment. The Northwest Power Planning Council and the project managers have considered the habitat issues you refer to in your comment when making decisions regarding the development of the project. Please refer to Response to Comments B01-04, B01-05 and D06 for more information relating to your comment.

B02 - Management and Coordination

B02-01

Comment: Examine the example of the Yakima watershed council - consensus building, emphasizing water conservation.

[YPM-024-01]

Comment: Our environmental concerns are primarily based on the need to ensure that the Bonneville Power Administration and other responsible parties are evaluating opportunities to complement their respective management actions/objectives within the Yakima River Basin.

[Joan Cabreza 057-02]

Response: The management structure of the project is described in Section 2.2.3 of the FEIS. The Yakama Indian Nation and the State of Washington, working closely with the BPA, will work to achieve the project's goals and objectives. The project managers will work in conjunction with other agencies (e.g. USBR, NMFS, and USFWS) and review all opportunities to reach and build consensus on pertinent project issues (e.g., water conservation). A paragraph has been added to the FEIS (new section 2.2.3.5) to address the relationship of the project with other agencies.

B02-02/B01-09

Comment: The Yakima River Basin Water Enhancement Project (YRBWEP), which was authorized by Congress in 1994, will also be a tool to improve the long-term management and enhancement of the Basin's water and fish resources. Reclamation, through the YRBWEP, will have opportunities to work with BPA to improve conditions in the Yakima River Basin for the anadromous fish resource. This cooperation, in turn, will influence the success of the YFP. We anticipate that BPA through the Yakima Fisheries Project will continue to commit resources and form partnerships to resolve potential conflicts over water issues that may arise from efforts to enhancement anadromous fish stocks in the Yakima River Basin.

[James V. Cole
Area Manager, Bureau of Reclamation, US Department of the Interior 048-04]

Comment: [We have] asked for clarification on the relationship of the YFP and the Bureau of Reclamation's (BOR) water enhancement. The revised draft EIS briefly discusses the relationship of the YFP to other fishery enhancement efforts going on in the Yakima River Basin. The EIS states that, in October of 1994, Congress passed legislation to authorize water conservation activities, including improvements to irrigation water delivery systems and a basin-wide water conservation program. It is EPA's understanding the BOR intends to prepare an environmental impact statement for implementing provisions of the legislation. This legislation appears to provide a great opportunity for improving habitat conditions (i.e., instream flows) in the Yakima River.

We believe the short and long term success of the YFP could be directly tied to the timing and implementation of the Water Enhancement Project. Therefore, it is imperative from a watershed planning/coordination perspective that the final YFP EIS explicitly discuss the relationship between the BOR's project and the YFP. To ensure a coordinated approach, the final EIS should outline the anticipated timeframes and schedules for implementation of these two projects along with any other major projects.

[Joan Cabreza 057-04]

Response: Thank you for your comments. All project participants are deeply committed to the success of this project, and intend to perform all work necessary to achieve its goals and objectives. It is anticipated that BPA, the Yakama Indian Nation, the State of Washington, and cooperating fish agencies will form partnerships to secure habitat improvements which complement the project's projection goals and objectives. Further clarification is provided in the FEIS, consistent with the following:

As stated in the EIS, Congress passed P.L. 103-434 in October 1994. Title XII of this Act authorizes improvements to irrigation facilities in the Yakima Basin (through the Yakima River Basin Water Enhancement Project (YRBWEP)). The primary focus of Title XII is a conservation program that will conserve water by improving delivery systems and on-farm practices. Sixty-five percent of the water saved through these measures will be dedicated and used for instream flows. Other elements contained in Title XII include the 1-meter (3-foot) rise of Cle Elum Dam, which will provide approximately 18,510,000 m^3 (15,000 acre/feet) of water for instream flows; electrification of the Chandler hydropumps, which will improve instream flows between Prosser Dam and Chandler Powerhouse; and efforts to improve instream flows on a number of tributary streams.

Although not directly related to the YFP, implementation of Title XII will certainly complement and improve the success of efforts undertaken through the YFP. Preliminary planning for implementing Title XII is currently underway. As part of that effort, the BOR is preparing pertinent NEPA documents, including a programmatic EIS, to be completed in 1997. BPA will be a cooperating agency. Implementation of programs authorized by Title XII will occur over a number of years as funding is appropriated by Congress.

B02-03/04

Comment: We recognize the need to develop strategies to restore and maintain the Basin's anadromous fish resources and think the YFP is a positive approach. Because of Reclamation's water management responsibilities in the Yakima River Basin, we believe there is a need for us to be more actively involved in the YFP in some advisory capacity. We would like to explore that possibility with the cooperating entities of the YFP in the near future.

[James V. Cole
Area Manager, Bureau of Reclamation, US Department of the Interior 048-05]

Comment: We recognize the YFP has been scaled down in size and numbers of stocks of anadromous fish to eliminate some of the unknown effects of large scale supplementation, so a smaller research project can continue. Though the project has been reduced in size, there is still some potential for conflicts over water issues related to returning adult supplemented fish and the evaluation of supplementation. We believe that it is in the best interest of all parties to recognize and mutually address these few potential problems early in the process. Reclamation would like to see BPA commit to forming partnerships and cooperative projects in the final EIS to resolve these potential conflicts related to YFP project sites.

[James V. Cole
Area Manager, Bureau of Reclamation, US Department of the Interior 048-02]

Response: Thank you for your comment and interest. The BOR's participation in project management decisions in an advisory capacity will be explored by project managers and BPA. See also comment responses B02-01 and B02-02.

B02-05

Comment: How do we integrate supplementation with water legislation to avoid conflict; one driving the other?

[YPM-015-01]

Response: Thank you for your comment. Project managers have considered habitat and related issues when making project production decisions. Water legislation generally attempts to address a large spectrum of concerns--of which fish habitat is but a single component. As stated in the EIS, the YFP use of surface water would be non-consumptive, and use of groundwater would not be substantial enough to adversely affect others' water rights. In addition, YFP plans will be consistent with and responsive to current and future water legislation.

B02-06

Comment: Any activities or actions in the Yakima River basin related to the Columbia River Fish Management Plan under US v OR Agreement and not described in the Revised DEIS should be summarized in the Final.

[Connie Iten
State of Washington, Dept. of Fish and Wildlife 040a-05]

Response: Specific actions under the Columbia River Fish Management Plan (CRFMP) are dynamic and vary from year to year. Since release of the RDEIS, actions under the CRFMP in the Yakima River watershed have included an initiative by the Yakama Indian Nation which resulted in the release of 270,000 pre-smolt coho salmon into the Naches River system (210,000) and Ahtanum Creek (60,000). In addition, approximately 330,000 coho are being reared for smolt release below Prosser in the spring of 1996. This release of smolts will be in addition to the 700,000 mandated by the CRFMP, as mentioned in the RDEIS. The FEIS has been modified to reflect these changes.

B02-07

Comment: John Lowe in testimony to the Northwest Power Planning Council in March of 1994 recognized that actions on USFS administered lands cannot, by themselves, bring recovery to anadromous fish stocks. It is important that the revised Yakima Fish Plan is brought forward as one item of many in the NPPC's Fish and Wildlife Program that will help achieve the objectives of increasing salmon and steelhead runs in the Columbia River Basin. Such actions complement Forest Service activities.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-02]

Response: Thank you for your comment and insights. The Northwest Power Planning Council's Fish and Wildlife Program recognizes the YFP as one component of their multifaceted effort to maintain and rebuild populations of anadromous salmonids in the Columbia River Basin. We agree, and expect that YFP and USFS activities would be complementary.

B02-08

Comment: Although no acclimation ponds/facilities are planned for USFS lands in the RDEIS, our role as habitat managers will be integral to the success and adaptive management aspect of stock recoveries. If supplementation leads to increased natural production, as hoped, I would expect that more salmon will utilize natural habitat on USFS lands.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-04]

Response: Thank you for your comment and interest. We agree, and will work together with the Forest Service to maximize the benefits to fish.

B02-09

Comment: Should the coho program continue to expand, activities on Forest System Lands must be scoped out well in advance. Many portions of the Yakima Basin are designated as Key Watersheds under the President's Forest Plan, and any activities in riparian reserves must meet the Aquatic Conservation Strategy Objectives of the President's Forest Plan.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-07]

Response: Any plans for potential future expansion of the YFP coho program will receive full environmental, technical and policy review and will be coordinated with the Forest Service.

B02-10

Comment: As part of the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl ("The President's Forest Plan"), the Snoqualmie Pass Adaptive Management Area (AMA) was established. The emphasis within this AMA is to provide scientifically credible, comprehensive planning for providing late-successional forest on the "checkerboard" lands in parts of Kittitas and King Counties. Further recovery of natural production of salmonids is one aspect of late-successional forest management. There may be opportunities as part of the Snoqualmie Pass AMA plan process to develop innovative and experimental approaches to fish stock recovery in the upper Yakima Basin. These opportunities should be explored as both the AMA and YFP plans are implemented.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-08]

Response: Thank you for your comment. The project managers appreciate your offer of assistance. The AMA and its processes will be tracked by the project managers, who will participate as appropriate to achieve the project's goals and objectives. The FEIS has been modified to identify the AMA in the context of ongoing habitat enhancement in the Yakima River Basin.

B02-11/12

Comment: It would be positive for continued cooperation between the YFP managers (YIN, WDFW) and the Forest Service. Project managers may coordinate with my staff, specifically, Ken MacDonald, Forest Fish Program Manager, and should keep Ken informed on the project's status. Ken may also be available to provide input and assistance to the program as implementation proceeds.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-14]

Comment: The Forest Service is involved in several activities to help achieve recovery of anadromous stocks, including habitat protection and restoration, which is supported by watershed analyses and refinement of aquatic objectives. Watershed analysis is critical to implementing management decisions and indicating the most important factors for monitoring environmental change. Cle Elum Ranger District is beginning a watershed analysis for the upper Yakima River, and any opportunities for cooperative planning should be pursued by the YFP managers.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-1]

Response: The project managers sincerely appreciate your offer of assistance. Like you, the managers believe that open channels of communication between cooperating agencies and governments will lead to complementary activities benefiting the Yakima River Basin fisheries and other natural resource objectives.

The managers welcome the opportunity to participate in your agency's efforts to improve anadromous fish habitat. Your success in evaluating the current condition of the existing habitat will be a useful tool to measure the success of future habitat improvement activities. Of course, the success of these activities will affect the project's production goals and objectives. See also the response to B02-10.

B02-13

Comment: Use AmeriCorps - give them job experience, summer employment (OJT), etc.

[YPM-001-01]

Response: Thank you for your suggestion. The project managers will consider it as we implement the project.

B02-14

Comment: No single entity in charge of fish on the river, as necessary according to Dr. Bevan.

[YPM-005-01, 006-02]

Comment: BPA, Corps, State, and Tribe all doing their own thing, going separate ways.

[YPM-006-03]

Response: The Yakama Indian Nation and the State of Washington, in cooperation with the BPA, will manage the project using the project management structure described in Section 2.2.3 of the RDEIS. To the extent that your comments pertain to broader Columbia River issues, it is outside of the scope of this EIS.

B03 - Public Involvement

B03-01

Comment: [Environmental concerns too numerous to mention here.] Please advise when you will have your next public meeting in the Seattle area.

[Jim Carkonen 004-05]

Response: Thank you for your comment. There are no additional public meetings planned for this part of the NEPA process. If and when additional public meetings for the project are planned in the Seattle area, you will be notified by mail or by publication in your local newspaper.

B03-02
Comment: Why has this been on the boards for several years without much knowledge by the public until now? I have talked to numerous people living and/or recreating in the Teanaway, and Cle Elum residents who have absolutely no knowledge of this extensive project.

[Ronald L. Pyeatt 056-02]

Response: The project has been discussed in open meetings of the Northwest Power Planning Council for over a decade. Over the past 5 years specifically, this project has been discussed in a wide variety of forums, including at least two public meetings which were held in the Cle Elum/Ellensburg area [area where the commenter lives], as well as others around the state. Prior to such meetings, notice was published in your local newspapers. In addition, follow-up articles were published in local papers describing various aspects of the YFP. The project managers regret that you and your friends and neighbors missed the opportunity to comment upon this project in the past. Fortunately, you were able to participate in the public process at this critical opportunity, and submit your comments regarding the project's RDEIS.

B03-03
Comment: Education about fish issues in the schools.

[CPM-01-07]

Response: Project managers are committed to the policy of educating the public, including school age children, with regard to fish resource and management issues and the importance of habitat. However, specific school programs are outside the scope of this EIS. BPA has, however, funded some school programs addressing fish issues in the Yakima basin.

B03-04/05
Comment: Would like to see the interpretive centers built - important to educate children.

[CPM-11-01]

Comment: Need to provide opportunities for the public to become informed and educated regarding the way the river, the fish, the land are tied together and to provide learning opportunities through hands-on personal opportunities: i.e. trails interconnecting throughout the area; interpretive kiosks, trails, center; inter-agency cooperation and communication.

[CPM-29-01]

Comment: The Forest Service initially played a major role in exploring the opportunities for interpretation as the YFP planning process proceeded. I would like to emphasize the importance of interpretation for public awareness, education, and ultimately support of increased natural production of fish stocks in the Yakima River Basin. Interpretive facilities should be an integral part of the Cle Elum hatchery site. They should promote public awareness and education opportunities on sustaining natural habitat, not just explain supplementation as a process separate from the role of publics who utilize the watershed. Interpretation as part of the YFP would

expand current opportunities to focus on people who are key users of riparian and meadow areas which are so important to maintaining aquatic system health in the upper Yakima River Basin.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-09]

Comment: Because the salmon restoration process must be supported by the general populace, we would support early construction and operation of interpretive facilities. The visitor center should be an educational facility offering exhibits, audio/visual presentations, interpretive trails, as well as naturalist program to take full advantage of the educational opportunities. With the location just off of Interstate 90, sufficient visitors should be able to support a viable tourist facility in all but possibly the winter months.

[J. Daniel Kinney
Yakima Valley Audubon Society 054-06]

Response: Thank you for your comments. As indicated in the RDEIS, the project managers are considering the different options relating to the size, diversity and use of the proposed interpretive facilities. Budget constraints will dictate the viability of the options under consideration. The project managers are committed to the construction of such a facility so long as its demand for construction funds does not interfere with the goals and objectives associated with the construction of the project's fish production facilities.

B03-06
Comment: Mark spawning beds with signs so people will protect them and for education.

[CPM-19-01]

Response: Thank you for your comment. As co-managers of the resource, the Yakama Indian Nation and the Washington Department of Fish and Wildlife will be given notice of your suggestion. Please also see comment E03.

B03-07/08
Comment: Consider using volunteers - my son would like to be involved.

[CPM-19-03]

Comment: Get public more involved in fish projects.

[CPM-01-06]

Response: Thank you for your interest in the success of the project. The project managers have and will continue to consider volunteers in support of project activities.

B04 - Decisionmaking

B04-01
Comment: Fly fishermen from the west side should leave the determinations of east side streams such as the Yakima to the local people.

[CPM-002-03]

Comment: The west side flyfishers look forward to working with the local people of the Yakima Basin to preserve, protect, and enhance the Yakima River.

[CPM-13-02]

Response: Cooperation by all concerned individuals will help advance the goals and objectives of this project.

B05 - Schedule and Timing

B05-01
Comment: BPA hasn't been truthful - project was to be underway in 1993.

[YPM-006-04]

Comment: Been at it too long--let's get the project started.

[CPM-01-01]

Comment: We are "planning" fish to death, runs falling rapidly.

[YPM-006-05]

Comment: We've studied the Rivers enough--it's time to get started!

[YPM-035-01]

Response: Thank you for your comments. Given the innovative and complex nature of the YFP, much planning has been required to address concerns raised by the public during deliberations about the YFP conducted by the Northwest Power Planning Council. Other planning and public review steps were needed to identify risks to natural resources and to comply with environmental impact assessments under federal law.

B05-02

Comment: Would like to see a schedule of fish returns and associated short-term and long-term project results, i.e., 2001 first returns.

[YPM-003-09]

Response: A schedule is given below and has been added to section 2.3.5 of the FEIS. The first experiment year is dependent upon the construction schedule for the project; at this time we anticipate that the first brood stock would be taken in 1997, and the first experiment year would be 1998. In that case, the schedule is shown below. The first adults (jacks) would return to the basin in the year 2000. All of the adults from the first treatment group would return by 2003.

Experiment Year	Treatment									
	First Generation Treatments					Second Generation Treatments				
	1	2	3	4	5	1	2	3	4	5
1998	Rearing									
1999	Release	Rearing								
2000	Age 2 adult returns	Release	Rearing							
2001	Age 3 adult returns	Age 2 adult returns	Release	Rearing						
2002	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing					
2003	Age 5 adult return	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing				
2004		Age 5 adult return	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing			
2005			Age 5 adult return	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing		
2006				Age 5 adult return	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing	
2007					Age 5 adult return	Age 4 adult returns	Age 3 adult returns	Age 2 adult returns	Release	Rearing

B05-03

Comment: The BPA does a good job of raising the appropriate issues [in the RDEIS], but in no way provides satisfactory answers to many of them. You are in no way prepared to make a decision to move ahead with this project. The reasons not to build these hatcheries and proceed with this project far out weigh any possible justification to move ahead. Stop please.

[Jim Carkonen 004-04]

Response: The Northwest Power Planning Council has approved the project as part of their Fish and Wildlife Program. It is the project managers' intent that the preferred alternative be fair and justifiable. The project has been designed as an experiment in order to help answer many of the questions raised.

B06 - Costs and Funding

B06-01
Comment: This whole process is flawed and a waste of money.

[Anonymous 024-02]

Comment: How can we stop this ridiculous boondoggle and waste of our tax money.

[Gary Furukawa 012-04]

Comment: Consider this alternative: Stop wasting time and money on an unnecessary project that will serve only the special interests of a few.

[Jim Carkonen 004-02]

Response: We acknowledge your concern. However, there is a great amount of support for this project. It was initiated through the Northwest Power Planning Council's Fish and Wildlife Program, which is a regional consensus on what must be done to mitigate for losses of fish and wildlife due to hydropower development in the Columbia River Basin.

B06-02
Comment: It is regrettable that so many millions of our tax dollars will be wasted due to uncertainties and experimental nature of project. With so many years of fisheries research why don't "we" know exactly what to do most expediently and cost effectively?

[Ronald L. Pyeatt 056-01]

Response: Thank you for your comment. Unfortunately, scientific endeavors rarely are based on a foundation of absolute certainty. This is the case for fisheries projects such as the YFP, especially since similar statistically sound large scale experiments have not previously been conducted. The YFP is designed to improve understanding of strategies for rebuilding anadromous fish stocks that could also be applied elsewhere.

B06-03
Comment: Construction and Operation of Jack Creek Site: My education and over 25 years experience in construction have shown that a remote site such as this is fraught with problems, delays and cost overruns. No utilities and lack of winter access compound the potential problems and cry of higher than usual and budgeted costs.

Question: What costs have you budgeted for this? Do you recognize that this could be an enormous problem over its entire life?

[Ronald L. Pyeatt 056-07]

Response: Project managers and engineers have considered the risks and benefits of all of the proposed acclimation sites, including the Jack Creek site as well as the new North Fork Teanaway site. We believe that the risks you identified can be accommodated in the design of the YFP.

B06-04
Comment: Appears that costs may be too constraining if we want to get into other species later.

[YPM-006-08]

Response: The project managers agree that budgetary considerations will have an influence as planning for possible inclusion of other species progresses.

B06-05/07
Comment: *Some information you still need:* costs vs. the benefits of the various alternatives. (If our good friends at OMB and/or GAO were to review this project, they might also mention the economic benefits vs. project costs.)

[R. Rhodes
Aquafood Business Association 018-01]

Comment: *Your environmental study should have included:* the total cost to the Electrical Utility rate-payer over the entire course of the enhancement program. This should be broken down to cost/average utility consumer and cost/fish returned.

[Anonymous 035-01]

Response: Thank you for your comment. A cost/benefit analysis for project alternatives would be problematic given the uncertainties regarding adult returns and related issues. In addition, it would be difficult to quantify the economic benefits from a major project goal--to learn about the strategy of supplementation, including the positive as well as negative aspects.

We acknowledge that costs associated with fish protection and restoration efforts are sometimes high. In most cases this is related to the severity of the damage already done to those resources. Total construction costs for the Cle Elum hatchery and the acclimation facilities is estimated to be $14 million. To date, the total amount of ratepayer funds spent on the YKFP is approximately $38 million. This figure includes costs since 1982 for a multitude of activities, including project planning, coordination, fisheries research, design of hatchery and sampling facilities, and environmental impact analysis. Many of the fisheries research and environmental analysis activities responded to public concerns over impacts of the proposed hatchery on resident and anadromous fish and other environmental resources in the Yakima River Basin.

B06-06
Comment: Would like to see a schedule of priorities, technology, and budget.

[YPM-003-02]

Response: Priorities for supplementing additional stocks are discussed in Section 2.6.2 of the EIS. At this time, project managers are emphasizing steelhead and lower Yakima River fall chinook as the most likely stocks to be added to the project. A schedule of fish returns for the project is given in the response to comment B05-02. Technological issues addressed by project management can be identified by examining Chapter 2 of the EIS.

With regard to the project budget, see the response to B06-05/07 above.

B06-08
Comment: You state clearly all direct and indirect costs for this project and state the impact on the rate payers. It seems to me that BPA has become the full employment funding source for all fishery people in the Northwest.

[Ted Sorenson 011-01]

Response: Thank you for your comment. The Northwest Power Act of 1982 states that BPA is responsible for the protection, enhancement, and mitigation of impacts resulting from the construction and operation of the federal hydroelectric facilities in the Columbia basin.

B06-09
Comment: I hope the funds are available for your work.

[Anonymous 036-05]

Response: Thank you for your support. The funds are budgeted in BPA's Fish and Wildlife program.

C - Project Alternatives and Operations (General)

C-01

Comment: *My environmental concerns about the Yakima Fisheries Project are:* that you do it! Do Alternative #2 or we are going to leave barren rivers to our kids to satisfy our own short term nonsense.

[Anonymous 003-01]

Response: Thank you for your comment. Alternative 2 has been identified by the Policy Group as the preferred alternative of the YFP.

C-02

Comment: The YVAS would support the proposed Alternative 2 which would fund a project consisting of one hatchery with less than a million juveniles, and only Spring Chinook. In addition a feasibility study on the introduction of coho salmon should be conducted in conjunction with the current Columbia River Fish Management Plan (CRFMP).

[J. Daniel Kinney
Yakima Valley Audubon Society 054-04]

Response: Thank you for your comment. Coho planting in the Yakima Basin is supported by the production plan of the Columbia River Fish Management Plan.

C-04

Comment: Eliminate clear cutting in the upper basin and install fish ladders on the three upper basin lakes--you won't have a fish problem! And the irrigation water would increase.

[Jay Atherton 007-01]

Comment: [Concern expressed in other comments over water rights/release.] The answer, of course, is to build more reservoir storage to provide the water to enhance fisheries. Why aren't you pushing for this?

[Larry Olsen 008-03]

Response: It is recognized that a number of habitat improvement and restoration activities could benefit salmon and steelhead production in the Yakima Basin, as well as other watersheds within the Columbia River system. It would not, however, meet a primary purpose of this proposed project: ". . . to conduct research activities designed to increase knowledge of supplementation techniques." Reservoir storage and fish ladders are being proposed as part of the Bureau of Reclamation's Yakima River Basin Water Enhancement Program

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C-05

Comment: Smaller scale projects such as riparian repair, etc. could restore runs on small tributaries such as Satus, Logy, Toppenish, and Ahtanum creeks more easily than large scale projects.

[YPM-19-01]

Comment: Why don't we do low tech habitat improvement on lower streams--Toppenish, Satus, Logy, etc. Low capital expenditure, high volunteer participation - involve volunteer salmon enhancement groups.

[YPM-019-02]

Response: It is recognized that a number of habitat improvement and restoration activities could benefit salmon and steelhead production in the Yakima Basin, as well as other watersheds within the Columbia River system. Several low-tech projects have and will be installed in the Yakima Basin. These projects would not, however, meet a primary purpose of this proposed project: ". . . to conduct research activities designed to increase knowledge of supplementation techniques."

C-06

Comment: *Your environmental study should have included:* the nearly complete destruction of natural fish population and habitat on the Tieton River.

[Anonymous 046-01]

Comment: *My environmental concerns about the Yakima Fisheries Project are:* the apparent sacrifice of the Tieton River fishery and the rivers ongoing transformation to an irrigation ditch in deference to the upper Yakima Valley.

[Anonymous 046-02]

Response: The present proposal spotlights the currently depressed upper Yakima spring chinook stock. The project may, however, expand to focus on other species and stocks in the basin. Decisions to move forward with other stocks will depend on successful completion of planning efforts for those stocks. Local stocks for supplementation include the Naches spring chinook and steelhead. This could include restoration efforts in the Tieton River.

C-07

Comment: The USFS agreed several years ago that artificial backwaters should be created along the river where fish can hold during peak irrigation flows.

[Anonymous 046-03]

Response: A number of habitat restoration efforts are underway in the Yakima system, including side channel construction. Your comment will be relayed to USFS as a reminder for their consideration.

C-08

Comment: Since hatchery supplementation remains an experimental technology with unproven results, Oregon Trout urges caution in the implementation of the proposed Yakima Fisheries Project. Enclosed is a copy of Oregon Trout's draft policy on hatchery supplementation. Please see that this document is included in the hearing record on this issue and its recommendations considered.

[Jim Myron
Oregon Trout 031-01]

Comment: Please include the enclosed report (White, et al.) in the hearing record on this issue. The report supplements Oregon Trout's written comments dated 7/6/95. *[Report entitled "Better Roles for Fish Stocking Programs."*

[J. Evy
Conservation Director, Oregon Trout 034-01]

Response: Per the commenters' request, we have included the above-mentioned reports in the record. The project managers have reviewed the reports, as well as previous, similar comments from Oregon Trout, and agree that extensive planning and caution must be used in implementing any supplementation project. As you may be aware, the project has been reduced substantially from the range of alternatives proposed in the draft EIS. As described in the RDEIS and the current FEIS, the preferred alternative includes research on the supplementation of upper Yakima spring chinook and feasibility studies on the reintroduction of coho salmon in the Yakima Basin.

The project managers believe that the report *Better Roles for Fish Stocking Programs* essentially supports both programs described in the preferred alternative. In section III.A.6.k (p.63), White et al. proposed a new term: "Breed-release Involving Less Domestication" (BRILD), and define BRILD as "the artificial breeding, rearing, and stocking of fish to reestablish or augment a wild stock, while minimizing the adverse genetic and learned influences that such artificial operations inevitably have." BRILD "should (1) use exclusively local, wild (hence adapted) parent stock; (2) never take so many adults from the parent (target) stock that the naturally spawning population is jeopardized; (3) stock progeny at the earliest possible stage; (4) stock in ecologically attuned ways, such as by matching body size, timing, and numerical density of the stocked fish to the needs (capacities) of the recipient population and environment; (5) conduct any such program only on a temporary basis (whether it succeeds or fails); (6) never pretend that BRILD completely avoids domestication; and (7) never pretend that BRILD is a substitute for proper control of harvest or for protecting and restoring habitat such that the wild population can maintain itself."

We believe that the supplementation research proposed for the upper Yakima spring chinook addresses each of the above listed suggested guidelines in a scientific manner. This process has included an extensive review of the literature, including, but not limited to, literature suggested by Oregon Trout. The review had led to acceptance of some concepts as experimental constants, and the addressing of others as experimental variables, where more research is needed before accepting the concept. It is expected that the results of this research will help resolve some of these questions regarding the use of supplementation.

The preferred alternative also includes a feasibility study of reintroduction of coho salmon into the Yakima system. The White report discusses such an activity in section III.D ("Situations in Which Stocking May be Justified"): "Stocking almost undoubtedly can be beneficial (if successful) where it is used to restore an indigenous species or genetic unit to a water body from which human activity has eliminated it." We believe that this circumstances apply to coho salmon in the Yakima system.

The White report frequently holds that managers have used hatcheries as a stopgap measure in lieu of adequate protection for the natural environment necessary for the production of fish. Clearly, such protection is paramount in the natural production of fish. However, development (urbanization, agriculture, forestry, and so on) will continue to occur and to affect the environment. Those effects may be minimized but perhaps not eliminated. Until we can fully correct habitat degradation, and/or achieve a society of reduced population and reduced demand on the natural systems, hatcheries have a very real role to play in maintaining some fish populations.

C-09

Comment: *Other alternatives to consider:* go back to the list of eliminated alternatives (improvements of passage, habitat, instream flows, etc.) - without them, the whole idea of supplementation is flawed.

[Vance Jennings 017-03]

Comment: We have requested additional information on fish habitat conditions in the Yakima River Basin. As we indicated in our December 30, 1992 comment letter, increased salmonid production (via supplementation) will not necessarily lead to increased adult returns if habitat degradation and reduced flow regimes are not addressed. Ultimately, fisheries production (especially for those species such as chinook, steelhead and coho that spend substantial periods of their pre-smolt life in freshwater), is directly tied to water quality and instream flows. Presently the revised draft EIS provides little in sight on salmonid habitat needs or limitations in the Yakima Basin. Before a supplementation approach can be implemented there must be a clear understanding of the limiting factors of those particular fish populations at all relevant life cycles. The final EIS should provide a detailed discussion of the scope of habitat problems/limitations in the basin and the likelihood that they can be resolved.

[Joan Cabreza 057-03]

Response: It is recognized that a number of habitat improvement and restoration activities could benefit salmon and steelhead production in the Yakima Basin, as well as other watersheds within the Columbia River system. Section 3.3.1 of the EIS does address salmonid production limitations and habitat needs. The project managers continue to support such restoration efforts. These would not, however, meet a primary purpose of this proposed project: ". . . to conduct research activities designed to increase knowledge of supplementation techniques." The managers hope eventually to return species and races to the basin which have been extirpated. Habitat restoration cannot achieve that goal; these fish must be reintroduced through supplementation or other stocking programs.

C-10
Comment: Lots of other rivers for anadromous fish production and fishing--why focus on Yakima River?

[CPM-07-02, CPM-20-01]

Response: There are a number of control (collection) sites already available in the Yakima basin where observations on adult returns can be made. There is also a large amount of pre-project baseline data available. Other basins do not provide the level of baseline information and collection points that are found in the Yakima basin. BPA and the project managers have explored supplementation programs at existing hatcheries in other Columbia River basins. None of these, however, meet the rigid statistical and biological needs of this proposed project (see Sections 2.6.4 and 2.6.5.) Additionally, one of the purposes of the proposed project is " . . . in the Yakima River Basin to increase natural production and to improve harvest opportunities. . ." The purposes of this project are explained in greater detail in Section 1.2 of the EIS.

C-11
Comment: Other alternatives to consider: No action.

[Ted Sorenson 011-02]

Response: The "No Action" alternative is discussed in Section 2.5. While some critical Yakima Basin activities--such as passage improvements, water enhancements, and the coho plants--would continue, a primary purpose of the YFP, "...to conduct research activities designed to increase knowledge of supplementation techniques," would not be met. Also, stock recovery rates would be slow, at best, and harvest opportunities in the Yakima would remain low or possibly be eliminated.

C01 - Proposed Fish Stocks, Numbers and Areas

C01-01
Comment: *My environmental concerns about the Yakima Fisheries Project are:* that an attempt is being made to re-introduce a cold-water fish species into an environment that has been altered into a warm-water river.

[Anonymous 035-02]

Comment: I believe you are fighting forces which are eventually going to win. Basically, the environment has been altered to a very large extent. Yet, your efforts are to maintain a species which was adapted to the previous environment. At what cost? $100/fish? $500/fish? $10,000/fish? Alter the philosophy that the Yakima River is a natural cold-water, anadromous fish-supporting stream, and realize that it has been altered to an irrigation waterway containing warm-water fish.

[Anonymous 035-04]

Response: It is well recognized by BPA and the project managers that the Yakima River is no

longer the same, high quality salmonid production system that it was historically. Many of the current constraints are discussed in Chapter 3 of the EIS. Despite these constraints, the system is still capable of supporting significant runs of salmon and steelhead. It is our view that implementation of this supplementation and reintroduction effort will hasten recovery of the currently depressed stocks. It is also recognized that improved habitat conditions will also result in improvement of the fish runs. The project managers support activities in the Yakima Basin that would improve habitat for fish.

C01-02

Comment: Horseshoe Bend could be a good place for rearing fish. Water is always cold.

[YPM-028-07]

Comment: Recommends Horseshoe Bend to build a rearing area.

[YPM-028-11]

Response: Thank you for your comment. A number of potential sites throughout the basin have been explored for the central hatchery site as well as the acclimation facilities. The selected sites meet both the biological and physical requirements for fish production. Other sites, such as Horseshoe Bend, may be of value if there is a future decision to expand production to include other stocks of salmon and steelhead.

C01-03

Comment: Between Rosa Dam and Ellensburg [have] a lot of floaters that can ruin spawning habitat and temperature can get pretty high.

[YPM-28-04]

Response: We do not anticipate that the floater traffic between Roza Dam and Ellensburg will have any significant impact on habitat in this reach. The water temperatures in this area fall within a reasonable range for this project. This reach is not a significant spawning area but does provide valuable rearing habitat.

C01-04

Comment: Naches has reliable source of cold water which is viable for anadromous fish, plenty of food, pockets of water (deep holes), good current. Naches water is clean - controlled by Bumping Lake Reservoir, which is a lake high in the Cascades.

[YPM-28-02]

Comment: Look at lower tributaries that pertain to Yakima--creeks that flow into Naches are good rearing habitats. If look between here and Ellensburg, very few creeks cold enough to keep trout and salmon alive.

[YPM-028-05]

Response: Thank you for your comment. A number of potential sites throughout the basin have been explored for the central hatchery site as well as the acclimation facilities. The initial Draft EIS included alternatives which encompassed the Naches stocks of fish. Alternatives in the Revised Draft EIS, partially in response to public comments, have been reduced and the Naches stocks are not being considered at this time. It is the project's intent, however, to expand production to other stocks upon successful completion of planning efforts for those stocks. Naches stocks and rearing sites would likely be considered at that time. The selected sites meet both the biological and physical requirements for fish production.

C01-05
Comment: Look at temperature - important for trout and salmon.

[YPM-28-03]

Response: Thank you for your comment.

C01-06
Comment: What happened to the lower Yakima acclimation ponds projects?

[Anonymous 003-02]

Response: Acclimation sites in the lower Yakima were originally proposed in the Draft EIS as acclimation sites for fall chinook and coho. The fall chinook alternative has been deferred in this Revised Draft EIS. Consequently, those sites are not currently under consideration. The coho feasibility study will use three acclimation facilities already in operation under the US vs. OR coho program.

C01-07
Comment: Why only the Yakima River watershed and not the Naches?

[YPM-28-01]

Comment: Why isn't there more emphasis on the Naches River?

[YPM-032-01]

Comment: I think the North and South Forks of the Naches which flow east out of the Cascades and are joined by the Bumping River from the South would be one watershed we could restore with little effort. The cost would be low.

- Implant fry to get scent of the home water
- Implant egg boxes
- No siltation/good current flow
- Control the flow from Bumping better than Rimrock
- Access road allows easy attendance/monitoring

[YPM-028-09]

Response: BPA and the project managers recognize the actual and potential value of the Naches River and its tributaries. Naches production was considered in the alternatives of the original Draft EIS. In response to public comment, the project has been scaled back to include only upper Yakima spring chinook and coho at this time. (See also response to C01-04.)

C01-08

Comment: American River spring Chinook aren't being supplemented, these and other Naches runs are very important. Numbers of fish are now very low.

[YPM-006-09]

Comment: The Bumping River could provide Steelhead and Coho fishing; maybe later bring in spring Chinook.

[YPM-028-08]

Comment: Spring Chinook, Coho, and Steelhead need to be addressed in the Naches in the future.

[YPM-032-02]

Response: The present proposal spotlights the currently depressed upper Yakima spring chinook stock. The Revised Draft EIS notes in Section 1.1 that the "...YFP may eventually involve the supplementation of all stocks of anadromous fish known to have occurred in the Yakima Basin. . . . " The previous EIS considered implementation of programs for stocks other than those currently being considered. The project, however, was scaled down to two stocks of fish in consideration of public comments and current status of our knowledge of other stocks. Our efforts have concentrated on detailed planning for upper Yakima spring chinook and coho only. As planning efforts for other stocks are successfully completed, we may initiate programs for those stocks (see Section 2.6.2 of the EIS). A logical stock for supplementation is the Naches spring chinook.

C01-09

Comment: *Your environmental study should have included:* why introduction of sockeye into the upper river is not considered.

[Anonymous 27-02]

Comment: *Other alternatives to consider:* a sockeye fishery at Lake Cle Elum.

[Gary L. Lund 019-02]

Comment: *Other alternatives to consider:* Sockeye and the use of the upper drainage lakes.

[Anonymous 027-05]

Response: See response, above, to comment C01-08. The previous EIS considered implementation of programs for stocks other than those currently being considered (although sockeye were not considered at that time). The project, however, was scaled down to two stocks

of fish in consideration of public comments and current status of our knowledge of other stocks. Our efforts have concentrated on detailed planning for upper Yakima spring chinook and coho only. As planning efforts for other stocks are successfully completed, we may initiate programs for other stocks (see Section 2.6.2 of the EIS).

Sockeye of the Yakima Basin are discussed on RDEIS pages 3/73 and 3/74. National Marine Fisheries Service has completed a study on the feasibility of reintroducing sockeye in the Cle Elum system. The results of this study are expected later this year.

The Northwest Power Planning Council, in their letter of August 8, 1990, asking BPA to proceed with the final design phase of the YFP, stated that the managers should " . . . review with the Council and public any proposed reintroduction of sockeye salmon into the Yakima Subbasin."

The project managers will, before implementing programs for sockeye, or any other stocks not proposed in the current EIS, work closely with the Council and public and ensure all necessary NEPA compliance is complete.

C01-10
Comment: Why aren't steelhead in this EIS?

[YPM-03-01]

Comments: *Other alternatives to consider:* building a sports fishery for Steelhead.

[Anonymous 030-02]

Comment: I think it's time we get some steelhead in the upper Yakima.

[YPM-035-04]

Comment: Why aren't we supplementing steelhead on Yakima that are close to extinction?

[YPM-006-06]

Response: The critical status of the steelhead resources in the Yakima system are certainly of concern to BPA and the project managers. The Draft EIS included alternatives which encompassed steelhead. The Revised Draft EIS, partially in response to public comments, has been reduced and steelhead are not being considered at this time. It is the intent, however, to expand production to other stocks (including summer steelhead) as planning efforts for those stocks are successfully completed. We will be working diligently on developing a better understanding of the steelhead of the system, their critical links to the environment, and the best opportunities to reverse their decline while maintaining the genetic integrity of the stocks.

C01-11

Comment: And why do we have an alternative adding silvers that are extinct in the river?

[YPM-006-07]

Comment: Shouldn't more effort be put on Coho? Coho are the number one staple for tribal members.

[YPM-026-05]

Response: BPA and the managers are interested in species that currently and formerly inhabited the Yakima Basin. The proposed action (Section 1.1 of the EIS) states that techniques developed in this effort "would be applied to rebuild naturally spawning anadromous fish stocks historically present in the Yakima River Basin. . . ." The present and historic status of coho are discussed in Section 3.3.1.4. It is true that these natural stocks have been extirpated in the system. We feel, however, that integrating the current coho stocking program called for in the CRFMP with the goals, objectives, and monitoring activities of this project offers an excellent opportunity to investigate the feasibility of restoring natural production of this species. While coho are not the number one staple for the Yakama tribal members, restoration of the resource would provide a valuable addition to their in-river fisheries, as well as to other fisheries in the Columbia River and Pacific Ocean.

C01-12

Comment: Why are we not doing a series of stocks? Why only one?

[YPM-026-04]

Comment: Disappointed that we cut down on number of stocks. By waiting to implement all stocks, we may lose the opportunity (i.e. now down to only 87 steelhead).

[YPM-006-01]

Response: BPA and the project managers recognize concerns for all present and past stocks of salmon and steelhead in the Yakima system. As you are no doubt aware, the Draft EIS considered implementation of supplementation efforts for up to seven salmon and steelhead stocks in the basin. Subsequently, the project managers have reduced the scope of the project and elected to approach this supplementation program on a more conservative, yet still meaningful basis. The proposed action (Section 1.1) notes that "YFP may eventually involve the supplementation of all stocks of anadromous fish known to have occurred in the Yakima Basin. . . ."[Chapter 1/1]. Our efforts have concentrated on detailed planning for upper Yakima spring chinook and coho only. As planning efforts for other stocks are successfully completed, we may initiate programs for other stocks.

C01-13

Comment: In October 1992 the Draft EIS was released calling for a very ambitious plan - 3 hatcheries, up to seven fish stocks, and introduction of more than 8 million juveniles. Whether it was public, or scientific comment, or economic considerations, the Revised Draft EIS has scaled back the plan considerably. Since this project is considered a research project, the smaller scale project is a more realistic approach. If the project is successful a more full scale project can be developed at a later date to take advantage of research.

[J. Daniel Kinney
Yakima Valley Audubon Society 054-03]

Response: Thank you for your comment. As you have noted, in the Revised Draft (and Final) EISs we have not given up on other stocks but have chosen this smaller scale approach to test the supplementation and reintroduction issue.

C01-14

Comment: Because the Forest Service is active in maintaining and restoring productive salmon and steelhead habitat in the Yakima Basin, the BPA should not preclude future supplementation or re-introduction of other stocks that are native to the basin. This should include proposals for re-introduction of sockeye in the upper Basin.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-13]

Comment: The final document should clarify the likelihood of the project expanding to incorporate other fish species and/or stocks (e.g., steelhead, fall chinook) following completion of additional planning. The FEIS should indicate the order or relative priority of these species.

[Connie Iten
State of Washington, Department of Fish and Wildlife 040a-01]

Comment: The project sponsors need to indicate what the plans are for other stocks.

[YPM-03-03]

Comment: If the supplementation process works on 1 to 2 species, then we should go ahead and apply it to all the rest of the species in the river system.

[YPM-035-03]

Response: Thank you for your comments. While the Revised Draft EIS supports the immediate implementation of restoration efforts for only the upper Yakima spring chinook and coho, we are continuing our planning efforts with other stocks. Lower Yakima fall chinook and Yakima steelhead are the focus of the next series of modeling efforts. Other stocks may follow. Until these planning activities are completed, we cannot state with certainty the order or relative priority of these stocks. Note the change to the FEIS in Section 2.6.2.

C01-15

Comment: An annual release of 810,000 spring chinook smolts to the upper Yakima River is proposed under Alternative 1 or 2 of the YFP. This proposed release is over 4 times the recorded average production of wild spring chinook smolts from the entire Subbasin.

[Charles C. Flower
[Attorney, Flower & Andreotti, rep. Yakima River Basin Defense Coalition 042-04]
From a report prepared by D.B. Lister & Associates Ltd

Response: The commenter points out that a release of 810,000 hatchery spring chinook smolts is more than four times the average wild outmigration counted at Chandler. We assume the commenter was implying that the carrying capacity of the system *for outmigrating smolts* will be exceeded, impairing survival of all smolts, hatchery and wild alike. The commenter thus assumes that strong density-dependent mortality affects outmigrating smolts in the Yakima Basin. As we stated in our response to Comment 042-05, we see no evidence that this is the case. Our interpretation of the data is that smolt-to-smolt survival is density-*independent*, except in the context of a strong functional or numerical predatory response. While it is reasonable to believe significant functional response predation impacts exist in the Yakima, it is impossible to predict now whether they will be exacerbated or attenuated by an 810,000-fish release. In this context, it is worth noting that a predator control program would probably be highly effective in an area as compact and accessible as the lower Yakima River. Although the YFP does not now plan to implement such a program, predator control has been discussed in the past and could be incorporated in the future through the adaptive management process, if necessary.

If, on the other hand, the commenter was implying that an 810,000-smolt release is inconsistent with the *smolt-rearing capacity* of the Basin, he is simply mistaken. It is the project managers' goal to achieve a smolt-to-adult survival for YFP hatchery fish that will be roughly half the survival of wild fish (with conventional hatcheries it is usually much less). Thus, the projected releases, in terms of returning adults, are equivalent to no more than 405,000 wild smolts. Thus, given natural smolt production on the order of 200,000, our program entails the production of no more than 605,000 "wild smolt equivalents" in a Basin with a 900,000-smolt capacity.

C01-16

Comment: Computer model simulations indicate a smolt production potential of 900,000 fish for upper Yakima spring chinook (RDEIS, Chapter 2, page 26). Model estimates of spring chinook smolt capacity for the entire Yakima Subbasin range from 1.5 million (Instream flow model) to 2.4 million (Northwest Power Planning Council model) (RDEIS, Chapter 3, page 67). It should be noted that the estimated outmigration of spring chinook smolts at Prosser has only once in 18 years exceeded 300,000 and has averaged less than 200,000 (see Appendix A, Table 2 for data to

1990). If observed smolt outputs at Prosser reflect actual capacity, as indicated by spawner-recruit analysis (Appendix A), model projections developed for YFP planning would appear to be unrealistically high.

[Charles C. Flower
[Attorney, Flower & Andreotti, rep. Yakima River Basin Defense Coalition 042-02]
From a report prepared by D.B. Lister & Associates Ltd.

Response: The commenter notes that the estimated numbers of smolts observed at Chandler are much less than the 900,000-smolt carrying capacity for upper Yakima spring chinook found on page 26 of Chapter 2 of the RDEIS, and suggests that this figure is unrealistically high. The figure on page 26 of Chapter 2 is a typographical error and has been corrected in the FEIS. The estimated smolt capacity for the Upper Yakima stock is 543,000; the 900,000-smolt figure refers to the smolt capacity of the Basin as a whole.

However, we believe 900,000 smolts to be a reasonable, if perhaps rather conservative, figure for Basin-wide smolt capacity under existing conditions. Note that this figure refers to smolt production *prior* to smolt-to-smolt mortality. If one accepts, as data from releases of marked smolts indicates, that as much as 50% of the Basin's smolt production is lost before fish are counted at Chandler, a 900,000-smolt capacity does not seem unreasonably high. A 50% pre-counting mortality applied to the 1957 Chandler estimate of 485,300 would, for instance, imply that total smolt production was 970,600.

C01-17

Comment: Is there a plan to allow sport fishing for spring chinook should they return in sufficient numbers? Did sockeye salmon used to run in the Yakima and is there any plan to reintroduce them? What salmon used to run in the Yakima when you mention historic runs were 600,000-900,000?

[Anonymous 030-03]

Response: Harvest management issues are outside the scope of this project. We have, however, included a discussion of harvest management as Appendix E. It is expected that sport fisheries will be allowed if the spring chinook run rebounds to an acceptable level. One of the purposes of this activity is to ". . . improve harvest opportunity (in the Yakima River Basin)." That harvest opportunity could include sport as well as tribal fisheries.

Sockeye salmon, as well as discussion of other species and their historic abundance, are discussed in Section 3.3.1 of the Revised Draft EIS. Before implementing programs for sockeye, or any other stocks not proposed in the current EIS, the project managers would work closely with the Council and public. A supplemental EIS may be required.

Historic runs in the Yakima River included spring, summer, and fall chinook, coho, sockeye, and steelhead. Table 1.2 of the EIS presents these species and the estimated numbers of each group.

C01-18

Comment: Pg 66, section 3.3.1. It is unclear how 0.6 million to 0.96 million anadromous fish could have been present near the turn of the century when "about 90 percent of the Yakima spring chinook fishery was lost between 1850 and 1900" (at page 69). Most of the listed causes for decline would have affected, to some extent, all anadromous stocks present. Should the statements be read to mean that historically 6 million to 9.6 anadromous fish existed in the basin, that the above figures applied to the turn of the eighteenth century, or that only spring chinook were significantly affected by anthropogenic disturbances between 1850 and 1900? Does the 5,500 mean annual return figures include fall chinook?

[Lynn Hatcher
Yakama Indian Nation 049-15]

Response: The commenter requests clarification of some confusing entries in the RDEIS relating to historical and current runs of anadromous salmonids to the Yakima Basin. We have become aware that the RDEIS includes some typographical errors and errors of chronology in this area, that have been corrected in the FEIS. These corrections include the following:

Page 66, Section 3.3.1. The first sentence should read, "*Around the middle of the 19th century, 600,000 to 900,000 salmon returned to the Yakima River annually...*", **not** "*Around the turn of the century...*".

Page 69, Section 3.3.1.1, "Causes for Decline". The first sentence should read, "*About 90% of the fisheries **for all anadromous salmonids** was lost between 1850 and 1900*".
Page 66, Section 3.3.1, first paragraph, second to last sentence. The figure of "5,500 adults" for the mean annual return of all anadromous salmonids at first looked too small to us, too. However, it is not, at least not by much. The returns of steelhead, spring chinook and fall chinook ("above-Prosser" counts for fall chinook) for the last 5 years of record are summarized in Table 1. The figure in the sentence should be 5,100 adults, not 5,500; and it does include fall chinook.

Table 1. Returns of anadromous salmonids to the Yakima Basin over the last 5 years of record.

YEAR	STEELHEAD	SPRING CHINOOK	FALL CHINOOK
1995	919	663	(IN PROGRESS)
1994	554	1,280	1,421
1993	1,184	3,873	1,065
1992	2,263	4,415	1,612
1991	834	2,879	971
1990			1,505
5-YEAR MEAN	1,150	2,622	1,314

C01-19
Comment: Seen about 20 fish spawning just below the Cle Elum Dam. Will there be a site there?

[CPM-08-01]

Response: Thank you for your comment. We are aware that spring chinook are spawning in the Cle Elum River. There is, however, currently no acclimation site proposed for this river.

C01-20
Comment: Since coho spend about two years rearing in fresh water, what is the habitat capable of supporting in terms of juvenile coho? Habitat condition?

[Vic Stacostha 015-02]

Response: The 1993 Yakima/Klickitat Fisheries Project Planning Status Report, Volume 5: Yakima Coho Salmon has been updated and included as an appendix to the FEIS. Habitat conditions are sufficient in many tributaries in the Basin to support summer-rearing populations of juvenile coho.

C01-21

Comment: Pg 26. The process by which the production estimates were developed should be better explained, particularly how assumption (3) yields the resultant productivity increases forecast for the Naches and American stocks.

[Lynn Hatcher
Yakama Indian Nation 049-04]

Response: Production estimates assume that virtually all mortality among outmigrant smolts is due to predation by resident predators in the lower Yakima (a migration corridor common to all stocks). "Predator swamping" and "predator diversion" also play a role.

Predator swamping presumes a ceiling on smolt mortality, that is, smolt survival will increase in direct proportion to the number of smolts in excess of the predators' maximum consumption capacity. This concept is generally clearly valid, but difficult to assess in terms of actual, prey densities and predation rates. A related effect concerns the relative vulnerability of hatchery and wild fish to predators. If hatchery fish are relatively more vulnerable than wild, then a release of hatchery fish might improve the survival of wild fish by diverting predation pressure away from wild smolts ("predator diversion"). Thus, supplementation may increase the survival of pre-existing wild smolts by both swamping and redirecting predation. We assume that there would be relatively mild predation pressure (B = 240,000) and that relative hatchery/wild smolt-to-adult survival would be 50% or less (i.e., that hatchery smolts are twice as vulnerable). Therefore, the release of close to a million hatchery smolts was assumed both to swamp the predators and to divert predatory pressure away from wild fish.

C01-22

Comment: Continued natural escapement of upper Yakima River spring chinook should also be emphasized.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-05]

Response: Continued natural escapement of all stocks is a critical element in measuring the success of this project. Several steps will be taken to protect natural production while implementing the project. Genetic risks to natural production are reduced by broodstock collection criteria which require that less than 50% of the natural-origin returning adults be used for artificial production. Steps will be taken to assure that fish used for hatchery production are not first-generation hatchery returns. Juveniles will be released only in the ancestral drainage. The project will also manage the proportion of natural- to hatchery-origin adults allowed to spawn naturally.

C01-23
Comment: What are the smolt to adult returns for existing supplementation projects?

[CPM-38-02]

Response: One major need described for this project is to test the effectiveness of supplementation as a tool to restore and enhance depressed salmon and steelhead stocks. The project is designed as an experiment because little empirical data exists on smolt-to-smolt survival rates for projects of this type. The project has assumed that survival rates will approximate 0.2%; modeled experimental responses ranging from 0.1 to 0.3% were modeled.

C01-24
Comment: Not enough fish in river to support program.

[YPM-009-01]

Response: The project managers acknowledge the precarious status of the returns to the Yakima Basin. That status underscores the need to carry out this supplementation program. In light of this, it is unlikely that full production of spring chinook will be realized at the onset of the project. Broodstock collection will follow genetic guidelines to assure continued natural spawning while initiating a balanced hatchery production component.

C02 - Project Facilities

C02-01
Comment: Electric Service None to [Jack Creek] site: closest service is 4.1 miles down Teanaway Road: service in North Fork is notorious for frequent interruption, particularly in winter; single phase power; Connor sawmill must generate portion of their power due to inadequate supply on line.

Question: Why do you need this remote location when you'll need to replace line 12.8 miles to supply on Hiway 970? Is this included in your estimate of construction costs?

[Ronald L. Pyeatt 056-06]

Comment: If you must have a site on the Teanaway why not consider the vicinity where the Teanaway Road crosses the river, downstream from the West Fork road intersection?

Most of your problems are solvable and much less expensive. In addition Kittitas County keeps the snow plowed in this vicinity, relieving you of that expense. You will not catch the wrath of the winter recreationists also.

[Ronald L. Pyeatt 056-09]

Comment: The Jack Creek acclimation site will be frozen solid until March or even April in some years (it was frozen in late March in 1995). How will you "heat" the site so you can put smolts in it in Jan/Feb? If you temper the acclimation water source (Teanaway R.) with ground water how will the fish acclimate?

[Anonymous 055-02]

Response: The Teanaway acclimation pond location was selected to optimize distribution of returning adults throughout suitable spawning habitat in that stream. The cost of bringing electrical service on site is part of the estimated construction cost and has been factored into design considerations for the Teanaway site. An engine generator is planned as an alternative source of electrical power for the Teanaway site.

Winterizing the Teanaway site for deep snow and sub-freezing temperatures will be included in the design of the acclimation facility. Special consideration will be given to maintaining the water supply to the raceways during adverse weather conditions. Use of an alternative ground water source to temper the river water is being considered for the Teanaway site.

Although a site on the Teanaway River near the vicinity of the West Fork road intersection would be more desirable from a standpoint of access and availability of utilities, such a location does not provide for the necessary distribution of returning adults to historic spring chinook spawning grounds. Project biologists evaluated numerous sites in the Teanaway system and determined that the North Fork site met the biological criteria for acclimation sites.

C02-02

Comment: On the map this looks just like another hatchery i.e. concrete rectangular raceway. If you plan on carrying out experiments, but you are constrained to use these types of raceways, initially, why don't you include smaller-scale experimental raceways to test experiments that are more complex but smaller in size?

[Anonymous 055-01]

Comment: I saw no experimental "stations" associated with the site description/maps. I realize the experiment is a test of "new" rearing techniques using thousands of fish per site/experiment. Why don't you have the equipment (small experimental facilities) in your plan to test the mechanisms (or other reasons) that lead to the results you may find after the adults return?

[Anonymous 055-05]

Response: The experimental design for the project requires a minimum number of fish to be used in the test in order to have a statistically valid sample. Also, as part of the pre-facility research for this project, the National Marine Fisheries Service has been conducting small-scale experiments to determine the various "more natural" components that could be included in the roster of changes that would differentiate the New Innovative Treatment from the Optimum Conventional Treatment.

C02-03
Comment: Bureau of Reclamation should study putting a fish ladder at the dam.

[CPM-08-02]

Response: The BOR has recently built or improved the adult fish passage facilities at all of the major dams on the Yakima river. There were no ladders constructed on the five irrigation storage reservoirs in the basin, however, and this is the reason that sockeye salmon are extirpated in the Yakima. We are waiting for the final report of a multi-year NMFS study on the feasibility of passage of sockeye smolts out of Lake Cle Elum as a preliminary study in the restoration of sockeye to the Yakima basin.

C02-04
Comment: We own the property at Clark Flats where one of the acclimation ponds will be constructed, as now proposed. On April 17, 1992, we had a conversation with Mr. Don Gerig. He told us at that time that the pond would require approximately 1 acre of land. Your RDEIS states that the ponds would require 2 acres of land. I also asked Mr. Gerig at the time to send the engineering drawings for the pond. We have not heard from him since that date. We would like a clarification on land requirements and the engineering drawings for the proposed pond. We did tell Mr. Gerig at that time, we had no objections to the proposed pond, however we would appreciate some communications.

[Paul M. DeFaccio 016-01]

Response: The exact size of the acclimation pond site has not been determined because the acclimation design has not been completed. The estimated size for acclimation sites is about 0.4 ha (1 acre), thought they could be as large as 0.8 ha (2 acres). The RDEIS stated that the acclimation ponds would require 0.8 ha (2 acres) in an effort to present the largest project size for environmental analysis.

In response to this comment letter, the project engineer contacted Mr. DeFaccio in regard to restoring communication and providing him with design drawings when they become available.

C02-05
Comment: Show location of Coho release facilities.

[YPM-003-06]

Response: The sites were described in the text of the RDEIS, in section 2.4.1.2. A new figure (2.1.5) showing this information has been added to the FEIS.

C03 - Monitoring and Evaluation

C03-01

Comment: Monitoring is critical. Knowledge of pre-facility fish density, growth, smolt numbers, timing, and size, interaction type and rate, predation, spawner number, timing, and distribution. This data must be continued after hatchery construction to answer the research question.

[Anonymous 055-03]

Comment: We believe the adaptive management process and proper monitoring and evaluation are critical in developing a successful program and insuring minimal adverse impacts. The project should be based on science and provide for an action based decision making process.

[J. Daniel Kinney
Yakima Valley Audubon Society 054-05]

Response: The Northwest Power Planning Council, the Bonneville Power Administration, and the project managers all agree the monitoring of this project is critical. Pre-facility baseline studies have been ongoing for many years and will continue through the implementation of this project. The project is designed as a group of scientific experiments that will be monitored throughout the life span of the fish and the duration of the project. The evaluation of the results of these experiments will determine the course of action for the future of the project.

C03-02

Comment: The literature and an emergency "conventional wisdom" supports a view that traditional hatcheries produce fish comparatively unfit for full life span survival and fitness. Looking for hatchery regimens that close this gap between wild and hatchery rearing is a reasonable task. It cannot be assumed however, that "naturalistic like" alterations to the hatchery environment will necessarily have any behavioral consequences for the fish or, if there are consequences, that they will be in the right direction! There must be rigorous, systematic, and ongoing research monitoring of rearing practices and outcomes at as many life span stages as possible.

[Jim Thomson 022-01]

Response: Again, we agree with the comment. The project is designed to compare the behavior and survival of the Optimum Conventional Treatment (OCT) as produced in traditional hatcheries with the New Innovative Treatment (NIT) fish reared under more naturalistic conditions. These treatments will be monitored throughout their rearing in the hatchery, and as outmigrating smolts and returning adults. These treatment fish will also be compared to the naturally reared fish that are produced from natural spawning in the river.

C03-03

Comment: Reclamation believes in the need to study supplementation and supports that research in the Yakima River Basin. However, there needs to be a strong commitment in the FEIS to monitoring and evaluation. The YFP must have the monitoring and evaluation component inseparable from the supplementation portion of the project. Reclamation owns and maintains several of the evaluation facilities in the Yakima River Basin and is committed to working with BPA, YIN and WDFW to ensure the facilities are capable of addressing the research needs to the YFP.

[James V. Cole
Area Manager, Bureau of Reclamation, US Department of the Interior 048-03]

Response: The comment is well taken. Much of the expense of the design, construction, and operation of the proposed project is due to the experimental nature of the supplementation research. This money would be wasted if the monitoring and evaluation component of the project were not completed. Valuable information of the effects and impacts of supplementation would also be lost. The project managers welcome BOR's commitment, and look forward to working with the BOR in ensuring that Reclamation's evaluation facilities are capable of addressing the research needs of the YFP.

C03-04

Comment: The RDEIS seems to clearly explain how the process for adaptive management will be applied as part of the YFP. This will be critical for the success of the project, and especially for continued growth of the plan for natural production of coho (and other stocks). It is not desirable, given already low natural production of spring chinook and summer steelhead, to further depress those runs. Although coho existed in the Yakima Basin, historical habitat conditions were different from the current conditions. We support the objective to increase and improve natural production of coho runs, but would like to emphasize the importance that adaptive management will have in obtaining knowledge useful to coho management.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-03]

Response: The purpose of the proposed coho alternative is to evaluate the potential impacts and benefits of reintroduction of coho into the Yakima basin. The project will monitor and evaluate the ongoing coho program under the CRFMP. This information will be used in the adaptive management process, to make decisions on whether and how to implement management practices that will optimize the benefits and minimize the impacts of reintroduction of coho.

C03-06
Comment: Use coded wire tags to determine survival of smolt and source of returning adults.
[Vic Stacostha 015-07]

Comment: Experimental design should note that all smolts will be marked or explain what will be marked.

[YPM-037-03]

Response: All of the fish produced for this project will be marked to allow monitoring and evaluation of each of the 18 research groups (9 OCT groups and 9 NIT groups). The method of marking these fish has not yet been finalized, but research is being conducted to determine the best marks for separately identifying each of the research groups.

C03-07
Comment: Why aren't feds monitoring Indian catches rather than using the Indians' catch numbers?

[YPM-012-05]

Response: Federal Court orders have authorized the Treaty Indian Tribes to manage their fisheries and also authorizes the Tribes to monitor and report on their ceremonial and subsistence (C and S) fisheries. The commercial catches are recorded on fish tickets issued when fish are sold to commercial buyers. This fish ticket information is entered into a catch database that is co-managed by the state and Tribes.

C04 - Project Operations/Broodstock Selection/Fish Rearing

C04-01
Comment: Supplementation in Yakima with Coho and spring Chinook which are the stocks that will primarily benefit the Indians.

[YPM-006-12]

Response: Thank you for your comment. The coho and spring chinook supplementation programs will benefit all users of the resource--Indian and non-Indian alike. Harvest is to be shared equitably between both parties.

C04-02

Comment: *My environmental concerns about the Yakima Fisheries Project are:* hatchery fish survival has a poor record in the Columbia. Have you considered stocking coho fry into systems with adequate rearing habitat?

[Vic Stacostha 015-03]

Comment: *Your environmental study should have included:* egg or fry plantings to nursery streams. The idea of acclimating salmon parr to predators is almost funny. Go for alternative 2.

[Anonymous 036-01]

Comment: *Other alternatives to consider:* stock fry in conjunction with creation of complex rearing habitat in suitable streams.

[Vic Stacostha 015-06

Comment: Use coho fry or parr, smolts would be too old to acclimate to the basin for return.

[Anonymous 036-04]

Response: The initial thrust of this program, for both spring chinook and coho, is to release fish as smolts. With the relatively small potential number of spring chinook eggs available, we must maximize the potential for return while still protecting the genetic integrity of the stock and minimizing impact of releases on naturally produced juveniles in the system. We must also have enough returning fish to detect differences between treatments of groups of fish. Using eggs or fry would not reliably produce sufficient returns to meet the experimental needs of the effort. Coho smolts, if acclimated within the basin, will return to the basin. Those that escape the fisheries are expected to seek out tributaries for spawning and natural production. The ecological impact of the fry produced in this way will be much less than the impact of large numbers of fingerlings or smolts planted directly into the tributaries, and our experience shows that survival will be higher.

C04-03

Comment: The goal of the YFP is "...to rebuild and support **naturally** spawning anadromous fish stocks..." (emphasis added). In order to achieve this goal, large numbers of **hatchery** fish will be released. The RDEIS acknowledges that the expected outcome of spring chinook supplementation is that "Substantial numbers of acclimated smolts are expected to return as adult spawners to the general vicinity of the acclimation sites." The expectation that these returning hatchery fish will produce viable natural/wild stocks is a leap of faith. Although the fish culture practices appear to be designed to maximize genetic fitness (selecting local stocks for culture) and encourage adaptation to natural conditions (the NIT treatment), decades of experience with mixed wild/hatchery stocks in the region demonstrate that this proposal may at best produce large numbers of hatchery strays that do not significantly contribute to natural reproduction.

[Steve Shepard 014-01]

Response: This proposed effort differs markedly from the "decades of experience" that *may* have produced "large numbers of hatchery strays that do not significantly contribute to natural

production." There is very limited past experience with programs such as that proposed for the Yakima River. There has been no concerted effort to use the local, indigenous stock of naturally-produced fish, incubate and rear them in a more natural environment, and release them back near the area in which they are expected to spawn; assuring that each year the broodstock collected is of natural, not hatchery origin. The experienced referenced is based primarily on releasing hatchery fish under less rigorous criteria. While our expectations may to some extent be a "leap of faith", we are confident that, through this carefully monitored effort, we can be successful in maintaining production in the Yakima Basin.

Table 1.1 of the Revised Draft EIS shows how this supplementation effort differs from conventional hatchery programs.

C04-04/05

Comment: This has been the experience with more than 25 years of Atlantic salmon restoration efforts. Even when hatchery smolts were released in viable habitats and returned to these areas as adults, they did not apparently spawn and produce viable progeny (as evidenced by the lack of juveniles the following year). Only when very young juvenile fish (non-feeding and feeding fry) were distributed painstakingly throughout the drainage did viable adults return and begin to rebuild a truly wild stock.

[Steve Shepard 014-02]

Comment: Another alternative to consider in the YFP is to let the habitat produce wild fish by returning them to the river as soon as possible, i.e., as feeding fry. Although this is logistically difficult (we distribute Atlantic salmon fry by canoe in oxygenated coolers), and initial mortalities may be up to 90%, the resulting juveniles will be adapted to local conditions and returning adults will home to appropriate spawning grounds.

[Steve Shepard 014-03]

Response: Thank you for your comment. We are aware of instances where releases of salmon smolts into suitable habitat have produced juveniles when they return to spawn naturally. With the constraints placed on broodstock collection, rearing environment, and release strategies, we anticipate that this proposed project will significantly improve on that success. (See also Response C04-02.)

C04-06

Comment: What is the source of "out of basin" coho? Is the "out of basin" source similar to Yakima streams?

[Vic Stacostha 015-04]

Response: The "out of basin" source of coho has in the past come from lower Columbia River hatcheries. There are no sources available that would be similar to the Yakima River streams. It is unfortunate that the only such source--native fish returning to the Yakima--have long been extinct. As the coho program continues, we may be able to collect broodstock from the Yakima River.

C04-07

Comment: The DEIS conveys an impression that production and productivity of Yakima River spring chinook under the YFP can be characterized as lying between two scenarios ["optimistic" and "pessimistic"]. [The commenter] assumes that both scenarios are based on 3,700 adult spawners for maximum production of filial adults. This number . . is the approximate median value of three estimates [described in commenter's report of July 20, 1995].

Optimistic Scenario. The optimistic scenario implies that survival of hatchery juveniles is half that of natural juveniles and that the capacity of the Yakima River to assimilate hatchery juveniles is largely unaffected by presence of natural juveniles. It is assumed that 500 spawners are taken into the hatchery to produce 810,000 hatchery juveniles to be released into the upper Yakima River. The remaining 3,200 adults are counted into the upper Yakima River to spawn naturally. The 3,200 natural spawners are assumed to produce 200,000 filial smolts and 8,000 filial adults (smolt-to-adult survival of 0.04). The 810,000 hatchery juveniles are assumed to produce 16,000 filial adults (smolt-to-adult survival of 0.02). Combined production of natural and hatchery fish is about 24,000 filial adults. The "productivity ratio" of filial adults to parent spawners is calculated to be 6.5 (24,000 ÷ 3,700). This productivity ratio for maximum production of filial adults if about 2.5 times higher than that of current Yakima River spring chinook in the absence of supplementation. [See commenter's report attached to his letter.]

Pessimistic Scenario. The pessimistic scenario assumes limited capacity of the Yakima River to assimilate natural and hatchery juveniles. If maximum production of filial adults is in the range of 9,000 to 10,000 from 3,700 spawners, partitioning spawners between hatchery (500 adults) and natural spawning (3,200 adults) is assumed to have little, if any, positive impact on maximum production of filial adults. The productivity ratio of filial adults to parent spawners would either remain in the range of 2.4 to 2.7 or would possibly decline due to overstocking of the ecosystem.

The YFP supplementation program described in the DEIS appears to provide an opportunity to address two important questions related to the potential capacity of the Yakima River to produce spring chinook.

1. Will escapements of three to four thousand spawners produce the maximum number of filial adults with or without supplementation?
2. Will supplementation provide for significant increased production of filial adults per parent spawner?

Answers to these questions should help resolve an ongoing debate about the role of artificial propagation in the management and restoration of Columbia Basin salmon. *[See also commenter's attached report.]*

[William J. McNeil, Ph.D.
Remarks prepared for the Yakima River Basin Defense Coalition 043-01]

Response: We are not able to understand the point of the comments. If the question was whether the YFP determine whether supplementation will increase production of filial adults per spawner, the answer is *yes*. Post-release survival (filial adults per spawner in the hatchery) and reproductive success (adult progeny per parent) for the supplemented population as a whole will

be closely monitored, and will be one of the major drivers in adaptively changing the project over time.

It is not easy to determine the point of the "Optimistic" and "Pessimistic" scenarios. Clearly, the ratio of returning adult progeny per parental spawner (both inside and outside of the hatchery) must increase under supplementation for the project to be successful. Although our assumptions and calculations differ considerably, we agree that a YFP supplementation program that meets the objectives set forth in RDEIS requires that the current recruitment rate (adult progeny/parent) be more than doubled -- by our calculations, raised by a factor of 2.1; by the commenter's, a factor of 2.5.

C04-08

Comment: The existence of a special case of density dependent limitation, known as "depensatory mortality", is not borne out by the spawner-recruit analysis in Appendix A. Yakima spring chinook exhibit their highest productivity, up to 11.3 adult returns per spawner, at low escapement levels (Table 1; Appendix A). In response to relaxed harvest pressures in the late 1970s, estimated spawning escapements rebounded from a low of 314 fish in 1977 to 8072 in 1986. There is a strong and statistically significant ($r=-0.82$; $p < 0.001$) negative relationship between parent escapement and adult returns/spawner, with returns/spawner approaching 1.0 at 3,500-4,000 spawners (Figure 3; Appendix A). Declines in stock productivity since the mid-1980s reflect the recovery of spawning escapements to levels at or near the Yakima Subbasin's carrying capacity. Rather than the depensatory mortality processes espoused in the RDEIS, the dynamics of Yakima spring chinook exemplify population regulation by compensatory processes which feature high survival rates at low population levels and declining survival rates as the population approaches carrying capacity. Spawner-recruit analysis of Yakima summer steelhead indicates relationships between escapement and stock productivity that are similar to those found in Yakima spring chinook (Appendix B).

As noted above, the RDEIS hypothesizes that Yakima spring chinook productivity is predation limited. Though it suggests that the northern squawfish is likely the most significant predator, the RDEIS notes that "--no work has been done in the Yakima River Basin to ascertain the abundance and distribution of the squawfish population," and "--no research as been conducted in the Yakima River to assess predator consumption rates and the actual relationship of predators to prey (e.g. spring chinook) density--" (Chapter 4, page 127). The RDEIS states that research on these subjects would be highly valuable, but that no research is currently planned to address the issues.

It has been suggested that animal populations subject to predation pressures may have multiple equilibria, wherein a breakthrough to a high abundance level is dependent on exceptional juvenile recruitment which saturates the predator population, i.e. the scenario described in the RDEIS. Researchers who have examined this problem, however, have concluded that evidence for this phenomenon has been difficult to document (Hilborn and Walters, 1992) and, in the case of the Pacific salmon, is weak and circumstantial (Peterman, 1987).

[Charles C. Flower
[Attorney, Flower & Andreotti, rep. Yakima River Basin Defense Coalition *042-01]*
From a report prepared by D.B. Lister & Associates Ltd.

Response: This comment suggests that the commenter's stock-recruitment analysis demonstrates that current low returns of Yakima spring chinook reflect primarily a low carrying capacity in the Basin (3,500-4,000 spawners), and does not support a hypothesis of predation-mediated depensatory mortality. These analyses contain some serious flaws, and may be dangerously misleading. Our reservations are listed in the response to Comment C04-10.

It also appears reasonable to assume that a relatively fixed population of resident predators, through a Type III functional response, significantly depresses spring chinook productivity, tending to constrain smolt production and subsequent adult recruitment to levels well below environmental capacity in the absence of predation. At the present time, we have assumed a population of predatory fish capable of consuming smolts as depicted in Figure 1 below.

It should be noted that predation consistent with a Type III functional response for squawfish feeding on chinook smolts has been demonstrated in the Columbia River below McNary Dam (Petersen and DeAngelis, 1992). Moreover, the impact of predation (as we modeled it) is, if anything, conservative in light of observed smolt losses. In 1988, an outmigration of 283,000 wild smolts was estimated at Chandler. Also in 1988, it was estimated that the mean survival of wild, branded spring chinook smolts from four mid-river release points to Chandler was 52.5%. If this rate applied to the outmigration as a whole, then 283,000/0.525 or 539,000 smolts began the outmigration, and 256,000 died before reaching Chandler. For reasons cited in response to Comment C04-10, we believe the bulk of this loss was attributable to predation. The number of smolts in a 539,000-fish outmigration lost to predators as modeled in the EDT is only 155,000. Finally, it is not unreasonable to propose that enough predatory fish exist in the lower 100 miles of the Yakima River to consume several hundred thousand smolts. If, over the course of a 68-day outmigration (April though the first week of June), each predator consumed only one smolt per day, it would take only 3,765 predators to consume 256,000 smolts.

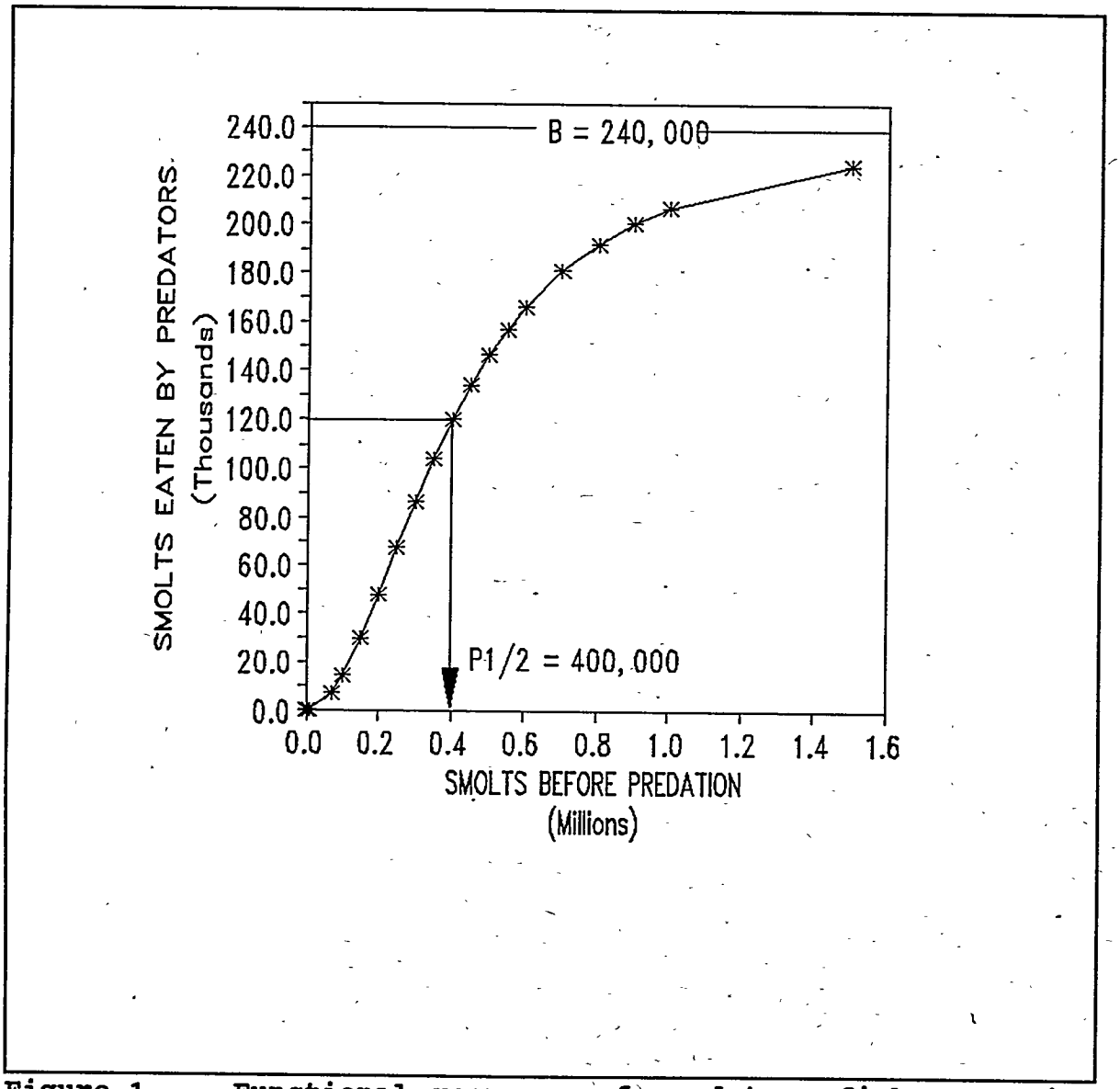


Figure 1. Functional response of predatory fish on Yakima spring chinook smolts assumed by initial application of computer model.

C04-09

Comment: Spawner-recruit analysis indicates that smolt-to-adult survival of spring chinook has been negatively correlated ($r=-0.79$; $p < 0.01$) with the number of outmigrating smolts (Figure 5; Appendix A). At existing levels of abundance the spring chinook smolt population is apparently experiencing density-related mortality. Under these circumstances, a dramatic increase in smolt migrants, as proposed under the YFP, would not appear to be prudent.

[Charles C. Flower
[Attorney, Flower & Andreotti, rep. Yakima River Basin Defense Coalition 042-05]
From a report prepared by D.B. Lister & Associates Ltd.

Response: Our analysis differs. First, it is generally believed that actively outmigrating smolts are not subject to density-dependent mortality, except for density-dependent *predatory* losses. Yakima spring chinook smolts observed in upriver locations are significantly smaller than smolts observed downriver (Fast et al., 1991). This suggests substantial growth during outmigration (and not feeding-related competition and subsequent mortality). Higher smolt density might increase mortality rates by inciting higher consumption rates among resident predators (the "functional response"), or by attracting more predators into the Yakima (the "numerical response"). However, even under this scenario, the number and behavior of local predators must be known in order to determine whether a given number of smolts will incur higher losses through functional and numerical predatory responses, or will instead simply overwhelm the predators' ability to find, capture and digest prey. This is one of the questions the project must examine.

Second, the commenter has made use of an inappropriate and incomplete data set from smolt years 1959-1963, and 1983-1990. Many features of the Yakima and (especially) the mainstem Columbia were quite different in 1959-1963: no mainstem irrigation dams were renovated on the Yakima, John Day Dam had not yet been built on the Columbia, and eight additional mainstem Snake and Columbia dams above the Yakima did not exist. The commenter should have examined the data collected *after* 1990. We have recently looked at the relationship between smolt-to-adult survival and a number of independent variables for smolt years 1983-1993. These variables included the following:

- estimated total number of outmigrants (the same data used by the commenter for the years 1983-1990 plus data for the years 1991-1993);
- lower Columbia run size 2 years after smolt outmigration (assumed to reflect oceanic and Columbia-wide impacts for 4-year-old adults); and
- weighted mean flows below Sunnyside and Prosser Dams.

Daily mean flows below these dams were weighted by the fraction of the total outmigration that passed Prosser that day; thus, these passage-weighted flows approximate the average flows experienced by the entire outmigration. We found no relationship between smolt-to-adult survival and the estimated number of outmigrants ($r=0.275$; $p=0.413$; see Figure 2). We did, however, find significant relationships between smolt-to-adult survival and mean flows below Prosser Dam (Figure 3), mean flows below Sunnyside Dam (Figure 4) and Columbia returns 2 years after outmigration (Figure 5). The correlation coefficients and significance levels of the relationships

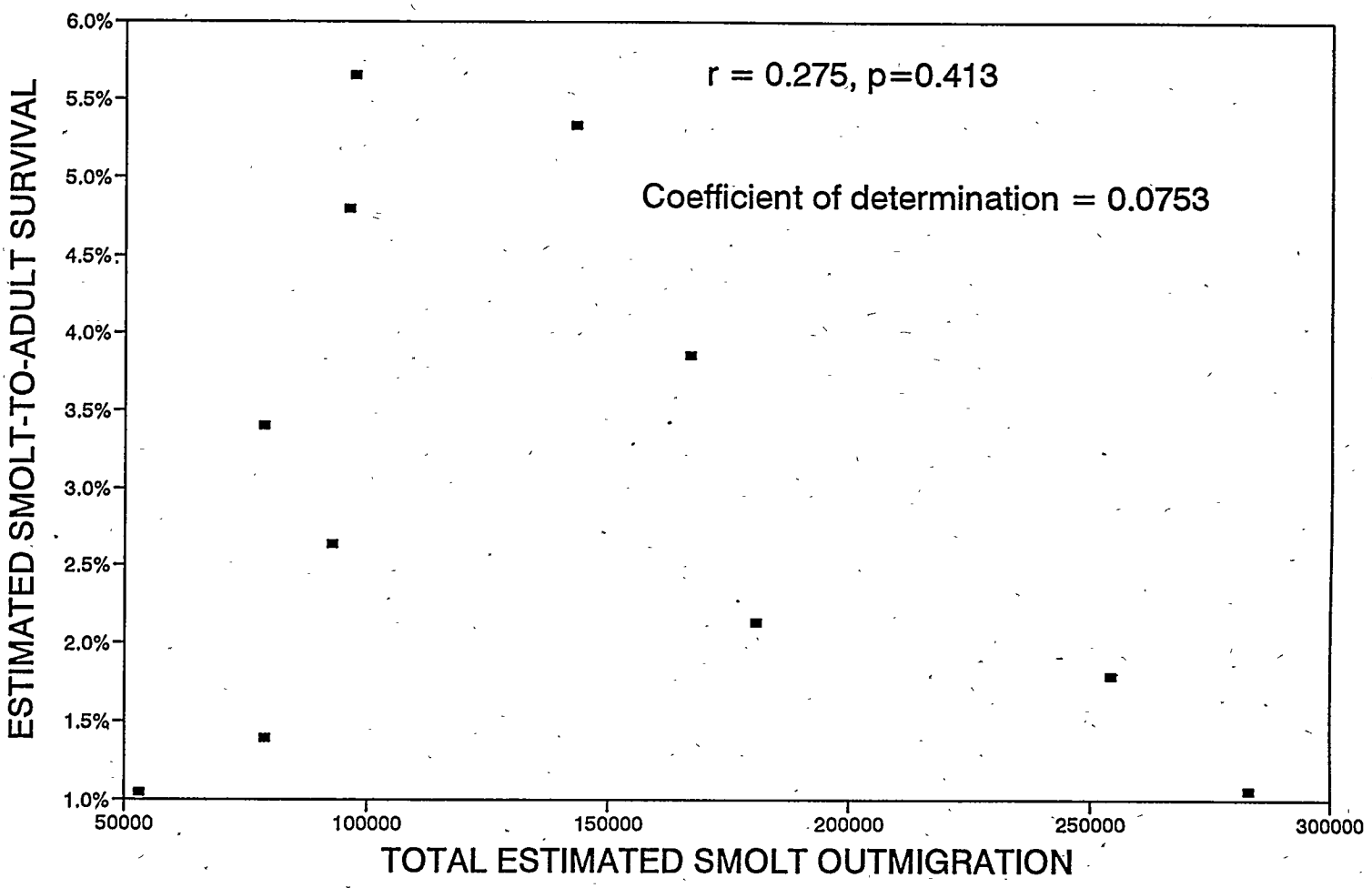


Fig. 2 Relationship between smolt number and subsequent smolt-to-adult survival, Yakima spring chinook, smolt years 1983 - 1993.

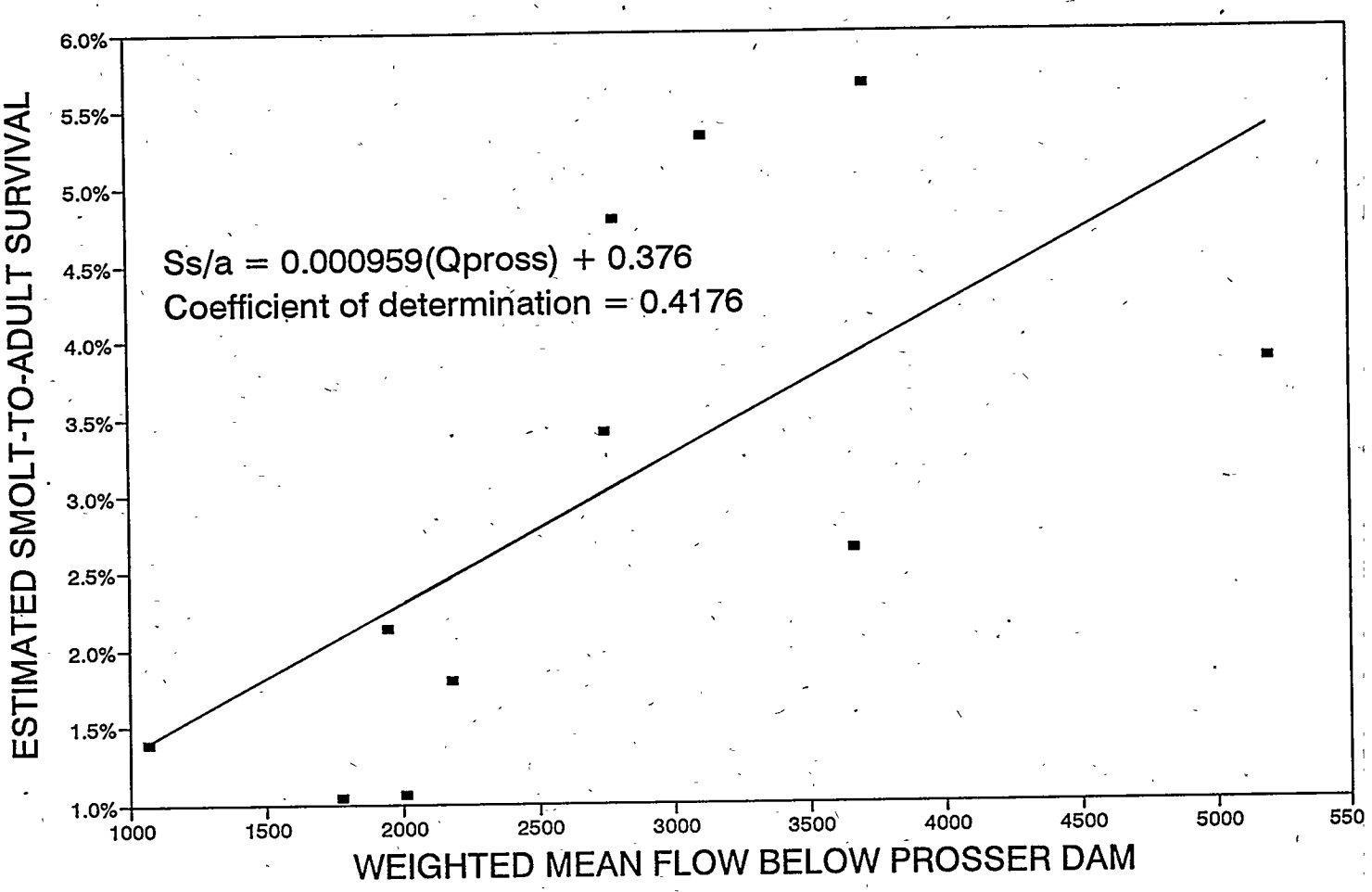


Fig. 3 Relationship between weighted mean flow below Prosser Dam and subsequent smolt-to-adult survival, Yakima spring chinook, smolt years 1983 - 1993.

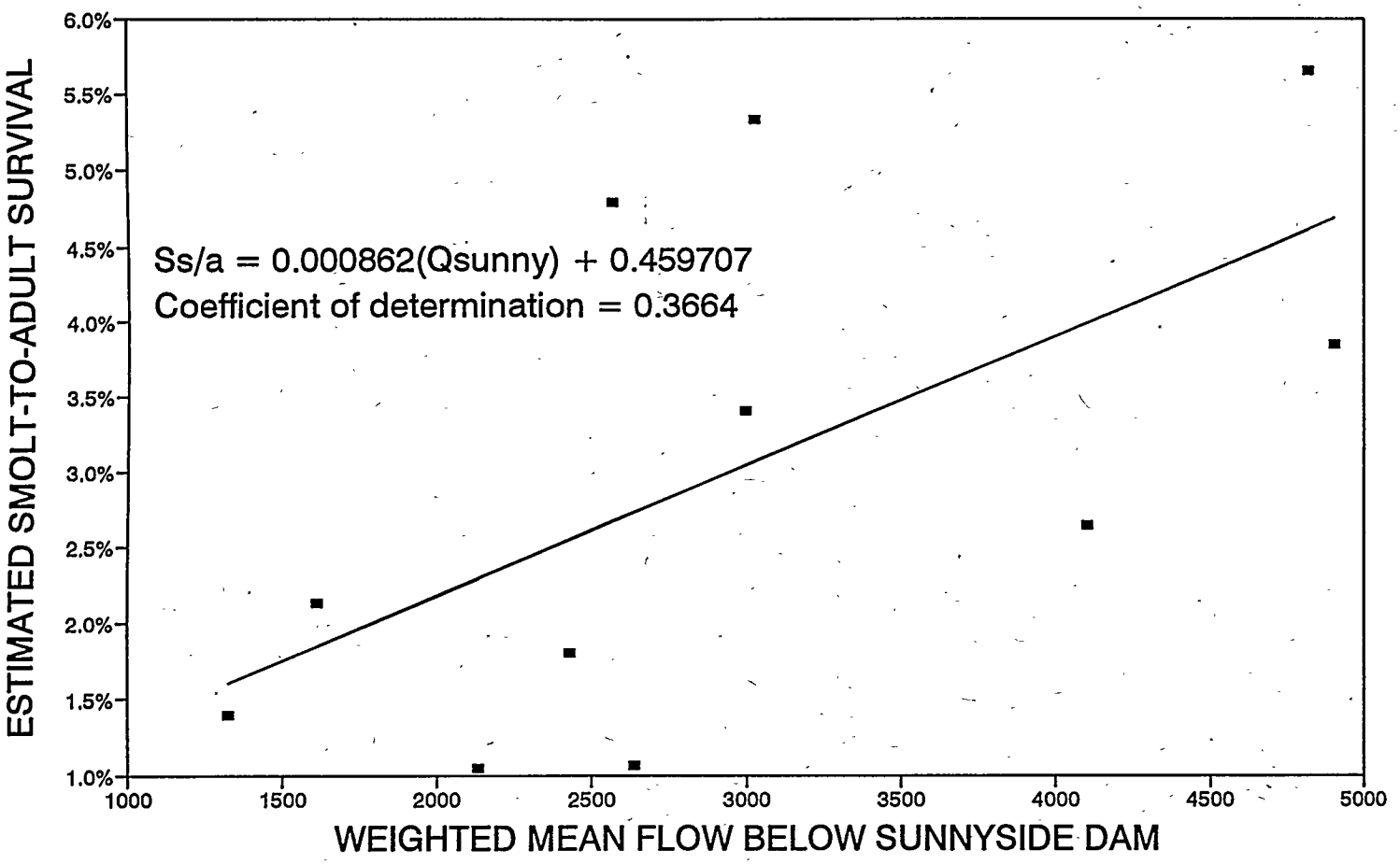


Fig. 4 Relationship between weighted mean flow below Sunnyside Dam and subsequent smolt-to-adult survival, Yakima spring chinook, smolt years 1983 - 1993.

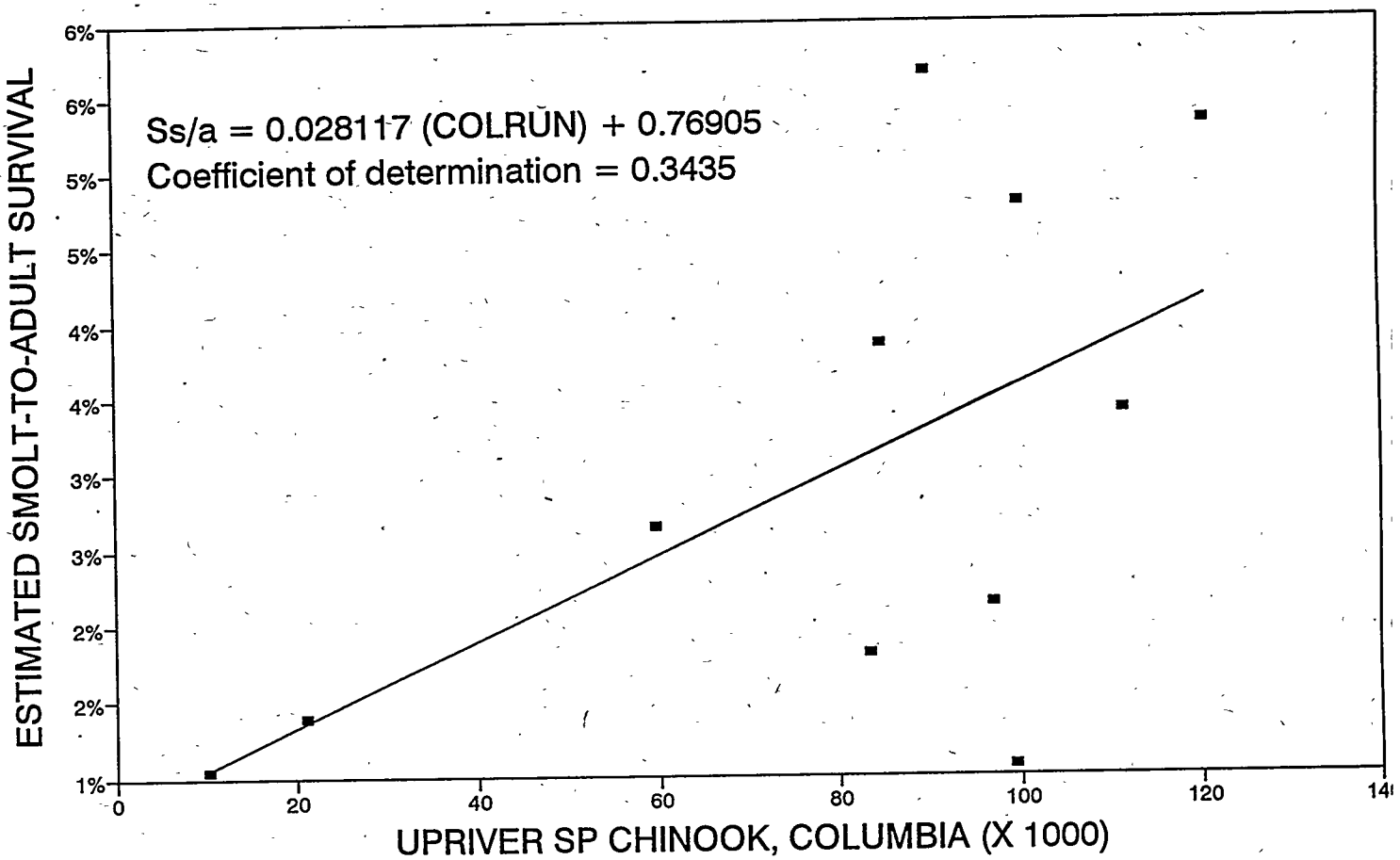


Fig. 5 Relationship between upriver spring chinook adult returns to the Columbia two years after outmigration and smolt-to-adult survival, Yakima spring chinook, smolt years 1983 - 1993.

between smolt-to-adult survival and mean flow below Prosser, mean flow below Sunnyside and total Columbia return are, respectively, (r=0.647, p=0.032), (r=0.605, p=0.048) and (r=0.585, p=0.059).

C04-10

Comment: The YFP proposal relating to spring chinook is based on two principal assumptions: (1) there is significant under-utilization of habitat by juveniles during the rearing and overwintering phases; and (2) predation pressures have created a bottleneck which limits the population's ability to fully utilize the Yakima Subbasin's production potential. The RDEIS has failed to support either assumption. Stock-recruit analysis, which would normally be used to support assumption (1), is absent from the document. The hypothesis of predation-limited smolt production has not been supported by any field investigation in the Subbasin.

Computer modeling is indicated as the basis for predictions of spring chinook production potential and smolt losses to predation. The RDEIS does not attempt to briefly describe the models, their assumptions, and applicability to the Yakima Subbasin, nor does it indicate whether the models have been validated.

In summary, the main assumptions underlying the proposed YFP have not, as yet, been supported by adequate scientific documentation.

[Charles C. Flower
[Attorney, Flower & Andreotti, rep. Yakima River Basin Defense Coalition 042-06]
From a report prepared by D.B. Lister & Associates Ltd.

Response: We agree with the commenter that the YFP is an experimental project hedged with a multitude of uncertainties. It is, however, our judgment that the value of the potential benefits and knowledge to be gained from the experiment justifies the risks incurred by proceeding, cautiously, in the face of these uncertainties.

We also agree that density-dependent mortality now occurs within current production areas. Some portion of this mortality is attributable to density-dependent predation on outmigrating smolts, however, degraded habitat quality also plays a considerable role. The project's preliminary objectives reflect an awareness that supplementation alone is unlikely to result in more than a relatively modest increase in abundance and fishing opportunity. A combination of short-term supplementation and long-term habitat restoration is clearly necessary. We are currently engaged in a detailed analysis of habitat quality and the nature of local impacts on habitat quality. When complete, these analyses will guide strategic habitat enhancement projects similar to those described on RDEIS pages 3/91-3/93.

Issues related to carrying capacity. The project managers differ with the commenter on three major points. First, the commenter appears not to believe that the *productivity* of the existing population is precariously low, and therefore does not include the assumption that supplementation will increase productivity (the number of smolts produced per returning adult or,

ultimately, the number of adult progeny that return to the Yakima per parental spawner--the "recruitment rate"). If the project's planned naturalistic rearing practices and genetic hatchery guidelines are successful, a supplemented population of Yakima spring chinook will produce significantly more smolts per returning spawner, and its recruitment rate will increase.

Second, the commenter's stock-recruitment curves for Yakima spring chinook do not provide the basis for a meaningful analysis of the carrying capacity of the basin or of the appropriateness of supplementation. Dr. William McNeil of the Yakima River Basin Defense Coalition, for instance, has estimated that historical runs of salmon and steelhead to the Yakima Basin numbered about 300,000 (McNeil, 1993). (This figure is less than half of project estimates of 790,000.) Using McNeil's historical runs of all anadromous species on the order of 300,000 fish, the historic spring chinook run would have been on the order of 75,000. It seems unreasonable to propose, as the commenter does in his stock-recruit analysis (Lister, 1994), that the equilibrium population for the Basin is now only 5,000, 1/15th of the run based on McNeil's conservative estimate of historical runsize or 1/40th of our own estimate (200,000).

The commenter's stock-recruitment analysis is also technically deficient. Along with Ray Hilborn and Carl Walters, we believe that a simplistic application of stock-recruitment analysis can give "terribly misleading answers," and that "bad stock recruitment analyses have been a significant factor leading to overexploitation and collapse for some major fisheries." (Hilborn and Walters, 1992, p. 287).

Hilborn and Walters list five serious sources of bias in stock recruitment analysis. These biases are not accounted for by the commenter. Particularly serious are the following:

- use of pre-1982 escapement figures (which, except for brood years 1957-1961, are rough expansions based on single-pass spawner surveys at a handful of index sites),
- failure to assess the implications of differing stock-recruitment relationships for the three stocks comprising spring chinook in the Yakima, and
- failure to recognize bias inherent in the relatively narrow range of spawner levels observed since 1982 (when thorough, multiple-pass spawner surveys were begun).

Hilborn and Walters (*ibid*, p. 290) fairly describe the impact of all five bias types:

> The biases themselves are almost always the same: they make recruitment appear to be less affected by spawning stock size than it really is. This means that optimum harvest rate will be overestimated and optimum stock size underestimated. *The biases will be most severe with severely overexploited stocks where large variation in stock size is not possible. If the stock was already overexploited when reliable data collection began, there is a very high chance that stock-recruitment analysis will tell you that the stock is near optimum stock size or harvest rate when, in fact, it is severely overexploited* [emphasis added].

Third, stock-recruitment analysis does not have to be used to demonstrate the existence of a substantial amount of underutilized rearing habitat within the Yakima Basin. Biologists familiar

with the Basin are aware that substantial amounts of good to excellent rearing habitat is currently lightly used because of recently corrected or existing (but remediable) adult passage problems.

Lack of support for "predation bottleneck." The assumption of a predator-mediated brake (functional response) on smolt survival and subsequent adult recruitment is indeed controversial. Currently, we can only demonstrate that such a phenomenon is plausible; we cannot prove it exists.

For decades, it has been widely assumed that predators in the lower Yakima River significantly reduce productivity of local stocks of salmon and steelhead. Anecdotal and indirect evidence of a heavy impact of smolt predators, primarily by small-mouth bass, seagulls, and (especially) squawfish, is abundant. More or less quantitative observations of large numbers of squawfish and/or bass and gulls have been made repeatedly (Washington Department of Fisheries, 1941; Patten and Thompson, 1970; Seiler, 1993); there are many unpublished accounts of feeding aggregations of these fish-eating species. The survival of many releases of marked hatchery smolts from upriver release points to the Chandler smolt trap on the lower river (RM 47) also suggests heavy predatory losses. Mean survival to Chandler of four releases of branded **wild** spring chinook in 1988 was estimated at 50% (Fast et al., 1991). These figures were observed *in the absence of* any factor other than predation that might account for such large losses.

Existence of "predator traps." The commenter states that researchers who have examined the problem of predator traps have concluded that evidence for this phenomenon has been difficult to document (Hilborn and Walters, 1992) and, in the case of the Pacific salmon, is weak and circumstantial (Peterman, 1987)."

The references cited by the commenter are problematic. We can find nothing in Hilborn and Walter's text to the effect that such phenomena "have been difficult to document", though there are several straightforward descriptions of the phenomenon and its underlying theory. Virtually the entire Peterman paper is devoted to demonstrating the mechanisms capable of creating populations with "multiple stability zones"--populations that, after suffering a severe drop in abundance, tend to remain at a low abundance level unless freakishly favorable survival conditions or supplementation "push" them to a higher, stable, level of abundance. The Peterman quote, when placed in context, conveys a somewhat different impression than that put forth by the commenter. The entire quote is as follows (ibid, p. 426):

> While evidence for multiple equilibria for Pacific salmon is weak and circumstantial, the empirical evidence is strong for insects, mammals, and other fishes (reviewed by May, 1977: Peterman et. al, 1979). There is no reason expect that Pacific salmon will be any different, because their populations are subject to the same processes that give rise to multiple equilibria in other systems....

The commenter does not mention Peterman's 1987 example of pink salmon in Zone 8 of British Columbia. The odd-year stock in this area was severely overharvested in the 1960s, and stayed at about 11% of its mean historical abundance afterwards, despite drastic reductions in exploitation. Peterman showed that the abundance of the odd-year stock moved into the zone of higher

abundance following two years of supplementation, and has since remained there despite harvest rates as high as 71% and elimination of the supplementation program.

This type of circumstantial evidence for the existence of "predator traps" is actually rather common (e.g., sockeye salmon in Karluk Lake Alaska subject to coho and Arctic char predation, McIntire et al., 1988). Peterman, for one, would suggest that many additional examples would be found if biologists no longer applied simplistic stock recruitment procedures.

Inadequate model description. The model employed in setting provisional objectives for upper Yakima spring chinook was the "Ecosystem Diagnosis and Treatment Planning Model" (EDTPM). (See Lestelle et al., 1994.) A complete description of the assumptions and scenarios examined for upper Yakima spring chinook may be found in Watson (1993), available from the YFP Project Office in Yakima. While a complete description of the EDTMP and its use on upper Yakima spring chinook is beyond the scope of this exercise, a brief description is possible:

- Yakima spring chinook were modeled as three separate stocks with a three-lifestage Beverton-Holt production function;
- productivity was assumed to be constrained by a lack of winter habitat and predation on outmigrating smolts;
- fish of all stocks were assumed to interact as smolts via interspecific predation (functional response); and
- smolt carrying capacities for the American, Naches and Upper Yakima stocks were estimated at 137,000, 206,000 and 543,000, respectively.

Note that the EDTPM is not intended to be predictive model, but rather a "simulation", incorporating numerous biotic and abiotic relationships. *Models* typically have a narrow focus and use "explanatory parameters" sparingly in order to increase estimate precision. *Simulations* are used to examine a wide range of scenarios with many parameters, typically to highlight relative differences between scenarios.

Thus, the EDTPM was used to examine two distinct "ecological scenarios" (quantified mechanisms of production limitation), three different levels of relative (hatchery/wild) performance for hatchery fish, and three distinct production levels (release numbers of hatchery fish) and harvest management schemes.

C04-11

Comment: For the past decades Biologists have relied on Hatcheries as a means to increase the dwindling numbers of salmon being caught by Commercial and Sports fishermen. Unfortunately this method has not been successful and there is growing concern for wild populations which continue to go extinct. It is clear from the continuing decline of fish stocks that the present

operation is not working. As an alternative to the present operation, the Yakima Valley Audubon Society would support an experimental Supplementation Project as a means to restore populations of naturally spawning anadromous fish stocks. We support attempts to preserve the wild genetic stocks and produce fish that more closely resemble wild fish in their behaviors.

[J. Daniel Kinney
Yakima Valley Audubon Society 054-01]

Response: Hatcheries have been very successful in increasing the numbers of fish available for harvest. It is, in some part, success that has driven some of the wild stocks to their present depressed status. The harvest rate for the hatchery fish in mixed stock areas exceeded the rate that many of the natural stocks (particularly those from areas such as the upper Columbia where other events were already "harvesting" large numbers through passage loss) could sustain. Unfortunately, hatcheries have not had similar success in maintaining wild (natural) stocks. We appreciate your support of Alternative 2.

C04-12

Comment: Your representatives could not provide assurance the fish "imprinted" at the site would return to, downstream or pass the site. Question: Why is this not known and why does so much money have to be spent on an admitted experiment?

[Ronald L. Pyeatt 056-04]

Response: We regret that you were unable to get your question answered at the public meeting. A number of past observations have shown that fish adequately imprinted to a site will return to the vicinity of that site to spawn so long as adequate adult passage conditions exist downstream from that site.

C04-13

Comment: I understand that Roza Dam either has poor capture efficiency of smolts or is not operated correctly by the Tribe. This is imperative for the experiment. How will you rectify?

[Anonymous 055-04]

Response: Roza Dam is operated by the Bureau of Reclamation, not the Yakama Indian Nation, for the purpose of diverting water for irrigation. A smolt trap has been operated by the Tribe in the fish bypass system of the diversion canal. All of the fish diverted by the screens have been collected through an inclined plane trap. The problem is not in the capture efficiency, but in the length of time for passage of the smolts through the bypass system. Some smolts remain in the bypass system for extended periods of time, confounding the estimation of daily captures and passage. Smolt trapping at Roza is not essential for the success of the project, as all smolts will be marked and can be evaluated at Chandler smolt trap in the lower river. Smolt trapping at Roza would, however, provide another tool for evaluating the success of the project. The project is operating screw traps below the dam at Roza to evaluate the effectiveness of this technique for monitoring smolts at that location.

C04-14

Comment: There has been considerable discussion in the fisheries community about the survival rates of wild fish being higher than for hatchery reared fish. If this is in fact the case and the survival rates for the fish produced in the supplementation project are lower than for the wild fish, the removal of wild adults as brood stock for the supplementation project may [accelerate] the decline of the wild adult fish population. This may be the exact opposite of the desired result anticipated.

[Robert Gorrenson 002-02]

Response: BPA and the project managers are concerned about the possibility of "broodstock mining"--removal of natural fish for broodstock purposes at a rate exceeding the return of the smolt produced by the program. This will be carefully monitored at all stages in program implementation to assure that does not occur. The smolt-to-smolt survival rate is often higher for wild fish than for hatchery fish. However, hatcheries provide a much higher survival rate for the period from egg deposit to smolt--about 80% survival compared to 10% for wild fish. For this reason, we believe that the hatchery approach has significant potential to increase the status of fish runs in the Yakima River.

C04-15

Comment: When you say "selective broodstock collection would occur," you might want to define what you mean by "selective" - geneticists might have a field day with that.

[Anonymous 025-02]

Response: Thank you for your comment. Broodstock will be "selected" from the proper stock, will not contain first-generation hatchery fish, and segregated from time of spawning to time of release. "Selection," of course, may have other connotations contrary to our intent. The EIS will be modified to reflect this concern.

C04-16

Comment: Is there a program in place that will ever allow this system to be self-sustaining? What is the likely and realistic return (smolt to adult) back to the Yakima? Are we just treating the symptom?

[Vic Stacostha 015-10]

Response: One purpose of this effort is to determine "a viable means to rebuild and support naturally spawning anadromous fish stocks." The ultimate goal is "to produce enough naturally spawning fish with a high enough survival rate to be able to phase out artificial propagation" (Section 1.2 of the EIS). This project is a test to see whether supplementation can accomplish these needs. If we were absolutely certain of the results, we would not hesitate to implement this sort of effort immediately for all stocks in the Yakima Basin. It is just this uncertainty that causes us to move cautiously forward.

D - Potential Project Impacts and Constraints (General)

D-01

Comment: Pg 7. Much discussion about enhancement efforts underway, but no mention of on-going habitat impacts. The RDEIS should at least acknowledge that project benefits will be undermined or nullified if additional habitat impacts occur.

[Lynn Hatcher
Yakama Indian Nation 049-02]

Response: Thank you for your comment. Clearly, the long-term benefits of the project would be compromised if additional habitat degradation were to occur. On the other hand, the benefits of the project would be enhanced if habitat improvements did occur. Recent activities to improve the habitat and passage have been undertaken in the basin, and we expect that the implementation of the Growth Management Act, the Washington Forest Practices Act, and the improvement in fish passage facilities in the basin will improve, or at least maintain, the overall habitat condition of the Yakima River.

D-02

Comment: It seems that either the potential for extinction or the continued lack of Tribal harvest resulting from no action would qualify as a "high impact." *[Reference to Table page 51.]*

[Lynn Hatcher
Yakama Indian Nation 049-06

Response: Thank you for your comment. Due to the other habitat improvement actions that would continue to be implemented under the no action alternative in both the Yakima River Basin and Columbia Basin, we do not believe it a "high impact" rating is warranted.

D01 - Genetic Resources

D01-01

Comment: On the whole, the draft EIS is an informative, well prepared document. Based on our review we [USEPA] have rated the draft EIS EC-2 (Environmental Concerns - Insufficient Information). Our environmental concerns are primarily based on the potential impacts to fisheries resources. We continue to have concerns with the impact of hatchery fish on naturally spawning Yakima River spring chinook salmon. As mentioned in our previous comment letter, hatchery fish may negatively affect the genetic integrity of wild fish when hatchery and wild fish compete on the same spawning ground. Even though the brood stock for spring chinook supplementation is from the remaining wild stock, there remain uncertainties and dangers to the wild stock it is intended to supplement. If survival of hatchery fish (fry to returning adult) is consistently too low, the hatchery operations' need for brood stock may continue to be a drain on those remaining in the wild escapement population. Northwest Power Planning Council scientists noted in the paper entitled Genetics and Salmon Production, that supplementation posed unacceptably high risks to gene pools, and that subsequent harvest rates on the resulting "mixed stocks" may be exceeding those that the wild stock can sustain. The draft EIS, to its credit, attempts to deal with these risks and other uncertainties in the discussion. EPA recognizes that development of supplementation is likely a necessary component of an overall integrated strategy to restore beleaguered salmon stocks in the Columbia River, and in turn, of restoring the integrity of treaty tribal fishing rights. Without substantial gains in habitat protection and restoration, gains made through supplementation may ultimately be ineffectual.

[Joan Cabreza 057-01]

Response: The WDFW geneticist working on this project participated extensively in the Council processes resulting in several documents, among them the one you refer to. It is true that supplementation operations pose genetic risks to the target population. Even when spawning protocols are followed that keep effective size high, and only native fish are used as broodstock, some genetic change will result as a consequence of hatchery rearing. This effect is commonly referred to as domestication selection (see Busack and Currens 1995; Genetic Risks and Hazards in Hatchery Operations: Fundamental Concepts and Issues. AFS Symposium 15:71-90). At present, because of lack of research, two major uncertainties surround this effect: (1) the magnitude of effect to be expected, and (2) its permanence. The YFP staff have developed specific planning measures designed to minimize the impact of this effect, such as limiting the proportion of wild broodstock that can be taken, limiting the proportion of hatchery returnees on the spawning grounds, and regulating the wild:hatchery mix in the broodstock. A substantial modeling effort is now underway to assess the likely effectiveness of these measures. In addition we are developing monitoring strategies to measure the selective change that does occur.

Habitat improvement projects have been ongoing in the Yakima River Basin. It is anticipated that these projects will continue in the future. The managers recognize that supplementation efforts must go hand-in-hand with efforts to improve habitat. The supplementation efforts of the project will take habitat issues into consideration when making production decisions.

D01-02

Comment: The source of the few returning adults. They may not be from previous stocking. Check them out!

[Vic Stacostha 015-09]

Response: At present, the returning spring chinook adults are all of natural origin, and they are essentially wild fish. Although some stocking of hatchery fish has occurred in the past, the impact of previous stocking on the fish populations is assumed to be nil. All the fish released from the proposed hatchery facilities will be marked, so we can readily assess the relative productivity of the hatchery and wild components of the run.

D01-03

Comment: On page 3/76: reference is made to three genetically distinct steelhead populations but their description is incomplete and should be updated.

[Connie Iten
State of Washington, Department of Fish and Wildlife 040a-04]

Response: This omission resulted from a word processing error in the RDEIS and has been revised in the final EIS. Several years of stock identification research by WDFW geneticists has lead us to conclude that there are three genetically distinct steelhead populations in the Yakima basin: Satus Creek, Toppenish Creek, and Naches/upper Yakima. The first two appear not to have been affected genetically by plants of hatchery rainbow trout and steelhead, and thus contain native gene pools. The genetic composition of the Naches/upper Yakima population has been heavily influenced by introductions of hatchery fish.

D01-04

Comment: Your goal of 1,110 adults for broodstock take, of which 50% are to be of natural origin, may be difficult to meet in some years. We would not support excessive take of spawners destined for natural habitat on National Forest System Lands.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-06]

Response: Our goal for broodstock take is 1110 adults. Two rules regulate the take of fish as broodstock. First, only natural-origin fish will be used; second, these fish can comprise no more than 50% of the natural returns. It may be that the 1110 fish goal cannot be reached until after a few years of operation, but if we achieve the survival rates we expect, taking this many fish for broodstock should not be difficult. In any case, our rules regarding broodstock collection will preclude an excessive take of spawners.

D01-05
Comment: Found in studies with Naches River, fish are firm and genetics seem to be good, no trouble catching them.

[YPM-028-06]

Response: Thank you for sharing your observation.

D02 - Species Interactions

D02-01/02/03
Comment: *Other alternatives to consider:* Pick another river without the resident rainbow trout fishery. Try your program there first.

[Louis K. Hurlbut 051-02]

Comment: *Other alternatives to consider:* any other river in the state that doesn't have a decent wild trout population to ruin. There are probably 100 candidates.

[Gary Furukawa 012-03]

Comment: [The project] will ruin the only quality wild trout stream in the state of Washington for no good reason. We don't need another river with dark spawning salmon and jet boats roaring up and down.

[Gary Furukawa 012-02]

Comment: *My environmental concerns about the Yakima Fisheries Project are:* maintenance of resident trout fishery due to the lack of other alternatives in Washington State.

[Anonymous 027-04]

Comment: Concern with impact on wild trout, no other options in the state for good wild trout fishing.

[CPM-07-01]

Comment: *Your environmental study should have included:* impact on resident wild trout population in the Yakima River.

[Gary Furukawa 012-01]

Comment: I'm still concerned about the impact on the resident rainbow fishery.

[Louis K. Hurlbut 051-01]

Comment: I don't like the idea of introducing a competitor fish into the Yakima canyon rainbow trout fishery.

[Michael T. Osborn 052-01]

Response: The project managers share your concern for the resident trout population. We are committed to monitor and evaluate this program's impacts on resident trout populations carefully, and to mitigate the risks to the resource. As noted in Section 4.1.2.1 of the EIS, "estimation of the actual effects of proposed supplementation activities on Yakima River fish populations (both resident and anadromous species) must be largely speculative . . . . However, it is likely that the released supplementation fish themselves, coupled with a possible increase in natural production . . . would affect pre-existing fish populations to some extent" (Section 4.1.2.1). Potential species interactions have been identified in the EIS (Table 4.2). Concerns of the nature expressed above would be present in *any* river system selected for a study of this sort in the Columbia Basin.

We are equally concerned with the depressed status of the anadromous fish resources of the Yakima Basin. A purpose and need for this program, as expressed in Section 1.2, states "The project responds directly to a **need for knowledge of viable means to rebuild and support naturally spawning anadromous fish stocks"** while **"keeping adverse genetic and ecological interactions with non-target species or stocks at within *acceptable* limits."** This project is proposed for the Yakima Basin in order to implement and be consistent with the Northwest Power Planning Council's Fish and Wildlife Program and to increase natural production and improve harvest opportunities *within the Yakima Basin.*

D02-04

Comment: The Revised DEIS indicates the impacts to pre-existing wild, native, and non-target fish populations would be mitigated through careful adherence to the adaptive management process. Further, the document states that adverse genetic and ecological impacts will be kept within acceptable limits. Clarification in the FEIS would be appropriate on the levels of impacts, standards for their detection, and possible mitigation options.

[Connie Iten
State of Washington, Department of Fish and Wildlife 040a-03]

Comment: The RDEIS concludes that spring chinook juveniles from the YFP would compete with wild stocks of spring chinook and perhaps rainbow and steelhead trout (Chapter 4, page 125). It suggests that growth, abundance and/or distribution of the affected stocks would be altered to a small extent. While monitoring and adaptive management are proposed to contain such interactions, no specific impact mitigation measures are described. The feasibility of influencing competitive interactions between hatchery and wild salmonids is not assessed in the RDEIS.

[Charles C. Flower
[Attorney, Flower & Andreotti, rep. Yakima River Basin Defense Coalition 042-03]
From a report prepared by D.B. Lister & Associates Ltd.

Response: Thank you for your comments. Objectives for "non-target" species such as resident trout are being developed from information in-hand and are under continued investigation. This is a mitigation measure for the project listed in Section 4.2.2 of the EIS. It is our intent to contain the risks of this supplementation effort through our monitoring and evaluation plan, minimizing

undesirable impacts so that mitigative actions are not needed. Should the impacts be excessive, the project managers can modify the supplementation program to reduce those impacts through adaptive management.

D02-05

Comment: *Your environmental study should have included* specific objectives for maintenance of the resident trout above Roza Dam (i.e., number or KG of fish).

[Anonymous 027-01]

Comment: Insist on objectives for trout - maintain current population levels and size.

[CPM-20-01]

Response: Thank you for your comment. The specific objectives for non-target species such as the resident trout population are being developed. See the response above.

D02-06

Comment: What is the bottom line for acceptable impact of the anadromous fish program on resident trout?

[CPM-20-02]

Response: A "bottom line for acceptable impact" in terms of hard and fast numbers on resident trout has not and will not be determined. However, objectives for "non-target" species such as resident trout are being developed from available information, including that generated from past and ongoing project activities in the upper Yakima River. These objectives will continue to be reviewed as part of the project's adaptive management process. This is a mitigation measure for the project listed in Section 4.2.2 of the EIS. The project managers share your concern for the resident trout population. We are committed to monitoring risks associated with the project, including impacts on resident trout, and will ensure that information from monitoring of resident trout is available to interested parties. We are, however, equally concerned with the depressed status of the anadromous fish resources of the Yakima Basin.

D02-07

Comment: Are you going to study squawfish predation - on the salmon smolts on the Yakima? Believes it is as big or bigger problem than predation by Coho.

[YPM-030-01]

Comment: There should be beefed up predator control programs - not just squawfish.

[CPM-12-01]

Comment: I would also like to see reliable estimates of the mortality due to predation of the migrating fry by the warm-water fish species.

[Anonymous 035-03]

Response: Predator *control* is not included as part of this study. Such control has, however, been proposed under the Yakima Subbasin Plan as part of the Council's planning effort. It is not included as an alternative in this project since it does not meet the supplementation research objectives or the need to reintroduce stocks now extirpated (see RDEIS Section 2.6.1). The effects of predators, however, are recognized as an important factor in present and future production of salmon and steelhead (see Section 3.9.1.2).

D02-08

Comment: *Some information you still need is* a survey of the quantity and species distribution of the warm-water fish along the entire migratory stretch of the lower Yakima River.

[Anonymous 035-04]

Response: Thank you for your comment. Surveys of this type have been completed (e.g. Patten, B.G., R.B. Thompson, and W.D. Grondlund, 1970. Distribution and Abundance of Fish in the Yakima River, Wash., April 1957 to May 1958. U.S. Dept. of the Interior, U.S. Fish and Wildlife Service Special Scientific Report -- Fisheries No. 603. Washington, DC. 31pp.). Project staff have used information from these reports in developing the objectives and strategies for the project.

D02-09

Comment: *Your environmental study should have included:* effects or benefits to Steelhead runs in the Yakima.

[Anonymous 030-01]

Response: Effects of the project on steelhead were addressed in Chapter 4 of the RDEIS, pages 122-125. In the original EIS, steelhead were included among the stocks considered for supplementation. The scope of the study, however, has been reduced and steelhead are not currently included. They are, however, a priority concern and may be included in the future. See Section 2.6.2 in the FEIS.

D02-10

Comment: Concern of deteriorating quality of fishing due to the introduction of 810,000 spring chinook salmon (the smolt will take anything, and the fishermen will spend all day releasing smolt rather than catching the resident trout).

[Anonymous 027-06]

Response: Spring chinook smolt from this project will be present in the river for a relatively short period of time. They will voluntarily leave the acclimation facilities when they are ready to migrate seaward in late March through early June. It is reasonable to assume that some of these fish will be caught in the recreational fisheries in the river.

D02-11/12

Comment: [We protest the release of spring Chinook smolts into Jack Creek because] We believe that the local trout will have even less food available for them to survive.

[Geraldine & Milton Downs 032-02]

Comment: *My environmental concerns about the Yakima Fisheries Project are:* the potential negative impact on wild fish populations that are currently healthy. It would seem ridiculous to endanger another stock to soothe our conscience over others we've already decimated.

[Vance Jennings 017-02]

Response: Fish released from the acclimation sites are expected to spend little time in that area. Releases will occur only when the fish have smolted and are ready to migrate downstream. Some impact on the resident fish populations is expected. These impacts will be monitored and release strategies may be modified if they are found to be excessive. BPA and the project managers share a priority for rebuilding anadromous fisheries resources to productive levels where risks can be contained.

D02-13

Comment: *My environmental concern about the Yakima Fisheries Project is:* if the project helps rebuild the spring chinook population quicker than projects in other basins (e.g. Snake River), what is the potential for negative impacts to the populations in these other basins (e.g. competition for food or space, on outmigration, or mixed stock harvest on returning adults)?

[Anonymous 023-01]

Response: Obviously, the best solution to this problem is to restore all depleted anadromous fish stocks at the same time and rate. This, of course, is not going to happen. We are aware of the potential interaction problems that you point out. Most of these issues are outside the scope of this project, but are nonetheless of concern to BPA and the project managers. The mixed stock harvest issue is addressed in the RDEIS in Appendix E. Some of the other issues are being faced in the U.S. Fish and Wildlife Service's programmatic EIS approach to the cumulative impacts of artificial production in the mainstem Columbia River. This EIS is being drafted and is entitled "Hatchery and Naturally Spawning Salmon/Steelhead Interactions in the Columbia River Basin."

D03 - Water Flows, Rights, and Claims

D03-01
Comment: More water flow monitoring stations required on all Yakima tributaries.

[YPM-011-01]

Comment: Water users must increase efficiency; monitoring required.

[YPM-003-07]

Response: More monitoring stations may be constructed on selected tributaries as the need arises, either pursuant to the YFP as identified by project technical staff, or under the auspices of the Yakima River Basin Water and Conservation Act, Title XII of P. L. 103-434.

D03-02
Comment: Very detailed water budget needed for Yakima River Basin.

[YPM-003-08]

Response: This issue is beyond the scope of this EIS. However, a water conservation program is the central focus of the Yakima River Basin Water and Conservation Act, Title XII of P. L. 103-434; it will include increased monitoring of water usage.

D03-03
Comment: Surplus water from Rosyln return to Crystal Creek.

[CPM-01-03]

Response: BPA is not involved in this situation, and it is outside the scope of this EIS. This suggestion has been passed on to the relevant agencies.

D03-04
Comment: It is also unclear how the project will "moderate(ly) impact" surface and ground water. *[Table page 51.]* The table should be changed to more accurately reflect project impacts.

[Lynn Hatcher
Yakama Indian Nation 049-07]

Response The reasons for the moderate impact rating on surface and groundwater are given in section 2.7.1.1 and 2.7.1.2 of the RDEIS. For surface water, the main concern was for impacts on water quality as a result of erosion and sedimentation during construction. For ground water, the concern was the pumping of groundwater and inability to return the water directly to the aquifer.

D03-05

Comment: Pg 52, 1st paragraph, last sentence. It is not clear what the "indirect effects" will be. Unless the statement is explained it should be removed from the document.

[Lynn Hatcher
Yakama Indian Nation 049-08]

Response: BPA and the project managers have reviewed the RDEIS and believe that the original language referred to in your comment does not accurately express the project's impact upon the existing water rights held by others. As the project's water use would be nonconsumptive, we do not believe that there would be an impact upon the water rights held by others. The text of the EIS has been modified accordingly. See also the reply to comment D03-25/26/27/28.

D03-06

Comment: Pg 58, Section 3.2.1.1. The document should explain where the 2.9 MAF figure came from and how the amount of return flow was calculated. USGS data for Union Gap for the time period 1896 through 1912 show an annual average nearer 3.5 MAF and did not consider the contribution of Satus, Toppenish, Sulphur or any other lower tributaries, nor did they consider ground water contribution below that point. The notion that only 0.9 MAF are consumed (through evaporation and evapotranspiration) is difficult to accept. Such figures should be substantiated and appropriately referenced.

[Lynn Hatcher
Yakama Indian Nation 049-10]

Response: The reference is: U.S. Army Corps of Engineers, 1978. Yakima Valley Regional Water Management Study. Volumes I-IV. U.S. Army Corps of Engineers, Seattle, Washington. The reference has been added to the FEIS. We do not have the information or expertise to refute their data.

D03-07

Comment: The statement that highest flows occur during spring runoff is true or false depending on where in the watershed such flows are measured.

[Lynn Hatcher
Yakama Indian Nation 049-11]

Response: Highest flows occur during periods of runoff in the late winter and spring throughout the Yakima Basin, with the possible exception of stream reaches directly below reservoirs. Currently, in years when the reservoirs do not fill and spill, the highest flows occur later in the summer during releases for irrigation. This has been clarified in the FEIS.

D03-08

Comment: Pg 60, second full sentence. BOR does not "provide" minimum flows at Easton, they "allow at least that much water to pass, although it is generally less than that which would be naturally available."

[Lynn Hatcher
Yakama Indian Nation 049-12]

Response: This issue is largely a matter of semantics. The Yakima River downstream of Easton Dam is largely controlled by the operation of Keechelus and Kachess Reservoirs and diversions into the Kittitas Main Canal. BOR operates the three reservoirs in the upper Yakima Basin (Keechelus, Kachess, Cle Elum) to protect spring chinook spawning and incubation pursuant to the November, 1980 decision of Judge Quackenbush in KRD v. SVID, Civil No. 21, E.D. Washington. Typically, this results in spawning flows of 5.7 m^3/s (200 cfs) and incubation flows of 4.2 m^3/s (150 cfs) below Easton Dam.

D03-09

Comment: Pg 63, section 3.2.2. Ground water sources also include stream flow and infiltration from the floodplain. The statement that deeper groundwater is "not hydraulically connected to surface sources" is not true in all cases. Some aquifers may be confined and accordingly are not recharged. Withdrawals from such aquifers amount to water mining and should be discouraged.

[Lynn Hatcher
Yakima Indian Nation 049-13]

Response: Streams can either be recharged by groundwater or can be a source of recharge to groundwater. Streams that act as sources of recharge for groundwater are referred to as "losing streams". Streams that are recharged by groundwater are referred to as "gaining streams". It is common for a stream to contain both losing and gaining reaches. The locations and lengths of these reaches may change depending on factors such as river stage, seasonal water level fluctuations in the aquifer, precipitation and snowmelt events, and other factors including groundwater pumping.

Data that would indicate whether the Yakima River in the vicinity of the Cle Elum site is a gaining or losing stream were not obtained as part of this study.

Long-term groundwater pumping from a confined aquifer near a stream could potentially lower the potentiometric head of the groundwater such that surface streamflow would recharge groundwater by vertical leakage through the confining layer. This leakage can be evaluated using aquifer test solutions by Hantush or Cooper (Lohman, 1979). However, evidence of leakage was not noted in the aquifer test drawdown data from the Cle Elum site, therefore the Theis (1935) solution for nonleaky confined (artesian) aquifers was used.

A confined aquifer is an aquifer that contains groundwater that is confined under pressure between relatively impermeable or significantly less permeable material and that will rise above the

top of the aquifer. If the water rises above land surface it will flow naturally (flowing artesian aquifer).

Generally confined aquifers are not recharged from direct surface water infiltration in the areas in which they are confined. The hydrostatic head produces an upward vertical gradient which stops downward infiltration of recharge water although the recharge water can be stored in the confining layer. Contaminants at the surface above such an aquifer have little chance of reaching the confined aquifer due to the low permeability confining layer and the upward vertical gradient through the confining layer. Groundwater pumpage from the confined aquifer could potentially reverse the gradient through the confining layer allowing surficial contaminants to reach the confined aquifer by downward movement of water stored in the confining layer and by leakage through the confining layer.

Pumping groundwater from the confined aquifer beneath the Cle Elum site would affect certain components of the water budget. These components must remain in equilibrium to avoid water mining. Groundwater pumpage at the Cle Elum site would potentially cause one or more of the following responses to occur; increase recharge rates to the pumped aquifer, decrease discharge rates from the pumped aquifer, or if equilibrium is not reached, mining of groundwater. Aquifer test data indicate that equilibrium was reached quickly in the pumping well, likely through increased recharge from water in storage in the confining layer and decreased natural discharge. Eventually, the downward vertical gradient induced on the confining layer would increase the rate of leakage from the Yakima River. Decreases in natural discharge and loss of surface water by leakage through the confining layer would be balanced by an equivalent increase in surface water discharge from the hatchery, therefore, the net water balance in the area would be unchanged.

D03-10

Comment: Pg 64, 3rd paragraph. The referenced CH2M Hill study lacked sufficient vigor to demonstrate much of anything about communication between local aquifers and the River. In fact, the study could be used to argue that the River is not hydraulically connected to itself. Pump tests must be of sufficient duration, intensity, and magnitude to reveal surface/ground water interactions. The quantities pumped in the subject would not have been detectable in the River if they had been pumping directly from it.

[Lynn Hatcher
Yakima Indian Nation 049-14]

Response: Geologic logs and geophysical data indicate that the clay layer confining the aquifer beneath the proposed hatchery site extends beneath the Yakima River. The clay layer has also been noted in well logs from wells drilled in South Cle Elum on the south side of the Yakima River.

Geologic evidence indicates that this clay layer is continuous in the vicinity of the site and has sufficient thickness and low permeability to, in effect, isolate the river from the confined aquifer. In addition, aquifer testing data indicated that the confined aquifer and the Yakima River are not

in direct hydraulic connection. Because the tested aquifer is confined, drawdown of the potentiometric surface is a hydraulic response, not a dewatering of aquifer material. The hydraulic response is almost instantaneous, even at relatively great distances, such as the observation well 1,000 feet away or the Yakima River. The hydraulic response caused by intercepting a positive boundary that is in direct hydraulic connection with the confined aquifer would be apparent in drawdown curves associated with even a short-term aquifer test. This hydraulic response was not noted in aquifer test data and therefore, based on geologic and hydraulic evidence, it was concluded that the Yakima River is not in direct hydraulic connection with the confined aquifer.

Even though the river and aquifer are not directly connected, pumping groundwater from the confined aquifer would increase leakage to the aquifer from the river by inducing a downward hydraulic gradient through the confining layer. The contribution of leakage of river water through the confining layer would be negligible compared to other sources of water such as storage in the confining layer, reduced discharge, and increased recharge. Cooper (1963) gives the following statement regarding the contribution of leakage through the confining layer to the yield of a well:

> Because the adjustment of the hydraulic gradient through a confining bed generally lags considerably behind the decline in head, the water yielded by an artesian aquifer is derived largely, if not entirely, from storage in the confining bed. For this reason, most time-drawdown plots deviate from the Theis curve to a greater degree than if leakage alone were involved.

The yield of water to the well from aquitard storage would tend to damp and delay the response caused by leakage of river water through the confining layer to the point that the response from the river would be negligible if it could be detected at all.

The loss of water from the Yakima River to the groundwater system would be matched by an equivalent increase in surface discharge from the hatchery. The overall effect would be that the water balance in the area would likely be unchanged.

D03-11

Comment: Pg 106, 3rd paragraph. The aquifer has not been demonstrated to be confined nor has it been proved to be hydraulically isolated from Yakima River Basin water resources.

[Lynn Hatcher
Yakama Indian Nation 049-17]

Response: The aquifer in question at the Cle Elum site is a flowing artesian aquifer and is by definition, a confined aquifer. According to Freeze and Cherry (1979), a flowing artesian aquifer is a specific type of confined aquifer in which the water level in a well completed in the aquifer rises above the ground surface. Topography is the reason that wells completed in a flowing artesian aquifer flow, but geology (an overlying low permeability layer such as the clay layer overlying the aquifer at the Cle Elum site) is the reason that the aquifer is confined (artesian).

There are circumstances in which a flowing well can be completed in an unconfined aquifer, however, this type of aquifer would not be called a flowing artesian aquifer because it is not confined.

D03-12
Comment: Pg 155, 1st bullet. Will flows be reduced or suspended at <350 cfs?

[Lynn Hatcher
Yakama Indian Nation 049-21]

Response: Water withdrawals for the Cle Elum hatchery will be reduced during periods when river flows drop below 350 cfs.

D03-13
Comment: Need more water (including added storage), better quality, to support fish runs (particularly from Mabton downstream).

[YPM-037-01]

Comment: TCC also would suggest that one of the areas that should be explored in conjunction with a project such as the YFP is the creation of additional storage to be dedicated solely to maintaining in stream flows for existing fish populations in the watershed and to be used to provide the additional water that will certainly be needed if the fish population in the river system increases. If the YFP project or projects of a similar nature were undertaken in conjunction with the construction of additional storage, then the environmental impact to surface water resources under either alternative would be moderate or low.

[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-08]
[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-08]

[Comments submitted for the two associations were identical and therefore have been combined here and below.]

Response: Thank you for the comments. The concept of additional storage is beyond the scope of this EIS. The potential for additional storage has been studied for several decades, but efforts to obtain Congressional authorization have been unsuccessful. The primary goal of Title XII of P. L. 103-434 is to increase instream flows in the lower Yakima River through a basin-wide conservation program. We understand that additional storage is currently under review by the Yakima River Watershed Council. We do not anticipate any adverse impacts on surface water supplies from the YFP. See also the response to comment D03-19.

D03-14

Comment: The only way to ease the "Flip Flop" pressure on the Tieton River is to increase storage on the upper Naches River. The irrigation burden must be shared by both rivers.

[Anonymous 046-04]

Response: Thank you for this suggestion. Please see comment response D03-13, above, regarding storage. BOR conducts the "flip-flop" in order to protect spawning spring chinook in the upper Yakima, pursuant to the November 1980 decision of Judge Quackenbush. This operation results in higher flows in the Tieton River in September and October, from increased releases from Tieton Reservoir. Although additional storage sites have been identified in the upper Naches River system, we do not anticipate construction at any of these sites in the near future.

D03-15

Comment: The proposed use of two cfs ground water pumped from wells to supply the hatchery raceways and returned to the stream may have a beneficial effect on raising the stream flow but may accelerate the decline of the water table. Two cfs is a lot of water to be removed from a water table in an area with low rainfall for groundwater recharge.

[Robert Gorrenson 002-01]

Response: Based on preliminary studies, including pump tests, it appears that the ground water supply is adequate to support pumping of 2 cfs without lowering the groundwater table.

D03-16

Comment: Concerned whether there will be enough water in the lower Teanaway for the fish to return.

[CPM-05-01]

Comment: Concerned about riverflow in Yakima River between Prosser and Sunnyside Dam - if not increased, supplementation won't work because fish can't survive.

[YPM-006-14]

Response: The YFP is designed to operate under existing conditions in the basin, including low flows in the lower Teanaway and Yakima River. Of course, improved basin conditions would increase the benefits of the project. Independent of the YFP, Title XII of P. L. 103-434 authorizes programs in tributary streams to improve instream flows. Preliminary planning is underway to address the instream flows needs in the lower Teanaway River. We anticipate that a program will be implemented by the time that adult salmon return from YFP releases in the Teanaway Basin. One of the primary goals of Title XII is the improvement of instream flows in the lower Yakima River. As implementation moves forward, flows in the lower Yakima River will increase.

D03-17
Comment: Due to the water shortage, how will this issue be addressed?

[YPM-026-01]

Response: Conservation measures authorized by Title XII of P. L. 103-434 will provide additional water for instream flows.

D03-18
Comment: Fish rescue efforts when streams dry up.

[CPM-01-08]

Response: We appreciate your concern about this issue, but it pertains to matters outside the scope of this EIS. Given the tendency for fish to disperse within a stream, difficulties regarding human access to streams, the exceptionally high labor demand for such efforts, and other reasons, it is not practical to undertake fish rescues when a stream dries up. A more practical and efficient approach would be to provide additional water for instream flows through implementation of Title XII of P. L. 103-434.

D03-19/20/21/22
Comment: I have major concerns with the proposed Yakima Fisheries, primarily increased water use that will eventually require farmers with junior water rights to sacrifice for the tribe. There are many reasons for the decline of fish runs, primarily dams on the Columbia, so requiring Yakima Valley farmers to sacrifice is not fair. I know the Northwest Power Act of 1980 and the Council's 1994 Fish and Wildlife Program say existing water rights will not be directly affected. However, the acclimation sites will require additional release of water. When the political climate shifts again, this can only come from junior water right holders. I am adamantly opposed to this.

[Larry Olsen 008-01]

Comment: Concerned that it not affect water rights.

[CPM-04-01]

Comment: A water right is a property right, is not under project purview.

[CPM-34-01]

Comment: This project EIS needs a proper water rights disclaimer.

[CPM-34-02]

Response: In order to accommodate the needs of this project, BPA is seeking groundwater rights and non-consumptive surface water rights. As explained in Section 4.1.1 of the EIS, we do not believe that the provision of water to operate the YFP would affect the water rights of any individual or entity in the Yakima River basin. Water use by the project would be considered non-consumptive because water diverted from the source would be returned to that source. In

fact, the quantity of returned water may be greater than that originally diverted, since it would be augmented with groundwater.

BPA recognizes that future conflicts regarding water availability for fish and irrigation diversions may arise when adults return to the basin. It is not possible to estimate the nature or extent of any potential conflicts at this time. Conflicts, if they occur, would be dealt with under the State of Washington's water adjudication process.

The water supply is dependent upon uncontrollable forces such as weather patterns, problems with water delivery systems, and effects of water conservation innovations. Water availability would also be affected by the actions of other diverters in the vicinity. Also, an increase in the numbers of fish returning to the Yakima basin may not be attributable solely to the Yakima Fisheries Project. Other activities such as:

- future habitat maintenance and improvement efforts in the Yakima,
- water flow conditions in the mainstem Columbia River,
- bypass and screen projects to protect outmigrating smolts at mainstem dams,
- juvenile screening improvements with the Yakima basin,
- ESA-related protection measures,
- Columbia River Fish Management Plan reprogramming efforts, and
- other related habitat or fish production activities

all share the potential and, in most cases, the intent to return more adult salmon to the Yakima basin.

The YFP fish production activities would be conducted within the complex network of these existing and planned fish productions and habitat improvement efforts. Any mix of these activities in concert with future weather and environmental conditions could combine to influence the number of fish in the basin.

Lastly, BPA is aware that a stream adjudication is presently underway in the Yakima basin that would establish rights to all the surface water in the basin. BPA is not a party to the water adjudication and has no claims for surface water involved in these proceedings.

D03-23/29

Comment: Jack Creek is a tributary of the Teanaway River. The Teanaway's lowest point is during the months of August and September. It is even low in July. Farmers have a right to construct dams on the Teanaway River for irrigation and stock water purposes.

We do not agree with BPA's plan to release spring chinook smolts into Jack Creek. There would probably be a high incidence of survival on the way downstream, however a return in late summer and early fall to Jack Creek would be disastrous. We believe that introducing more chinook into Jack Creek and the Teanaway will interfere with our irrigation rights.

We protest the release of spring Chinook smolts into Jack Creek because:
1. We believe there is not enough water for their return.
2. The BPA will try to appropriate our water which was adjudicated to us and has been in continuous use since 1885.
3. the water rights holders will be having to pay additional money for the water they already have the rights to. Some enhancement system will be put into the Teanaway whereby landowners will be charged for the water they have been adjudicated by the State of Washington to receive for free since 1885. Perhaps the enhancement system will be paid for by the government, but the costs of pumping the water will be an additional expense. *[commenters note that they are landowners in the valley, with historic water rights; are involved in Acquavella Water Rights Case.]*

[Geraldine & Milton Downs 032-01]

Comment: This version of the project and prior versions of the project called for acclimation sites on tributaries to the Yakima River. Many of the tributaries to the river, including creeks such as Jack Creek and Taneum Creek experience very low flows at various points during certain times of the year. These low flows could adversely affect upstream salmon migration and spawning. The draft EIS mentions this potential adverse effect but does not fully explore the ramifications of the low flows on salmon migration and spawning. The need to maintain sufficient flow in the tributaries to prevent harm to salmon migration and spawning will impact existing rights and the impact is one that will be direct.

[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-06]
[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-06]

Response: The YFP would not affect the water rights of any individual or entity in the Teanaway River or Yakima River basins. The YFP is designed to operate under existing conditions in the basin, including low flows in the lower Teanaway, so no additional instream flows would be required. There are fish presently returning to the Teanaway system, even with the reduced late summer and fall flows currently experienced there. Of course, improved basin conditions would likely increase the numbers of adults returning. Title XII of P. L. 103-434 authorizes conservation and other measures in tributary streams in order to improve instream flows. Preliminary planning is underway to address the need for instream flows in tributary streams. Participation in such programs by landowners is entirely voluntary, and those landowners that do not desire to participate in such a program may choose not to. Please see also the response to D03-19/20/21/22.

D03-24

Comment: Taneum Canal Company (TCC) *[The Manastash Ditch]* recognizes the need to maintain in stream flows in the Yakima River watershed; however, it is concerned that Alternatives 1 or 2 cannot be accomplished without having an adverse effect on existing surface and ground water rights in the Yakima River watershed and cannot be accomplished without a negative impact on the economy of Kittitas County. TCC believes any future fisheries projects should be water neutral and not impair existing rights. *[Commenter notes that TCC is a mutual water company with rights in Taneum Creek currently being adjucated under Acquavella.]*

[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-01]
[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Manastash Water Ditch Association 039-01]

Response: The operation of the hatchery and acclimation sites will not require the release of additional water. All water routed through an acclimation site from a stream will be returned to the stream. The YFP will not affect the water rights of any individual or entity in the Yakima Basin. See the response to D03-19/20/21/22.

D03-25/26/27/28

Comment: Section 2.7.1.1 indicates the surface water quantity impacts for Alternatives 1 and 2 would be low. This section states, "indirect effects on water rights are possible, but would most likely occur with or without the YFP". Section 4.1.1 provides that YFP facilities are designed to be "water neutral", meaning that operation of the project facilities would not affect the existing in stream flow levels in adjacent streams or the delivery of water to irrigation districts, canal companies, and individual farms. Section 4.1.1.1 then states "it is possible that water rights might be indirectly affected by the project". The EIS goes on to quote from the Northwest Electric Power Planning and Conservation Act of 1980 which says that nothing in the program will alter or establish the respective rights of the United States, States, Indian tribes, or any other person with respect to any water or water right. The EIS then concludes "therefore, the YFP would not cause increased demand for in stream flows in addition to those currently being sought, nor would the project cause water rights to be taken from irrigators". The EIS is deficient in this regard. What the EIS is saying is the project, by law, cannot impact existing rights; therefore, the project will not affect existing rights. The practical application of this project is that there are identifiable effects on existing water rights. To call these adverse effects "possible indirect effects" is to ignore the issue completely.

[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-02]
[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-02]

Comment: The EIS does not explore what those indirect effects might be nor does it offer solutions, alternatives, or ways to minimize these "indirect" effects on existing water rights. The EIS should specifically identify those indirect effects and discuss alternatives for eliminating those indirect effects or minimizing those indirect effects.

[Jeff Slothower Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-03]

[Jeff Slothower Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-03]

Comment: When at Section 2.7 the EIS identifies the environmental consequences of the project on surface water as a low impact, the EIS does so without fully exploring the "indirect" effects on existing water rights.

[Jeff Slothower Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-04]

] [Jeff Slothower Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-04]

Comment: TCC would suggest the environmental consequences under Alternatives 1 and 2 on surface water resources would be high, particularly if the "indirect" consequences of the plan were fully presented. For the EIS to say that the YFP will not cause increased demand for in stream flows and at the same time acknowledging indirect effects, the EIS ignores an area of significant impact on existing rights of this proposed project.

[Jeff Slothower Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-05]

[Jeff Slothower Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-05]

Response: We believe that the YFP will not affect the water rights of any individual or entity in the Yakima River Basin. However, as discussed in Section 4.1.1.1 of the FEIS, availability of water may be affected. BPA is not seeking any surface water rights, other than non-consumptive, in conjunction with this project. BPA realizes that a stream adjudication is presently underway in the Yakima Basin that will establish rights to all the surface water in the basin. BPA is not a party to the water adjudication and has no claims for surface water involved in these proceedings. The wording regarding indirect effects has been revised in Section 4.1.1.1 of the FEIS. See also the response to comment D03-19/20/21/22.

D03-30

Comment: Paragraph 3.9.2 refers to water management. Several court decisions, current adjudications, and other activities designed to manage the water available in the basin are identified. Section 3.9.2 fails to identify decisions made by Judge Stauffacher in Acquavella, supra, which altered his November 1990 Amended Summary Judgment decision. Judge Stauffacher also is in the process of considering a motion to declare the Yakama Indian Nation's treaty fish right a natural flow right which can be satisfied only from the natural flow of the basin

and not from stored project water. Judge Stauffacher's decision on this motion will have a tremendous impact on the system management, particularly if he grants the motion. The impact on existing rights if Judge Stauffacher grants the motion are uncertain but could be devastating to natural flow diverters who divert from the main stream of the river and from tributaries. The EIS at a minimum should explore the potential impacts of this motion and the entire adjudication process. The uncertainty created by this motion underscores the fact that, until the adjudication is completed and existing rights are settled, the true impacts of the YFP on existing rights cannot be ascertained.

[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Taneum Canal Company 038-09]
[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-09]

Response: The adjudication process will proceed with or without the YFP. Implementation of the YFP will not affect any particular decision rendered by the Acquavella Court. BPA is not a party in Acquavella and has no claims in the adjudication process. The YFP will operate within the water rights established by the Court. Section 3.9.2 of the FEIS has been modified to reflect these circumstances.

D03-31

Comment: Any acclimation pond plan that is adopted must be water neutral. To be water neutral, acclimation ponds should be placed on the main stream Yakima River in areas where sufficient in stream flows can be guaranteed to meet the needs of migrating and spawning salmon without an impact on existing rights.

[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. Taneum canal Company 038-07]
[Jeff Slothower
Lathrop, Winbauer, Harrel & Slothower, rep. The Manastash Ditch 039-07]

Response: Water supplies for each proposed acclimation site have been examined to ensure that adequate supplies are available.

D03-32

Comment: Public concern of water conservation needs emphasis.

[YPM-011-02]

Response: In general, water conservation is outside the scope of this EIS. However, water conservation is the major focus of Title XII of P. L. 103-434, which is currently in the preliminary implementation stage. See section 3.9.2 of the FEIS and the responses to B02-02 and B01-09 for a discussion of this key element of water management and conservation in the Yakima River Basin.

D03-33
Comment: Concern about flood impacts.

[CPM-02-02]

Response: BPA will comply with all applicable state and Federal rules and regulations concerning the placement and design of facilities, including those associated with construction of facilities in floodway/floodplain.

D03-34/35
Comment: Need for aggressive water legislation to deal with over allocation.

[YPM-003-04]

Comment: Need Water Czar/Commission, i.e. Dan Evans URGENTLY.

[YPM-003-05]

Response: Water allocation issues fall outside the scope of this EIS. The State of Washington has established laws and administrative processes that govern the allocation of water supplies among competing users. Currently, the water rights within the Yakima River basin are being adjudicated in Yakima County Superior Court. See Section 3.9.2.2 of the FEIS for a discussion of this process. The on-going adjudication will establish rights to all surface water in the Yakima River Basin. BPA is not involved in the allocation of water in the Yakima River Basin, and is not a party to the water adjudication. The ongoing adjudication process will establish rights to all surface water in the Yakima River Basin.

D03-36
Comment: Any ground water withdrawals in excess of 5,000 gallons per day or for the irrigation of more than one-half acre of lawn or noncommercial garden, or any surface water diversions will require a water right permit from Ecology.

[Barbara J. Ritchie
State of Washington, Department of Ecology 040-02]

Response: BPA will apply for the appropriate water permits for non-consumptive use of water for YFP facilities.

D04 - Threatened and Endangered Species

D04-01

Comment: Bald eagles: I have observed bald eagles at this [Jack Creek] site including young birds, and as recent as July 1994.

[Ronald L. Pyeatt 056-08]

Response: We have consulted with the US Fish and Wildlife Service concerning project effects on all threatened and endangered species, including bald eagles. The project is designed to have minimal negative impact on the bald eagles. If successful, the project will increase the food base for the eagles by increasing the number of salmon carcasses that the birds can feed on.

D04-02

Comment: Oregon Trout's primary concerns with the proposal are for those stocks of native wild fish that may be adversely affected by this project, including the listed Snake River salmon. Although the draft EIS claims that "It is unlikely the listed Snake River salmon would be significantly affected by the proposed project", we find no data to support that conclusion. Current straying problems from Umatilla River chinook are already creating numerous problems for the listed Snake River stocks, how can you be so sure that straying of Yakima stocks won't add significantly to that problem?

[Jim Myron
Oregon Trout 031-02]

Response: Straying is addressed in Chapter 4 of the RDEIS, pages 118-119, and 131. The stocks of chinook that strayed in the Umatilla basin were *fall* chinook, whereas the project proposed for the Yakima will be supplementing *spring* chinook salmon. The proposed project will also use extensive acclimation procedures for the smolts in the upper portions of the Yakima basin, whereas the fall chinook in the Umatilla were released directly into the lower reaches of that river at a time of extremely low flow in the Umatilla River. Consequently these fish had very little time to become acclimated to that river. Furthermore, when fall chinook adults returned to the Umatilla River in the fall, the flow is too low to allow easy passage. Project scientists expect that the use of spring chinook rather than fall chinook, and the extensive acclimation of those fish, will result in the adult fish returning to the areas of their acclimation and release.

D04-03

Comment: Will the fish that this project will propagate be taken in a terminal fishery in the Yakima River, or will these fish be caught in a mixed stock fishery in the ocean and mainstem Columbia River? If this project will lead to an increased mixed stock fishery, Oregon Trout believes that this will hasten the extinction of the listed Snake River stocks by subjecting those fish to yet another consumptive fishery. We fail to see how the draft EIS adequately addresses these issues.

[Jim Myron
Oregon Trout 31-03]

Response: The number of adult spring chinook salmon that are expected to return as a result of this project will not significantly change the harvestable number of salmon in the ocean and mainstem Columbia River. The ocean and mainstem Columbia fisheries are managed to strict standards for the protection of Snake River stocks, and the adults returning as a result of this project would not change those standards, nor create a new consumptive fishery in the mainstem or ocean. We have included a discussion of the harvest management activities in Appendix E.

D04-04

Comment: Oregon Trout asks that the BPA complete a formal consultation with the National Marine Fisheries Service on the potential effects of this project on the listed Snake River salmon before proceeding any further.

[Jim Myron
Oregon Trout 031-04]

Response: As required by the Endangered Species Act, BPA is consulting with the National Marine Fisheries Service regarding the potential impacts of hatchery operation on listed Snake River salmon. NMFS has reviewed the proposed project, and an assigned NMFS representative is participating in ongoing project review with the project managers.

D04-05

Comment: Yakima Tribes are interested in project so they can get more fish for their fishery. My interest is to see that the runs don't become extinct.

[YPM-006-13]

Response: The Yakama Tribe is interested in avoiding extinction of currently existing salmon stocks, and also in reintroducing species of salmon that have been driven to extinction in the Yakima Basin. The Yakama Tribe is also interested in increasing the population status of the existing and reintroduced fish species to levels that will allow harvest by both tribal and non-tribal fishers.

D04-06
Comment: Pg 140, 1st paragraph. Staging operations to avoid unlikely marbled murrelet conflicts will increase logistical problems (snow and ice) and will increase likelihood of impacts to incubating salmonid eggs.

[Lynn Hatcher
Yakama Indian Nation 049-19]

Response: There have been no reported sightings of marbled murrelets at any of the proposed project sites. The Keechelus site mentioned is an alternative site. If it is identified as a preferred site, marbled murrelet surveys would be conducted, and project operations would be planned to minimize impact if any birds were found.

See also D02: Species Interactions

D05 - Disease

D05-01
Comment: Have the water sources for the hatchery been tested for water quality or disease pathogens? This type of data might be invaluable to have pre-construction.

[Anonymous
Department of Interior, F&W Service 025-01]

Response: Candidate water sources have been tested for water quality and temperature. Facility designs include wells to manage water temperature during critical periods and a gas stabilization tower to assure a water supply with normal levels of dissolved oxygen and nitrogen.

Candidate water sources have also been assayed biologically to determine the presence of critically important ("reportable") pathogens as identified in the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State." None were found.

D05-02
Comment: I would like to see addressed more completely are the areas of infectious disease control. You adequately discuss control of Bacterial Kidney Disease (BKD), Ceratomyna, and others but do not address the threat of newer "potential" diseases to the river systems connected in the area. Specifically, the Salmonid "Whirling Disease." As you are well aware, this disease is devastating some of the Pacific Northwest streams (Madison Rivers, etc.), perhaps this should be addressed.

[Jeff Ayres, Sr. Geoscientist
CH2M Hill, Hanford 010-01]

Comment: What is being done to protect Washington fisheries from Whirling disease?

[Anonymous 027-08

Response: "Whirling disease" has not devastated or otherwise affected any Pacific Northwest streams. Project managers are aware of the Madison River situation as it relates to fish health issues; however, any fish health problems there present no immediate threat since the Madison River drains eastward into the Missouri River system and is thereby geographically isolated from the Columbia River system.

However, the occurrence of "whirling disease" or other diseases in fish cultured or held as broodstock in the Yakima system would be managed in a manner consistent with the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State." Strict Federal and state regulations govern the import of "whirling disease" and other fish pathogens. Beyond this, the management agencies presently rearing fish in the Columbia River basin are staffed with fish health specialists trained to identify pathogenic agents and treat fish diseases. They routinely observe tissues taken from adult fish for several diseases (including whirling disease) that have significant fish culture and fishery management importance. They also examine reared and released fish for a broader spectrum of fish pathogens.

The result of this effort is intended to minimize the potential for importing "whirling disease" and other fish threatening pathogens. It also provides information used to manage transfer of eggs/fish between facilities (all agencies) and release of fish within the basin in a manner minimizing potential for the spread of presently existing fish pathogens.

D06 - Water Quality

D06-01

Comment: Pg 112, 4th full paragraph. Releasing more smolts would not reduce the risk of their dying in the lower river from poor water quality and inadequate quantity.

[Lynn Hatcher
Yakama Indian Nation 049-18]

Response: Your comment is well taken. If water quality and/or quantity is responsible for low smolt survival in the lower river, the release of more smolts will not increase the survival rate. The problems of water quality and quantity are well documented, and efforts are ongoing to improve both.

D06-02

Comment: *My environmental concerns about the Yakima Fisheries Project are:* excessive use of chemicals, herbicides, pesticides, and the like, along the Yakima.

[James Pratt 006-01]

Comment: River needs to be cleaned up, i.e. inefficiency of irrigation system (run-off from ditch irrigation); more efficient use of water (drip systems, metering, etc.). Upgrade system that was designed in the '20s and '30s. Where does the money go that's paid for irrigation water?

[YPM-035-02]

Comment: *My environmental concerns about the Yakima Fisheries Project are:* Irrigators should be held to a no run off goal violated only during natural weather related incidents.

[Anonymous 044-05]

Comment: *My environmental concerns about the Yakima Fisheries are:* increased surface and underground runoff from dairies.

[Gary L. Lund 019-01]

Response: Thank you for the comments. Solutions to water quality issues in the Yakima basin are outside the scope of this EIS. However, the main focus of recent legislation, Title XII of P.L. 103-434, is a basin-wide water conservation program intended to address inefficient and out-dated irrigation systems. This includes implementing more efficient delivery and application methods to decrease the amount of run-off and the input of sediments and agricultural chemicals to streams. Implementation of the conservation program is expected to improve instream flows and improve water quality.

Fees paid by water users to the various irrigation districts are dedicated almost entirely to operation and maintenance of the respective irrigation delivery systems, and, in some cases, repayment for reservoir construction.

A no-run-off goal is desirable, but probably unlikely. Implementation of the National Discharge Elimination System (NPDES) is expected to help regulate the discharge of sediments and pollutants into the Yakima system. Also, as noted above, implementation of the basin-wide water conservation program pursuant to Title XII of P.L. 103-434 is expected to reduce run-off and improve water quality.

D06-03

Comment: *Some information you still need is:* effects of siltation from Wilson Creek and its impact on the canyon section.

[Anonymous 027-03]

Comment: Will sedimentation from Wilson Creek impact mainstem production? Is there a plan to clean it up? If no plan at present, how could such effort be initiated?

[CPM-20-03]

Response: In addition to the implementation of the acts and actions mentioned in the previous several responses, the Washington Department of Ecology is implementing Best Management Practices (BMP) to meet the predetermined "beneficial uses" of the river. Fish have been determined to be one of those beneficial uses. The DOE is also monitoring the Total Maximum Discharge levels (TMDL) at various points in the system. Thus, various activities are currently underway to improve the conditions in the Yakima basin, including the Wilson Creek siltation problem. The YFP is designed to operate under existing conditions in the basin, with expectations that improved basin conditions will increase the benefits of the project. Also, little spring chinook spawning occurs in the canyon section of the basin, so the heavy siltation occurring here would not impact many redds. Spring chinook do rear in the canyon section, and improvement of water quality conditions would benefit these juveniles.

D06-04/05

Comment: *My environmental concerns about the Yakima Fisheries Project are:* septage from more development along tributaries to the Yakima River.

[W.G. Bunger 050-01]

Comment: Clean-up the Yakima tributaries and sewage from the surrounding towns.

[YPM-026-02]

Comment: What is being done to improve the water situation (pollution/sewage/logging) on the mainstem?

[YPM-026-06]

Response: The Growth Management Act (GMA) is designed to address most of the non-agricultural pollution and sewage treatment issues in the Yakima Basin. See also the other responses in this section.

D06-06

Comment: How are you going to address the buffer zones along the tributaries, private citizen landowners and industrial. I understand buffer zones are being shortened for development. (Shade may be removed which would raise the temperature of water).

[YPM-026-08]

Response: The Growth Management Act is designed to address the issues of buffer zones and other issues related to development along the mainstem and tributaries of the Yakima.

D06-07
Comment: Should the Clean Water Act be enforced in the Yakima Basin?

[CPM-13-01

Response: Yes, the managers of the project believe that the Clean Water Act should be enforced in the Yakima Basin. The Clean Water Act is administered by the Environmental Protection Agency; with the implementing agency in the State of Washington is the Department of Ecology. One problem with the Act is that it does not address non-point sources of pollution very effectively manner, and much of the pollution in the basin is from non-point sources.

D06-08
Comment: Pg 163, section 5.3.2. Washington Department of Ecology would be the entity issuing an NPDES permit, not EPA.

[Lynn Hatcher
Yakama Indian Nation 049-23]

Response: Thank you for your comment. This has been corrected in the FEIS.

D06-09
Comment: Concern about large woody debris in the river.

[CPM-02-01]

Response: Your comment is well taken. Large woody debris is a natural part of a healthy watershed that provides cover and rearing habitat for juvenile fish and holding cover for adult fish. Many areas of the Yakima have lower than normal amounts of large woody debris. Recent improvements in logging practices will improve this condition to some degree.

D06-10
Comment: Appears there is more algae growing in the river - will this affect the fish - has it been studied?

[CPM-19-02]

Response: Algae is a natural part of a healthy watershed ecosystem; however, an increase in algae could indicate a problem with increased sediment or nutrient levels in the river. The Department of Ecology has been collecting data for a Total Maximum Daily Load for Sediment (TMDLS) study in the basin. Recent other studies by the U.S. Geological Survey National Water Quality Assessment Program in the Yakima River Basin have indicated that the water quality in the basin appears to be remaining stable. Again, numerous water quality

problems have been documented, but recent ongoing efforts have targeted improvement of these problems.

D07 - Fish Harvests

D07-01

Comment: I think they should stay with Option no. 3 until fishing off our coast and up the Columbia has a shut off period to try letting fish get back to spawn. You can't grow a crop without seed.

[Henry L. Sorensen 020-02]

Response: Option 3 (No Action Alternative) does nothing to assist in the restoration of the anadromous fish runs in the Yakima Basin. Harvest management activities are beyond the scope of this EIS. We have, however, included a discussion of the harvest management activities in Appendix E. Note also that there has not been a commercial harvest of spring chinook in the Columbia Basin for nearly 20 years. Ocean fisheries have been severely restricted, and in 1994 virtually eliminated, to avoid increased harvest on the depressed Columbia River, as well as other stocks of salmon and steelhead; nevertheless, spring chinook in the Yakima have not rebounded.

D07-02

Comment: When I see all the nets along the Columbia and sport fishermen in the mouth of the river during spawning and the commercial fishing off our coast, I wonder how any fish could get back up the river. Also, TV sports news shows fish caught below Wanapum Dam bright red ready to spawn. Should this kind of fish be in someone's fish basket? I think we should take a hard look at what cost we are going to pay for salmon. While we are not letting the fish get back to spawn. Let's cut back on fishing for 2 to 5 years and see if the salmon numbers won't increase. We still want fish, but at what cost?

[Henry L. Sorensen 020-03]

Comment: Overharvest appears to be a problem since many coastal runs, where there are no dams, are depressed.

[YPM-006-11]

Response: Harvest management activities are beyond the scope of this EIS. We have, however, included a discussion of the harvest management activities in Appendix E. In response to the suggestion that fishing be "cut back" for "2 to 5 years," we would note that no recreational or commercial fishing has been permitted in the Columbia Basin on upriver stocks of spring chinook for far longer than that. Ocean fisheries have been severely restricted, and in 1994 virtually eliminated, to avoid increased harvest on the depressed Columbia River, as well as other coastal, stocks of salmon and steelhead. Even so, salmon returns to the Yakima River have continued to decline.

D07-03
Comment: *[Should look at:]* Total ocean catch within 200 mile limit by foreign fisheries.
[Anonymous 044-01]

Comment: Total ocean domestic catch with gill nets and with lines.
[Anonymous 044-02]

Comment: Total non Indian Columbia catch. Total Indian line or dip net. Total Indian gill net.
[Anonymous 044-03]

Response: Thank you for your comment. See response to comments D07-01 and 02, above.

D07-07
Comment: In addition to being a farmer, I am also an environmentalist and want to see a healthy Yakima River. I would be delighted to see Coho Salmon return. Will only the Yakima Indians be allowed to catch them despite what the treaty says?
[Larry Olsen 008-02]

Response: Thank you for your comment. The coho and spring chinook supplementation programs will benefit all users of the resource--Indian and non-Indian alike. Harvest is to be shared equitably between both parties.

D07-08
Comment: How will Canadian interceptions impact success of the project?
[YPM-006-10]

Response: A ceiling has been established on the Canadian ocean fishery. Only small numbers of Yakima spring chinook are harvested in that fishery, so the impact would be negligible.

D08 - Wildlife and Other Ecological Resources

D08-01
Comment: [Other environmental concerns include] the loss of companion waterlife, trout, frogs, water plants. "Walleye" are not mentioned.
[James Pratt 006-02]

Response: Thank you for the comment. An ongoing part of the YFP is the species interaction study that has been monitoring the trout populations in the upper Yakima. These populations will be monitored through the implementation of the project to evaluate the effects of the project on other species. The frogs would be associated with wetlands, and the project is being designed for no net loss of wetland habitat. Walleye are not common in the Yakima

River, especially in the upper Yakima where the project will occur, so it is expected that there will be no impact on that species.

D08-02

Comment: Seals and sea lion populations continue to increase; why aren't we doing something about it?

[YPM-012-02]

Comment: Seals and sea lions are a big problem below Bonneville Dam.

[YPM-037-02]

Response: Seals and sea lions have become a species of concern for their impacts on salmon and steelhead in the lower Columbia River. The NMFS Snake River Recovery Plan acknowledges this concern and recommends research to determine the level of predation by these species and to evaluate non-lethal methods of reducing predation by seals and sea lions on salmonids.

D08-03

Comment: Pg. 52. The table makes a poor case for the project. It looks as if the impact to the environment is, in all cases, lower without the project. The DEIS should take credit for the fact that floodplains and wetlands, for example, by virtue of being under public ownership, will remain in better condition over the long term than if left in private ownership.

[Lynn Hatcher
Yakama Indian Nation 049-05]

Pg 53, 2nd full sentence. The No Action Alternative may affect floodplains and wetlands if these sites are developed by other parties in a more environmentally destructive manner than they would if the project is implemented.

[Lynn Hatcher
Yakama Indian Nation 049-09]

Response: Thank you for the comments. We have added your observation that the floodplains and wetlands would potentially remain in better condition under the proposed project to the discussion in the FEIS, but do not believe that the impact rating should be changed.

D09 - Socioeconomic Resources

D09-01

Comment: Although the economic impacts of the project are important, it does not address the socioeconomic benefits. For example, what is the general public willing to pay for preservation of wild genetic stocks? (By the way, it has been my experience that they are willing to pay a lot compared to a given project's cost.)

[R. Rhodes
Aquafood Business Association 018-02]

Response: Thank you for your comment. The socioeconomic impacts of the project are addressed in Section 4.1.8 of the EIS. The project has not conducted any surveys of public willingness to pay for the preservation of wild genetic stocks.

D10 - Recreational Resources (Other than Fishing)

D10-01

Comment: My main comment interest is your apparent lack of knowledge and recognition that winter recreation in the Teanaway is extensive. Your operation in the Jack Creek area is winter oriented, and at the prime season of snowmobiling and cross-country skiing. Your representatives at the meeting did not know of these activities. Winter Recreation: Washington State Parks and Recreation Groomed Snowmobile Trails map, area 5, Swauk Pass, shows that the North Fork Teanaway road is a designated groomed snowmobile trail north from Lick Creek which is south of your proposed site; Greentrails map 209 "Mt. Stuart" clearly shows the North Fork Teanaway as winter recreation.

Question: Are you aware of this and choose to ignore it or have not done your research? Your use of this road with trucks hauling smolt will destroy its winter recreation capabilities. Your RDEIS paragraph 4.1.9.1 "Other Recreation Resources" in incorrect and incomplete. Apparently you have not recognized that winter recreation exists.

[Ronald L. Pyeatt 056-03]

Comment: Main concern is that winter recreation uses along USFS roads 970 and 9738 adjacent to site are not impacted. Roads are not being plowed to this area and should not be because of proposed action. Winter recreations parking area and turnaround are back at Lick Creek. Existing groomed snowmobile trail must not be impacted. Recreation is an important part of the upper Kittitas County economy year round and must not be negatively impacted.

[Howard Briggs 037-03]

Comment: I ask that you please use care during the winter to preserve the snow surface on the road from Lick Creek to above the 29 Pines campground so that the historic snowmobile routes are preserved.

[Richard N. Burrows 045-01]

Response: Project managers and BPA are aware of the recreational use of the Teanaway basin above Lick Creek. We are working with the U.S. Forest Service, Cle Elum Ranger District to develop an access plan for this site that is compatible with winter recreation use. The District Recreational Director has consulted with local snowmobile organizations for their comments and ideas. We do recognize the need for, and the importance of, winter recreation use in the upper Kittitas Valley. We are seeking a solution through the Forest Service that is workable for both the project and winter recreational interests in the area. This has been addressed in the FEIS in section 4.1.9.1.

D10-02

Comment: The RDEIS paragraph 3.9.4, "Jack Creek Site" Boise Cascade is said to allow camping, etc. Boise Cascade has NOT allowed camping on any site other than a designated, improved campground, which would include the 29 Pines campground adjacent to the Jack Creek Site.

[Ronald L. Pyeatt 056-05]

Response: The referenced statement should have read: Boise Cascade permits camping in a designated campground next to the site. The statement has been corrected in the FEIS.

D10-03

Comment: *My environmental concerns abut the Yakima Fisheries Project are:* that river rafting on Yakima River could be affected by the Cle Elum site.

[Howard Briggs 037-01]

Response: The Cle Elum site will have a pump station on the bank of the Yakima River near the site, but the river channel will not be changed, nor will any obstructions be built into the river. The project would have no effect on river rafting in the Yakima.

D10-04

Comment: Who is the property owner of the Jack Creek site? Jack Creek is a recreation area with USFS involvement.

[Howard Briggs 037-02]

Response: The Jack Creek site is owned by Boise Cascade Corporation and is located just outside the Wenatchee National Forest boundary. The recreational influence of the USFS can

extend outside Forest boundaries. Such is the case for the area near the mouth of Jack Creek. The 29 Pines campground is located on Boise Cascade land, also just outside the Forest boundary. It is operated and maintained by Boise Cascade in conjunction with their timbered land holdings in the area.

D11 - Instream and Riparian Habitat

D11-01

Comment: *Some information you still need is:* capability based on habitat parameters of the Yakima system to support stocked fish.

[Vic Stacostha 015-08]

Response: The Project as proposed will release smolts from acclimation ponds in the upper Yakima and Teanaway Rivers. These smolts will use the river mainly as a migration corridor as they migrate out to the ocean. Models have been developed to determine the capability of the system to support juvenile fish rearing in the system as the result of natural production that would occur as these fish return and spawn as adults.

D11-02

Comment: *My environmental concerns about the Yakima Fisheries Project are:* is there sufficient fish passage at the developed sites along the river?

[Anonymous 036-02]

Comment: *Your environmental study should have included:* current practices to protect naturally recruited smolts. Are <u>all</u> irrigation diversions screened? To what extent are returning spawners protected?

[Vic Stacostha 015-01]

Comment: Fish screens for all diversions.

[CPM-01-05]

Response: Since 1982, BPA, BOR, various state and Federal agencies, the Yakama Indian Nation, and other entities have been involved in an extensive program to improve adult and juvenile fish passage in the Yakima River Basin. As of 1995, new fish ladders and fish screens have been installed at all major irrigation diversions in the basin, and at many of the smaller diversions. Installation of fish passage facilities at smaller diversions will continue over the next several years.

D11-03

Comment: In addition, the WNF Land and Resource Management Plan (LRMP) has been amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (1994). This is also referred to as the "President's Forest Plan." It is important to note that there are four specific components of the President's Forest Plan which effect land and aquatic resource management: 1) Riparian Reserve designation; 2) Key Watersheds, which are a system of refugia for at-risk fish species and stocks; 3) Watershed Analysis; and 4) Watershed Restoration. These components are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems (USDA/USDI 1994).

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-11]

Response: Thank you for your comment. Your global perspective on the watershed is appreciated by the project personnel. We agree that these four specific components of the President's Forest Plan will be important in maintaining and restoring the productivity and resiliency of riparian and aquatic ecosystems and should therefore act synergistically with the proposed project to improve the health of the existing salmon populations in the Yakima River basin, and improve conditions for the reintroduction of currently extirpated species.

E - Other Issues and Concerns

E-01

Comment: Will there be some study on the Yakima River Delta Blockage? One of the major arteries in the Delta System is blocked by manmade roadway to Bateman Island! The last 30 years have, [because] of Yakima River Delta Blockage, made some considerable changes in and around many islands and major arteries which feed into the Columbia River. Bateman Island roadway on Columbia River side will have dead salmon in spring on shore. This is a major artery blockage.

[Ken A. Artz 005-01]

Response: Thank you for the information. While the blockage of the delta is outside of the scope of this project, we have discussed it with the Washington Department of Fish and Wildlife. It appears that it may partially block access into the Yakima for anadromous fish. We will refer this to the Yakima River Basin Fish Passage technical work group for their consideration.

B01-11
Comment: Why are we spending $60M for Tribal fishing site when there is a shortage of fish and plenty of fishing sites?

[YPM-012-04]

Response: Thank you for your comment. The question you have raised is beyond the scope of this project. The project managers suggest that you address your inquiry to the U.S. Corps of Engineers, P.O. Box ____, Portland, OR. This agency is responsible for the in-lieu fishing site program.

B01-13
Comment: Shad are increasing in spite of all the dams, why aren't salmon and steelhead?

[YPM-012-03]

Response: Your comment raises valid questions which are beyond the scope of this EIS. We encourage you to contact the National Marine Fisheries Service and Oregon and Washington state fishery management agencies for more information.

B01-14
Comment: Focus instead on getting the government out of the fish and hatchery business. As in many endeavors, there has to be a more effective way to manage this valuable resource.

[Gary Furukawa 012-05]

Response: Thank you for your comment. Government and tribal fishery agencies share responsibility for fishery and hatchery management programs. Changes in these relationships and responsibilities are outside the scope of this EIS.

B01-15
Comment: You could provide a useful service by funding model projects of renewable energy sources to replace the energy lost by meeting the water needs of the anadromous fish--i.e., biogas, gasohol, wind mills, rape seed oil production and building insulation.

[William & Marjorie Hayes 013-02]

Response: Renewable energy projects are of interest to the Northwest Power Planning Council and BPA but are outside the Fish and Wildlife Program and thus are beyond the scope of this EIS. BPA does, however, fund many types of renewable resources, including wind generation and building insulation.

C-03
Comment: *Other alternatives to consider:* Barging adults to points above hydro dams before release--necessitates tagging smolts and segregating adults like-tagged.

[Anonymous 044-06]

Response: This issue is outside the scope of the EIS.

C-12
Comment: *Other alternatives to consider:* Net fishing in the Columbia River by commercial Indian fishing boats.

[W.G. Bunger 050-02]

Response: Thank you for your comment. This issue is outside the scope of the EIS. Commercial and treaty Indian fisheries are managed by the treaty Tribes and the Columbia River compact within the guidelines of the Columbia River Fish Management Plan under direction of the federal court.

C03-05
Comment: *Your environmental study should have included:* more focus on what happens to all anadromous fish once they enter the Columbia on their way to/back from the Pacific. An appropriate plan must be developed for any supplementation plan to be successful.

[Vance Jennings 017-01]

Response: The U.S. Fish and Wildlife Service (USFWS), in coordination with other fish management agencies, is developing a Programmatic EIS that tries to address part of this concern. It is entitled "Hatchery and Naturally Spawning Salmon/Steelhead Interactions in the Columbia River Basin" that attempts to address part of this concern. Other proposed and ongoing research is addressing the impacts of operation of the dams, predation, transportation, and other mainstem issues. These issues, while very important, are outside the scope of the project being proposed for the Yakima.

D07-04
Comment: There should be regulated fishing times during the smolt runs on the small streams.

[YPM-030-02]

Response: This is outside the scope of the EIS. We note, however, that the small streams with anadromous fish populations are generally kept closed to recreational fishing until the smolts have moved downstream.

D07-05
Comment: Harvest, consider releasing females (salmon/Steelhead) and only keep males.
[YPM-028-13]

Response: Thank you for your comment. This issue is outside the scope of the EIS.

D07-06
Comment: If there is a salmon fishery in the Yakima River Basin, they ought to think about catch and release for wild fish. I have seen the steelhead fishery very productive in this manner. Cut the adipose fins on hatchery salmon and steelhead and keep the wild ones wild. Only hatchery fish should be allowed to be caught.
[YPM-028-12]

Comment: Recommends no fisheries between Rosa and Ellensburg (currently a catch and release only - barbless hooks only).
[YPM-028-10]

Response: Thank you for your comment. This issue is outside the scope of the EIS.

D07-09
Comment: How are we going to protect returning adults from illegal harvest?
[Vic Stacostha 015-12]

Response: This is the responsibility of the fishery managers, and outside the scope of this EIS.

E-02
Comment: The cost of the fish ladders and outmigration of sockeye salmon should be passed on to the irrigators who are getting the benefit of increased water. True, these costs increase and they should pass them on to the consumer. The true cost of the benefits of irrigation would be borne by product costs rather than via taxes.
[Anonymous 027-07]

Response: The Northwest Electric Power Planning and Conservation Act (Act), passed by Congress in 1980, requires BPA to use its revenues from the sale of power from Federal hydro dams in the Columbia Basin to mitigate for the impacts of those dams on salmon and steelhead. Thus, the cost of the Yakima Fisheries Project is being borne by Northwest electric ratepayers, who benefit from the abundant, low-cost power from the Federal hydrosystem. The cost of the YFP is not funded through taxes. We assume that irrigators were not included in the Act as a source of funding because the Act is related to hydro power impacts and mitigation. If you believe that irrigators should pay for sockeye enhancement in the Yakima Basin, you may want to pursue your ideas with your Congressional representatives.

E-03
Comment: Restrict sports anglers from walking on salmon redds.

[CPM-001-02]

Response: We agree that disturbance to salmon redds can cause damage to eggs and fry. Activities such as streambed disturbance and driving vehicles into streams are regulated, but walking is not at this time. Probably the best deterrent available at present is public education; the proposed interpretive center at the Cle Elum hatchery site could be used to help educate people about this problem.

E-04
Comment: *My environmental concerns about the Yakima Fisheries Project are:* Timber companies which do not manage for long term and with watershed maintenance as a prime concern - Plumb Creek.

[Anonymous 044-04]

Response: Section 3.9.3 of the RDEIS discusses land management activities that can affect fisheries habitat, including timber management practices. These practices are addressed under the Timber, Fish, and Wildlife agreement between the Washington state agencies, Tribes, citizen groups, and the timber industry. The YFP does not address timber management issues.

E-05
Comment: Appoint qualified people to the NPPC.

[CPM-01-04]

Response: BPA does not appoint people to the Council; appointments are the responsibility of the governors of each of the northwestern states.

E-06
Comment: Why don't Native Americans have to adhere to the same criteria as the Caucasians?

[YPM-012-01]

Response: Thank you for your comment. Although the issue you have raised in your comment is beyond the scope of this project, we will do our best to address what we take to be your concern.

Native Americans have been considered citizens of the United States since 1924, and, therefore, enjoy the same rights and privileges given all U.S. citizens, including the right to vote. In the western states, many specific rights enjoyed by Native Americans arise from the various treaties (contracts) between the Federal and Tribal governments. On a national basis, these particular rights may have become law by way of treaties, Executive Orders, or other Federal laws. Generally, such rights were reserved to the Tribal governments and their people, and are

considered to be a fulfillment of the obligations owed Native Americans by the Federal government.

E-07
Comment: Concerned about possible vandalism at acclimation sites - consider having volunteer "watchpersons".

[CPM-28-01]

Response: Thank you for your suggestion. We will consider this if vandalism becomes a problem.

E-08
Comment: In regard to making comments on the DEIS document, we have a concern that may also be of concern to you. About 200 yards east of the site of the hatchery just west of Cle Elum, there are several abandoned vehicles that have been sitting close to the south side of the Yakima River bank on a large piece of undeveloped property. They could be leaking contaminants into the water table and feeding into the river. This could perhaps put the health of the salmon at risk.

[Vern & Kristin Ahlf 033-01]

Response: Thank you for letting us know. We have passed this information on to the Washington Department of Ecology, Central Regional Office, 15 W. Yakima Ave., Suite 200, Yakima, Washington 98902-3401 for followup.

E-09
Comment: Would like the results of archaeological surveys on Teanaway River acclimation sites.

[YPM-041-01]

Response: These are included in the FEIS, Sections 3.8 and 4.1.10.

E-10
Comment: Under Section 3.9.3 Land Management the correct title for the Wenatchee National Forest should read "Wenatchee National Forest Land and Resource MANAGEMENT PLAN". The same term needs to be corrected in the second sentence of the 1st paragraph.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-10]

Response: Thank you. These corrections have been listed in the FEIS.

E-11

Comment: The 3rd paragraph under this same section (3.9.3.1) should be replaced by the information regarding the President's Forest Plan. This is because PACFISH does not apply to lands covered by the President's Forest Plan.

[Sonny O'Neal
Forest Supervisor, Wenatchee National Forest, USDA 041-12]

Response: The second paragraph in section 3.9.3.1 (there is no third paragraph) has been revised in the FEIS as suggested.

E-12

Comment: Pg 67, 4th paragraph. "Wapatus" is correctly spelled W-A-P-T-U-S. Add Naneum and Wilson Creeks to the list.

Pg 72, 3rd paragraph. The sentence is redundant; sedimentation, (poor) water quality, and high temperatures are sources of presmolt mortality.

5th paragraph, 2nd sentence. Replace "production" with "spawning".

Pg 73, last paragraph, 3rd sentence. "Eggs incubate until . . . they hatch" is redundant.

Pg 79, 3rd paragraph, 3rd sentence. Delete "Aquatic".

Pg 80, 6th full paragraph, last sentence. Replace "wander" with wandered, or delete "have".

Pg 81, last sentence. Replace "Hunting unit" with "hunting area".

Pg 82, last paragraph, 2nd sentence. Delete the "s" from "stands" or "contains".

Pg 83, 3rd paragraph, 3rd sentence. Add North Fork Abtanum.
4th sentence. Delete "s" in "occurs".

7th sentence. Replace "another" with "a single individual".

Pg 92, 2nd bullet, 4th sentence. Replace "lead" with "led".

Pg 102, 3rd full paragraph, 2nd sentence. Adjudication is a means, it is not the means by which any instream flow rights would be established.

Pg 119, 1st full paragraph, 2nd sentence. Replace "stray" with "straying".

Pg 148, Recreation Resources. Execute a block-replace command on the work "wild" through the entire document. Replace with "resident".

Pg. 155. 5th bullet, 1st sentence. Add "floodway".

[Lynn Hatcher
Yakama Indian Nation 049-16]

Response: These corrections have been made in the Final EIS.

E-13
Comment: Would like to see fish back.

[CPM-004-02, CPM-005-02]

Comment: It would be great to see fish returning to the Teanaway.

[CPM-038-01]

Comment: Other comments: try to bring back the fish.

[Gary Lund 019-03]

Comment: I support this effort - I can remember salmon - sockeye and chinook - as well as steelhead in the Yakima as late as the early 1950s.

[W.G. Bunger 050-03]

Response: Thank you for your support. This is one of the objectives of the Yakima Fisheries Project.

E-14
Comment: Reclamation has strongly supported and cooperated with BPA, YIN, State of Washington, Northwest Power Planning Council (NPPC), irrigation entities, and others in the rehabilitation and enhancement of the anadromous fish resources of the Yakima River Basin. It is our intent to continue to pursue cooperative efforts to assure that programs such as the YFP are structured and implemented in a manner so that they will be a successful tool in the long-term management and enhancement of the fish resources, while maintaining compatibility with Reclamation's responsibilities for the regulation of the Basin's water resources. The YFP, as portrayed in the Revised DEIS, has tremendous possibilities in studying supplementation as a tool for rebuilding natural stocks of anadromous fish through the Columbia River Basin and enhancing the Yakima River spring chinook.

[James V. Cole
Area Manager, Bureau of Reclamation, US Department of the Interior 048-02]

Response: Thank you for your support. We look forward to continuing our cooperative efforts with the Bureau of Reclamation.

E-15

Comment: As cooperators in project planning, WDFW has long supported the broad intent of the Yakima Fisheries Project to investigate the strategy of supplementation in an attempt to increase the natural production of anadromous salmonids, while acknowledging and addressing various potential risks. We look forward to assisting the BPA in developing an accurate and complete Final Environmental Impact Statement.

[Connie Iten
SEPA/NEPA Coordinator, Washington Department of Fish and Wildlife 040a-06]]

Response: Thank you for your support and your assistance with the Final EIS.

E-16

Comment: The [U.S.] Department of the Interior . . . does not have any comments to offer.

[Charles S. Polityka
Regional Environmental Officer, U.S. Department of the Interior 047-1]

Response: Thank you.

E-17

Comment: I think the Jack Creek project is a good one and I hope you proceed.

[Richard N. Burrows 045-02]

Response: Thank you for your support.

E-18

Comment: In response to my inquiry on your behalf, I have been advised that your project has been forwarded to the Water Appropriations Committee, with the Congressman's support.

[Charlene Upton, Manager
Yakima District Office: Richard Hastings, House of Representatives 026-01]

Response: Thank you.

E-19

Comment: You are doing a great job.

[James Pratt 006-03]

Comment: I liked your study. Somewhat refreshing from other EISs I have seen.

[Louis K. Hurlbut 051-03]

Comment: The RDEIS is well written and I feel that the previous comments are adequately addressed.

[Jeff Ayres, Sr. Geoscientist
CH2MHill Hanford 010-02]

Response: Thank you.

Appendix B: 1995 Planning Status Report: Volume 3 - Yakima Spring Chinook Salmon; Volume 5 - Yakima Coho Salmon

Yakima/Klickitat Fisheries Project Planning Status Report 1995

Volume 3: Yakima Spring Chinook Salmon

May 1995

Prepared for
Bonneville Power Administration
Portland, Oregon

Preface

This is Volume 3 of the eight-volume 1995 Planning Status Report for the Yakima/Klickitat Fisheries Project. It contains an introduction detailing background information, project philosophy, and document organization, followed by specific information on Yakima spring chinook salmon. A general summary of project planning for all target species may be found in Volume 1. Detailed information for species other than Yakima spring chinook salmon may be found in the accompanying volumes:

Volume 2: Yakima Fall Chinook Salmon

Volume 4: Yakima Summer Chinook Salmon

Volume 5: Yakima Coho Salmon

Volume 6: Yakima Summer Steelhead

Volume 7: Klickitat Spring Chinook Salmon

Volume 8: Klickitat Summer Steelhead

Summary

The long-term YKFP goal for Yakima spring chinook salmon is to supplement and enhance the three identified stocks and associated habitat within the Yakima River Basin, while preserving stock characteristics, adaptability, and fitness. Yakima spring chinook salmon stocks include the Naches stock, upper Yakima stock, and the American River stock. The Upper Yakima stock will be the first to be supplemented. If supplementation is successful, the Naches stock will be included, followed by the American River stock.

Essential elements of the Yakima spring chinook salmon program are captured in the objectives and strategies **(Table S.1)**. More detailed statements are expected for the next iteration of the Planning Status Report.

These strategies are based on assumptions of varying degrees of uncertainty: accepted, resolvable, and unresolvable. Risks associated with accepted and unresolvable uncertainties are managed through risk-containment monitoring. Resolvable uncertainties are slated for resolution through uncertainty-resolution taskwork scheduled in the URP. Uncertainty resolution is an iterative process that is managed through the application of adaptive management.

Experimentation with spring chinook salmon in the YKFP supplementation facilities will initially compare two experimental treatments (detailed discussion of treatments is found in Chap. 8):

- Treatment A is an Optimal Conventional Treatment (OCT) that incubates, rears, and acclimates spring chinook salmon using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin.

- Treatment B is a New Innovative Treatment (NIT) that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrate, in-water structures) to produce fish that mimic attributes of naturally produced spring chinook salmon.

A third treatment, the Limited New Innovative Treatment (LNIT), that uses the OCT during the incubation to rearing phase and uses the NIT during other portions of the acclimation to release phase has been described for later implementation.

Supplementation and investigation of Yakima spring chinook salmon will require permanent and temporary facilities/structures to implement the program that is currently considered. Facilities are currently being planned and include those for supplementation, broodstock collection, and monitoring.

Monitoring for the project will encompass five levels: quality control, product specification, research (treatment effectiveness testing, comparison of hatchery vs. natural fish, patient-template analysis), risk containment, and monitoring of stock status. A detailed Monitoring Plan for Yakima spring chinook is found in Chapter 9.

Table S.1. Objectives and Associated Strategies: Yakima Spring Chinook Salmon

Objectives	Strategies
Genetic	
Manage genetic risks (extinction, loss of within- and between-population variability, and domestication selection) to all stocks from management of the fishery.	Segregate identified stocks by selecting broodstock whose origin can be reasonably well determined and release hatchery-reared progeny only in ancestral drainages. Use for broodstock only fish that are not first-generation hatchery fish. Operate the supplementation facilities using appropriate mating procedures, naturalized environments, and experimental numbers to reduce the possibility of extinction, loss of within- and between-population variability, and domestication selection. Use less than 50% of the natural-origin returning adult escapement from each stock for broodstock purposes. Manage the proportion of natural- and hatchery-origin adults allowed to spawn naturally.
Conserve upper Yakima and Naches stocks of spring chinook salmon.	Segregate identified stocks by selecting broodstock whose origin can be reasonably well determined and release hatchery-reared progeny only in ancestral drainages. Collect, identify, and segregate spring chinook salmon by stock through spawning, rearing, and release.
Conserve the American River stock of spring chinook salmon.	Collect, identify, and segregate spring chinook salmon by stock through spawning, rearing, and release. Develop and apply methods to maximize the likelihood that only American River-origin fish enter and spawn in the American River.

Objectives	Strategies
Natural Production	
Optimize natural production of spring chinook salmon with respect to abundance and distribution.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810 thousand acclimated smolts into the Upper Yakima Basin.
Optimize natural production of spring chinook salmon while managing adverse impacts from interactions between and within species and stocks.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810 thousand acclimated smolts into the UpperYakima Basin.
Maintain the upper Yakima chinook natural production at a level that would contribute an annual average of 3,000 fish to the Yakima Basin adult returns.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810 thousand acclimated smolts into the Upper Yakima Basin.
Natural escapement of Upper Yakima spring chinook (hatchery and wild) averages 2000 adult returns and is consistently greater than 1700 spawners per year.	Improve the physical, biological, and chemical environment on a priority basis. Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). Release 810 thousand acclimated smolts into the Upper Yakima Basin.

Objectives	Strategies
Experimentation	
Learn to use supplementation as defined by the Regional Assessment of Supplementation Project (RASP 1991) to increase natural production of upper Yakima and Naches spring chinook salmon and increase harvest opportunities.	Conduct experiments using upper Yakima and Naches stocks to evaluate the risks and benefits of supplementation as defined by the Regional Assessment of Supplementation Project (RASP 1991). Design and conduct experiments using upper Yakima and Naches stocks to compare risks and benefits of a New Innovative Treatment against an Optimal Conventional Treatment for supplementation. The New Innovative Treatment will use methods that result in fish which mimic natural fish. The Optimal Conventional Treatment will use methods that result in fish raised according to the state-of-the-art hatchery definition of quality. Conduct an experiment using the upper Yakima stock to test whether it is sufficient to apply the New Innovative Treatment during a limited portion of the final rearing phase (acclimation). Collect Naches broodstock near or downstream from the spawning grounds. Collect upper Yakima broodstock at Roza Dam. Release six groups of 75,000 fish per group of the Naches stock into the Naches River. Release 18 groups of 45,000 fish per group of the upper Yakima stock into the upper Yakima River. Release experimental groups of fish from separate acclimation ponds connected to target streams. Design experiments to detect a 50% or greater difference (with 90% certainty) between test treatments for all response variables.

Table S.1. Yakima Spring Chinook Salmon Objectives and Associated Strategies (continued)

Objectives	Strategies
Harvest	
Increase harvest opportunities for all fishers to 5,400 upper Yakima spring chinook (hatchery and wild) consistent with the requirements of genetic, natural production, and experimentation objectives.	Use selective and/or "status-index harvest" policies to increase harvest opportunities for all fishers.

Glossary

This glossary contains a list of abbreviations and acronyms, technical terms, and species' common and scientific names used in Volume 3 of the YKFP Planning Status Report. Words that would be defined in a desk-size dictionary (for example, the College Edition of the American Heritage Dictionary) are not included. Technical terms are defined as they are used in this report and may differ from uses in other fields.

Abbreviations and Acronyms

BKD	bacterial kidney disease
BPA	Bonneville Power Administration
Council	Pacific Northwest Electric Power and Conservation Planning Council
DOE	U.S. Department of Energy
EIS	environmental impact statement
GHGs	Genetic Hatchery Guidelines
IHN	infectious hematopoietic necrosis
NEPA	National Environmental Policy Act
PAG	Policy Advisory Group
PAR	Project Annual Review
PSR	Planning Status Report
RASP	Regional Assessment of Supplementation Project
RM	river mile
URP	Uncertainty Resolution Plan
USBR	U.S. Bureau of Reclamation
WDFW	Washington Department of Fish and Wildlife
YIN	Confederated Tribes and Bands of the Yakama Indian Nation
YKFP	Yakima/Klickitat Fisheries Project

Technical Terms

Acclimation stage in rearing, preceeding release, intended to condition fish to the ambient environment

Ancestral drainages subbasin where parents spawned

Electrophoretic data genetic data derived through the process of electrophoresis

Fry early juvenile stage in salmonids

Genetic risk risk of affecting genetic characteristics in such a way as to decrease the long-term productivity of a population. It encompasses four types:

Extinction risk of losing a population altogether. Once a population is extinct, all its genetic material is irretrievably lost.

Loss of within-population variability reduction in genetic variability within a population as a result of low, effective population size, which can lead to inbreeding depression and genetic drift.

Loss of between-population variability reduction in gene differences between populations as a result of excessive gene flow, which can lead to outbreeding depression.

Domestication selection nonrandom change in genetic composition of a population as a result of anthropogenic selective forces, intended or not. The two main sources of domestication selection imposed by hatcheries are nonrandom selection of broodstock and the selective force of the hatchery.

Jacks male fish that are sexually mature at an early age, 1 year earlier than the earliest maturing females

Juvenile sexually immature fish

Limited New Innovative Treatment (LNIT) a treatment applied to spring chinook salmon that uses the OCT during the incubation to rearing phase and uses the NIT during other portions of the acclimation to release phase.

Locally adapted stock a stock or population of fish that, although perhaps not native to the stream, is capable of sustaining some level of natural or artificial production

Natural production spawning and rearing of wild or non-first-generation hatchery fish in the environment outside the hatchery.

New Innovative Treatment (NIT) a treatment that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrate, in-water structure) to produce fish that mimic attributes of naturally produced spring chinook salmon.

Nontarget species species not intended for supplementation

Optimal Conventional Treatment (OCT) A treatment that incubates, rears, and acclimates salmonids using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin.

Presmolt fish that have not begun the physiological process of readying themselves for saltwater entry

Preterminal harvest fish caught along their migration route before reaching their subbasin of origin, compared with terminal harvest which occurs in that subbasin

Race a subspecific designation indicating the season during which adult salmonids return to the subbasin (e.g., spring, summer, fall chinook salmon)

Raceways vessels designed to rear fish

Redd a number of adjacent nests (streambed depressions) into which salmon eggs are deposited by one female

Run(s) used interchangeably with "race" in this report

Salmonids trout, salmon, and other fish of the family Salmonidae

Smolt anadromous salmonid that is physiologically fit for saltwater entry and is migrating seaward

Smolt:adult survival ability of a fish to survive from the time it leaves the subbasin as a smolt until the time it returns to the subbasin as an adult

Smolt:smolt survival ability of a fish to survive from the time it becomes a smolt until the time it leaves the subbasin

Smoltification process by which an anadromous fish becomes physiologically fit for saltwater entry

"Status-index harvest" harvest policy that determines the rate of harvest on the basis of the strength of all run components

Steelhead sea-run rainbow trout

Stock a population of salmonids managed as a unit for supplementation purposes

Supplementation artificial propagation in an attempt to maintain or increase natural production while maintaining long-term fitness of the target population and while keeping ecological and genetic impacts on nontarget species within specified limits

Target species a species intended for supplementation or production

Wild fish indigenous fish that have never been in a hatchery system

Common and Scientific Names

Coho salmon *Oncorhynchus kisutch*
Chinook salmon *Oncorhynchus tshawytscha*
Rainbow trout/Steelhead *Oncorhynchus mykiss*

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1.0 Introduction

The Yakima/Klickitat Fisheries Project (YKFP) is a supplementation project designed to use artificial propagation in an attempt to maintain or increase natural production while maintaining long-term fitness of the target population and keeping ecological and genetic impacts to nontarget species within specified limits. The project is also designed to provide harvest opportunities. The planning, implementation, and evaluation of this project are guided by the framework developed by the Regional Assessment of Supplementation Project (RASP 1991). The purposes of the YKFP are to:

- enhance existing stocks of anadromous fish in the Yakima and Klickitat river basins while maintaining genetic resources,
- reintroduce stocks formerly present in the basins, and
- apply knowledge gained through supplementation throughout the Columbia River Basin,

all consistent with the fish and wildlife program of the Pacific Northwest Electric Power and Conservation Planning Council (BPA 1992).

Essentially, the YKFP is an experiment designed to resolve uncertainties (through uncertainty-resolution taskwork) associated with supplementation at the same time that it accomplishes construction and implementation milestones. As a "laboratory," the YKFP would help determine the role of supplementation in increasing natural production of anadromous salmonids.

Adaptive Management Process

The YKFP endorses an adaptive management policy, which expects objectives and strategies to change as new information becomes available (explained by Walters 1986). The PSR is an integral part of the YKFP adaptive management process, which revolves around three annual milestones:

completion of an updated long-range plan, the **Planning Status Report (PSR)**, by February of each year

completion of an updated long-range plan to resolve uncertainties, the **Uncertainty Resolution Plan (URP)**, by April of each year

peer review of work completed and in progress, the **Project Annual Review (PAR)**, during November of each year.

The PSR is intended to contain a complete and precise description of the YKFP long-range plan. It identifies objectives, strategies, and assumptions with justifications documented and changes and modifications recorded. Objectives and strategies are changed through an amendment process, typically in response to new information about the validity of assumptions.

Underlying assumptions form the rationale for the choice of strategies. The PSR identifies those assumptions that are accepted on the basis of their validity and applicability as established in the scientific literature or through peer-reviewed studies within the YKFP or elsewhere. Assumptions that are uncertain (those that lack documented justification) are classified as either resolvable or

unresolvable. Those that are resolvable are scheduled for resolution through the URP.

The description of objectives and strategies is iterative in the sense that, as the project moves forward and as different phases of the project approach implementation, more detail is added. Strategies intended for implementation during the coming year are described in more detail than those planned for later implementation. Future strategies, however, are of detail sufficient to provide clear and focused direction for project planning and uncertainty resolution. Consequently, the level of detail varies throughout the PSR.

Results of uncertainty-resolution work are reported in memoranda and annual project, completion and progress reports, all of which are summarized in the PAR. All underlying assumptions in the PSR are then reviewed and reclassified, and new assumptions added. Implications of these revisions on the strategies and objectives are assessed, along with risks and benefits, and amendment proposals submitted for policy review.

While justification for objective and strategy modifications may include technical judgment and policy preference, all changes in uncertainty levels of assumptions must be based on scientific evidence, hence the importance of peer review. Conclusions from the PAR about the progress of ongoing work and the revised uncertainties from the PSR are then used to amend the URP, and thus the adaptive management cycle continues (Figure 1.1).

In planning for the following year, strategies (implementation or experimental) are considered on the basis of the validity of their underlying assumptions (i.e., likelihood of meeting the stated objectives). Strategies are implemented only when the risk of failure is within acceptable limits. This risk is managed and reduced over time through implementation of the URP (i.e., the prior removal of uncertainties) and the Monitoring Plan (Chapter 9). In other words, risk of strategy failure (i.e., where objectives cannot be met and/or strategies cannot be implemented correctly) can be reduced through (1) pre-implementation research or (2) risk-containment monitoring during implementation. The "Risk Analysis" (Chapter 7) is intended to aid in the selection of strategies for implementation.

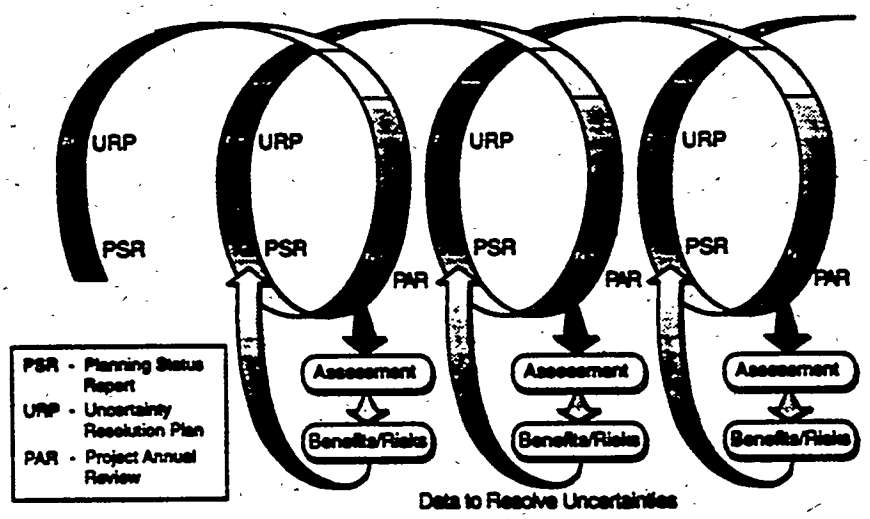


Figure 1.1. Planning Cycle for the Yakima/Klickitat Fisheries Project

Document Overview

In this volume, the PSR discusses the status of project planning for Yakima spring chinook salmon. The specific plans:

1 present background information,

2 describe objectives, i.e., statements of what is to be accomplished in the genetics, natural production, experimentation, and harvest components,

3 delineate strategies that should accomplish these objectives and the assumptions on which these strategies are based,

4 outline how uncertainties inherent in each assumption will be managed,

5 explain experiments designed to test supplementation for a specific stock,

6 present the risk analysis conducted to define management implications,

7 describe facilities for broodstock collection, hatcheries, rearing, and acclimation,

8 discuss monitoring needs, and

9 cite supporting statements and documents.

2.0 Background

The historical spawning areas for Yakima spring chinook salmon include the Yakima River upstream of the city of Ellensburg, the Naches River, the Cle Elum River (upstream and downstream of Lake Cle Elum), the Tieton River (north and south forks), Rattlesnake Creek, and the Bumping, Little Naches, and American rivers (Figure 2.1). Other areas that may have been important are the Cooper, Wapatus, and Teanaway rivers and Taneum, Swauk, Manastash, Wenas, Cowiche, Ahtanum (plus tributaries), and Logy creeks.

Run sizes for spring chinook salmon were 12,000 to 15,000 fish before 1960 but less than 3500 in 1984. The biological characteristics of native spring chinook salmon populations in the Yakima River Basin are thought to have changed during the past few decades.

Causes for Decline

About 90% of the Yakima spring chinook salmon fishery was lost between 1850 and 1900. The in-basin causes of this decline include (Davidson 1953):

1 construction of unladdered dams (especially Pomona Dam around 1880 and Sunnyside Dam in 1893) that completely blocked adult migration during part of their run

2 entrainment of fry and smolts in unscreened diversion canals (few of which were screened before 1934)

3 periodic destruction of spawning beds by driving logs downriver on large volumes of water suddenly released from dams, as evidenced at Pomona

4 indiscriminate and intensive local fishing

5 elimination of braids and natural floodways by diking and channelization projects

6 drastic reduction in the number of beavers and beaver ponds, and the resultant loss of natural water storage and rearing habitat.

Yakima River Basin escapements were reduced to perilously low levels; e.g., the estimated mean escapement in the decade of the 1970s was 384 fish.

Present Stock Status

Spring chinook salmon currently spawn in the Yakima River upstream of the city of Ellensburg and downstream of Roza Dam; in the Cle Elum River downstream of Lake Cle Elum; and in the mainstem Naches, Bumping, Little Naches, and American rivers and Rattlesnake Creek.

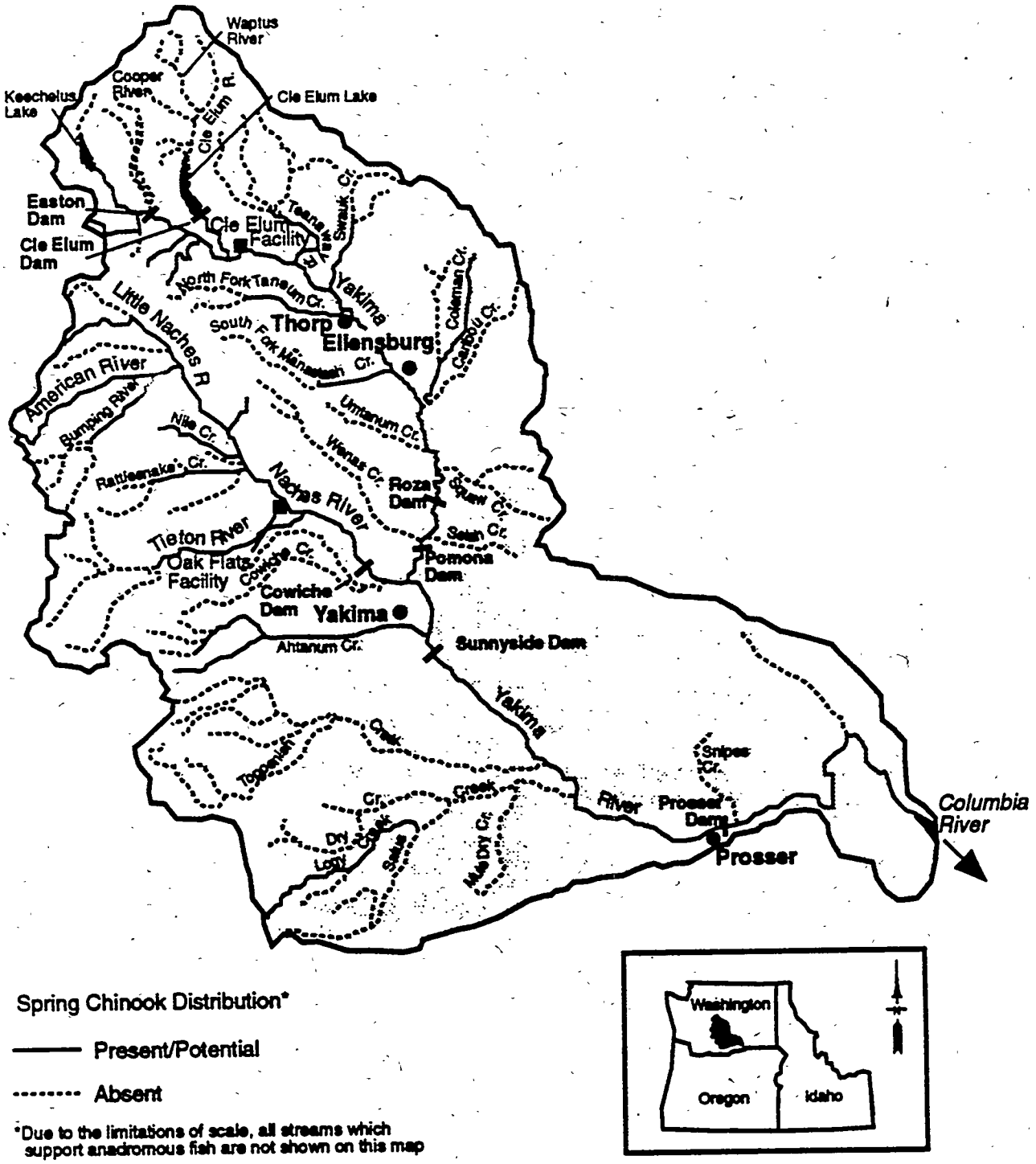


Figure 2.1. Historical Distribution of Yakima Spring Chinook Salmon

Adult spring chinook salmon begin migrating upstream past Prosser Dam in late April and have completed passage by late July. American River populations of Spring chinook salmon begin spawning in the American River in late July and the other Naches populations about 4 weeks later. Upper Yakima River populations spawn in early- to mid-September and usually peak by late-September. American River and Naches populations reach peak spawning by mid-August and mid-September, respectively. All spring chinook salmon populations have completed spawning by mid-October.

Yakima River spring chinook salmon have the most thoroughly examined stock structure of the YKFP target species. Major spawning aggregations have been genetically sampled. To a great extent the current stock structure agrees with that summarized in Howell et al. (1985). Based on differences in electrophoretic data, age composition, and observations of spawning timing between 1989 and 1990, the Naches system and upper Yakima River support clearly separate stocks (Busack et al. 1991; Fast 1990). The most significant differences between recent findings and previous descriptions is that American River stock is apparently not as distinct as once thought and the lower Naches stock is not genetically intermediate between the American River and upper Yakima stocks. In fact, electrophoretic data show the 1989 and 1990 American River samples differ significantly, and the 1990 American River samples are more similar to the Bumping River samples than 1989 American River samples, indicating there may be gene flow between the Bumping and American river populations in some years.

Constraints to Action

Spring chinook salmon production in the Yakima River Basin is limited by suboptimal instream flows, passage around irrigation diversions, degraded riparian and instream habitat, and excessive temperatures. Low instream flows while reservoirs are refilled (approximately mid-October through early July) may be the single greatest constraint to natural production of spring chinook salmon in the Yakima River.

3.0 Project Objectives

The YKFP objectives for Yakima spring chinook salmon are statements of planned accomplishments relative to genetics, natural production, experimentation, and harvest.

Genetic Objectives

1 Manage genetic risks (extinction, loss of within- and between-population variability, and domestication selection) to all stocks from management of the fishery.

2 Conserve upper Yakima and Naches stocks of spring chinook salmon.

3 Conserve American River stock of spring chinook salmon.

Natural Production Objectives

The Preliminary Design Report (BPA 1990) states a quantified natural production objective is to "increase the adult production potential by about 65% to 70% above the current level." The current natural production objectives for Yakima spring chinook salmon are to:

1 Optimize natural production of spring chinook salmon with respect to abundance and distribution.

2 Optimize natural production of spring chinook salmon while managing adverse impacts from interactions between and within species and stocks.

3 Maintain upper Yakima spring chinook natural production at a level that would contribute an annaul average of 3,000 fish to the Yakima Basin adult return.

4 Maintain natural escapement of upper Yakima spring chinook (hatchery and wild) at an average of 2000 adult returns and consistently greater than 1700 spawners per year.

Experimentation Objectives

1 Learn to use supplementation as defined by the Regional Assessment of Supplementation Project (RASP 1991) to increase natural production of upper Yakima and Naches spring chinook salmon and increase harvest opportunities.

Harvest Objectives

1 Increase harvest opportunities for all fishers to 5400 upper Yakima spring chinook (hatchery and wild) consistent with the requirements of genetic, natural production, and experimentation objectives.

4.0 Strategies

The YKFP strategies are statements of action(s) intended to achieve specific objectives. These strategies have been developed on the basis of current knowledge; they are provided in detail sufficient to allow the planning of facilities, operations, and experimentation to proceed in a focused manner. Planned actions relate to genetics, natural production, experimentation, and harvest components. Each strategy relates to at least one project objective.

Strategies to Meet Genetic Objectives

The genetic strategies listed below will be further detailed as the Genetic Hatchery Guidelines (GHGs) are prepared (the first draft was scheduled for completion by spring 1993).

1 Collect, identify, and segregate spring chinook salmon by stock through spawning, rearing, and release. This strategy relates to Genetic Objectives 2 and 3.

2 Segregate identified stocks by selecting broodstock whose origin can be reasonably well determined and release hatchery-reared progeny only in ancestral drainages. This strategy relates to Genetic Objectives 1 and 2.

3 Use for broodstock only fish that are not first-generation hatchery fish. This strategy relates to Genetic Objective 1.

4 Operate the supplementation facilities using appropriate mating procedures, naturalized environments, and experimental numbers to reduce the possibility of extinction, loss of within-population variability, loss of between-population variability, and domestication selection. This strategy relates to Genetic Objective 1.

5 Develop and apply methods to maximize the likelihood that only American River-origin fish enter and spawn in the American River. This strategy relates to Genetic Objective 3.

6 Use less than 50% of the natural-origin returning adult escapement from each stock for broodstock purposes. This strategy relates to Genetic Objective 1.

7. Manage the proportion of natural- and hatchery- origin adults allowed to spawn naturally. This strategy relates to genetic objective 1.

Strategies to Meet Natural Production Objectives

1 Improve the physical, biological, and chemical environment on a priority basis. This strategy relates to Natural Production Objectives 1 through 4.

2 Use harvest controls and supplementation to optimize natural spawning distribution (temporal and spatial). This strategy relates to Natural Production Objectives 1 through 4.

3 Release 810 thousand acclimated smolts into the Upper Yakima Basin. This strategy relates to Natural Production Objectives 1 through 4.

Strategies to Meet Experimentation Objectives

These experimentation strategies all relate to Experimentation Objective 1:

1 Conduct experiments using upper Yakima and Naches stocks to evaluate the risks and benefits of supplementation as defined by the Regional Assessment of Supplementation Project (RASP 1991).

2 Design and conduct experiments using upper Yakima and Naches stocks to compare risks and benefits of a New Innovative Treatment (NIT) against an Optimal Conventional Treatment (OCT) for supplementation. The New Innovative Treatment will use methods that result in fish which mimic natural fish. The Optimal Conventional Treatment will use methods that result in fish raised according to the state-of-the-art hatchery definition of quality.

3 Conduct an experiment using the upper Yakima stock to test whether it is sufficient to apply the Limited New Innovative Treatment (LNIT) during a portion of the final rearing phase (acclimation).

4 Collect Naches broodstock near or downstream from the spawning grounds.

5 Collect upper Yakima broodstock at Roza Dam.

6 Release six groups of 75,000 fish per group of the Naches stock into the Naches River.

7 Release 18 groups of 45,000 fish per group of the upper Yakima stock into the upper Yakima River.

8 Release experimental groups of fish from separate acclimation ponds connected to target streams.

9 Design experiments to detect a 50% or greater difference (with 90% certainty) between test treatments for all response variables.

Strategies to Meet Harvest Objectives

1 Use selective and/or "status-index harvest" policies to increase harvest opportunities for all fishers. This strategy relates to Harvest Objective 1.

5.0 Management of Assumptions and Uncertainties

The project assumptions are intended to be complete sets of significant suppositions or statements of conditions or perceptions that affect the choice of strategies and how these strategies are to achieve specified objectives. Assumptions relate to the genetics, natural production, experimentation, and harvest components. Each assumption relates to at least one strategy.

Any statement of an assumption includes some degree of uncertainty; e.g., a strategy may not be definitely achievable within a planned time-frame, or for a given quantity or frequency of occurrence. The implication of errors in these assumptions is important. The wrong strategy could result in serious damage to a species/stock in the Basin or the fruitless expenditure of monies. To successfully implement the objective-related strategies stated in the previous section, the uncertainties must be resolved and all associated risk must be monitored. Within the context of the YKFP, uncertainty resolution is achieved through the application of adaptive management (Walters 1986) wherein planning, implementation, and evaluation are steps in an iterative process that, over time, reduces uncertainties and risk. The manner in which an uncertainty is resolved depends on its particular place in the uncertainty-resolution structure (Figure 5.1).

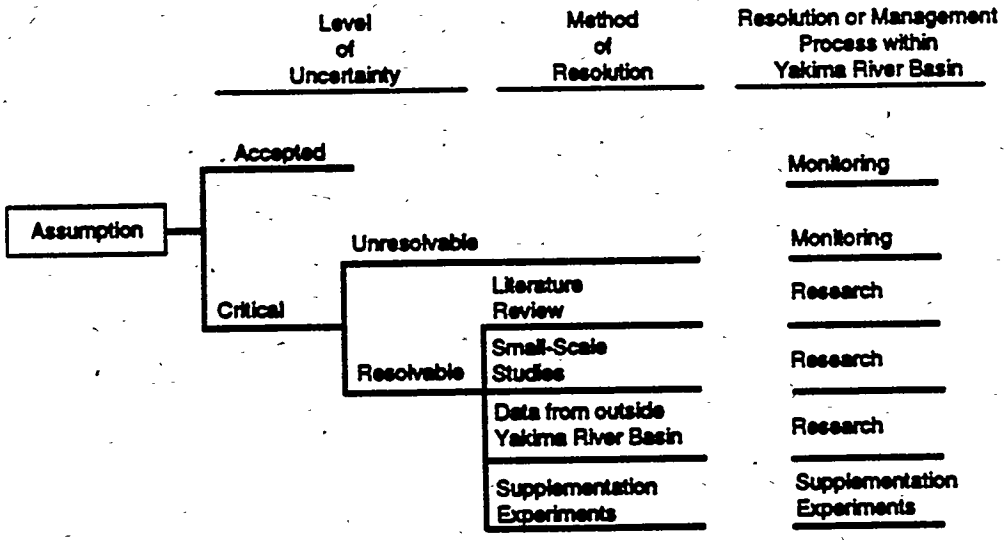


Figure 5.1. Resolution of Uncertainties Within the Yakima/Klickitat Fisheries Project

Management of Accepted Assumptions

Some assumptions related to the management of Yakima spring chinook salmon are accepted on the basis of existing knowledge and information, pending documentation (Table 5.1). Each of these is deemed unlikely to be wrong and/or to have more than a minor impact on the success of strategies selected to meet stated objectives. The accumulated risk associated with potential errors in these assumptions is managed through monitoring. New information gradually allows resolvable uncertainties to be moved into this accepted category. The assumptions in Table 5.1 are currently lacking complete documentation.

Management of Critically Uncertain Assumptions

Unresolvable Uncertainties

Some critical uncertainties are not expected to be resolved as part of the YKFP supplementation experiment or other research efforts (Table 5.2). For most of them, resolution is not feasible, and all extend beyond the scope of the YKFP. The risks that any of these assumptions is wrong are managed through monitoring (Figure 5.1). While these uncertainties cannot be resolved, the health and condition of the fish population can be monitored, e.g., for signs of unexpected change. On the basis of new information and other evidence, strategies can be reevaluated.

Resolvable Uncertainties

Four methods can be used to manage those critical uncertainties that can be resolved: by (1) reviewing the scientific literature to determine how others have resolved or managed them; (2) conducting small-scale studies (i.e., short-term laboratory or field experiments), feasibility studies, and baseline studies; (3) learning from studies or experiments conducted outside of the YKFP; and (4) using large-scale multitreatment studies for which the YKFP is designed.

Uncertainties that may be resolved (Table 5.3) are a high priority in the near term, because they affect the ability to implement the YKFP. Thus, careful assignment of priority and execution of work are critical to resolving the short-term questions. Plans for literature searches, small-scale studies, and review of studies done outside the Yakima River Basin are the thrust of the Uncertainty Resolution Plan. Table 5.4 lists the assumptions that will be resolved by specific experiments and hypotheses to be tested once the YKFP is operational.

It is important to note that large-scale studies constitute the main experimental purpose of the YKFP, which offers a unique opportunity to test hypotheses intractable to small-scale studies. In the long-term, the program and its facilities are designed to meet these needs. While the outcomes of small-scale studies can modify details of the large-scale experiments (e.g., incubation facilities design, rearing container design, acclimation pond design, feeding methods, and fish marking methods), these short-term results are not expected to fundamentally change the experiment, but rather help ensure its success. The purpose of small-scale studies and facility planning is to "set up" the large-scale experiments. Consequently, it is important to define the experimental design for spring chinook salmon in detail sufficient to make the planning focused and efficient.

Table 5.1.
Accepted Assumptions Related to Management of Yakima Spring Chinook

Assumption	Strategy Relationship
180 Only releases prescribed by the YKFP will occur.	Genetic Strategies 1 & 2
339 Up to 50% of the adults returning to the upper Yakima and Naches can be taken initially for brookstock without significantly impacting the effective size of the population.	Genetic Strategies 1 & 2
181 Habitat either is available or can be made available in the Yakima River Basin that can be effectively utilized by expanded populations of spring chinook salmon.	Natural Production Strategy 1
182 Smolt:adult mortality related to mainstem passage, pre-terminal harvest, and ocean conditions will be less than or equal to those at present, and are understood well enough to refine strategies.	Natural Production Strategies 1 & 2
183 The natural production potential in the Yakima River Basin is known for spring chinook salmon.	Natural Production Strategies 1 & 2
184 Supplementation can be managed to avoid unintended ecological effects.	Natural Production Strategies 1 & 2
326 Baseline spawning escapements, representing current conditions, for the Upper Yakima, Naches, and American spring chinook stocks are 2260, 830, and 470 (jacks not included).	Natural Production Strategies 2 & 3
329 Yakima spring chinook will be managed to achieve the following on a priority basis: (1) minimum natural spawning escapements, (2) supplementation broodstock, and (3) harvest and spawning escapements above the minimum.	Natural Production Strategies 2 & 3 Experimental Strategy 7
331 Fisheries can and will be managed to achieve stock-specific spawning escapement, broodstock, and harvest objectives in accordance with assumed priorities.	Natural Production Strategies 2 & 3 Harvest Strategy 1
332 Selective harvest of hatchery fish can and will occur to achieve natural spawning and harvest objectives.	Natural Production Strategies 2 & 3 Genetic Strategy 2
338 Prespawning and egg-to-smolt survival in the artificial environment will exceed 80% and 75%, respectively.	Natural Production Strategy 3

185 Supplementation is an appropriate strategy because natural production is limited by smolt:smolt and smolt:adult survival.	Natural Production Strategy 1
186 Release numbers and locations in Experimentation Strategies 6 and 7 are consistent with natural production objectives.	Experimentation Strategies 1 & 2
187 Experimentation fish can be released in a manner that does not confound the results of the experiment comparing hatchery and rearing methods.	Experimental Strategies 2 & 3
188 All harvesting of Yakima spring chinook salmon can be monitored through catch sampling and reporting.	Harvest Strategy 1
189 "Status-index harvest" policy is described in sufficient detail to allow effective implementation.	Harvest Strategy 1
190 Fisheries in the basin can be managed and regulated, and laws enforced to ensure implementation of the harvest strategy.	Harvest Strategy 1
191 Spawner recruit or stock productivity relationships can be developed to establish appropriate harvest rates for each stock component.	Harvest Strategy 1

Table 5.2.
Unresolvable Uncertainties Related to Management of Yakima Spring Chinook

Assumption	Strategy Relationship
192 Upper Yakima, Naches, and American River stocks are the only remaining historical populations; they are all of locally adapted origin and/or locally adapted.	Genetic Strategies 2 & 3
193 Selecting broodstock from naturally produced returns will reduce the possibility of extinction, loss of within-population variability, loss of between-population variability, and domestication selection.	Genetic Strategies 1 & 2
194 The impact of sports fishery on spring chinook salmon smolts can be evaluated by stock and/or release group.	Experimentation Strategies 1, 2, & 8

Table 5.3.
Resolvable Uncertainties Related to Management of Yakima Spring Chinook That Can Be Studied in the Near Term

Assumption	Strategy Relationship
3 Facilities and operations afford the ability to segregate by stock from collection through release.	Genetic Strategies 1& 2
4 First-generation and other-generation fish can be identified by stock.	Genetic Strategies 1 & 2
1 Naches stock (including Bumping River) can be identified, described, and collected.	Genetic Strategies 1 & 2
2 Upper Yakima stock can be identified, described, and collected.	Genetic Strategies 1 & 2
5 The American River stock can be effectively identified/ described.	Genetic Strategy 5
6 American River stock can be identified and selected for natural spawning in the American River without handling stocks.	Genetic Strategy 5
7 A broodstock collection protocol can be developed to accomplish collection consistent with minimum genetic risks.	Genetic Strategy 4
8 GHGs can be developed that meet Genetic Objective 4.	Genetic Strategy 4
9 Supplementation facilities can be designed and operated to reduce the possibility of extinction, loss of within-population variability, loss of between-population variability, and domestication selection.	Genetic Strategy 4
10 Effective population size can be managed to achieve optimal natural and supplemented populations.	Genetic Strategy 4
11 A genetic monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	All Genetic Strategies
12 Nontarget species and their ecological relationship to spring chinook salmon can be effectively identified and described.	Natural Production Strategy 1
13 Physical, biological, and chemical limiting factors are well defined for all life stages so that the environment can be improved effectively (in terms of consequences and costs).	Natural Production Strategies 1 & 2

Table 5.3. Resolvable Uncertainties Related to Management of Yakima Spring Chinook Salmon That Can Be Studied in the Near Term (continued)

Assumption	Strategy Relationship
14 Upstream and downstream passage problems in the Yakima River Basin can be identified, and natural production can be optimized accordingly.	Natural Production Strategies 1 & 2
15 There are three distinct stocks of spring chinook salmon in the basin; each may have distinct life history characteristics and habitat requirements.	Natural Production Strategies 1 & 2; Genetic Strategy 6
16 A natural production monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	All Natural Production Strategies
17 Methods for evaluating risks and benefits are available.	Experimentation Strategies 1 & 2
18 Experimental designs are available for evaluating risks and benefits.	Experimentation Strategies 1 & 2
19 Genetic guidelines for raising fish under both the New Innovative Treatment and Optimal Conventional Treatment are the same.	Experimentation Strategies 2 & 3
20 Hatchery methods to raise natural fish from fertilization to release are known for the New Innovative Treatment.	Experimentation Strategies 1, 2, and 3
325 A New Innovative Treatment can be defined.	Experimentation Strategies 2 & 3
21 An Optimal Conventional Treatment can be defined.	Experimentation Strategies 2 & 3
22 The appropriate response variables for long-term fitness are known.	Experimentation Strategies 1, 2, & 3
23 The appropriate response variable for post-release survival is survival over all return ages to Prosser Dam.	Experimentation Strategies 1, 2, & 3
24 The appropriate response variables for reproductive success are known, and methods for comparing reproductive success among treatments are known.	Experimentation Strategies 1, 2, & 3
25 The appropriate response variables for ecological interaction are known.	Experimentation Strategies 1, 2, & 3
26 Benign marks can be applied to hatchery-reared juveniles and accurately read on returning adults.	Experimentation Strategies 1, 2, & 3; all Genetic Strategies
27 Key attributes that characterize natural fish are known, including some that can be observed in smolts at the time of release.	Experimentation Strategy 2

Table 5.3. Resolvable Uncertainties Related to Management of Yakima Spring Chinook Salmon That Can Be Studied in the Near Term (continued)

Assumption	Strategy Relationship
28 Hypotheses in terms of measurable response variables that reflect risks and benefits have been stated.	Experimentation Strategy 2
29 Key attributes that describe returning adults are known and measurable.	Experimentation Strategy 2
196 Experimentation fish can be released in a manner that does not confound the results of the experiment comparing treatment methods.	Experimentation Strategies 1 & 2
30 Facilities and operational procedures for experimentation protocols can be accommodated.	Experimentation Strategies 2, 6, 7, & 8
31 Naches broodstock can be most effectively collected from spawning grounds.	Experimentation Strategy 4
32 Naches broodstock can be collected without adversely impacting the American River stock.	Experimentation Strategy 4
33 Upper Yakima broodstock can be most effectively collected at Roza Dam.	Experimentation Strategy 5
34 An experimentation monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	All Experimentation Strategies
35 Adult fish can be readily identified by origin for selective harvest purposes.	Harvest Strategy 1
36 Preseason forecast and inseason update of runsize and composition can be determined.	Harvest Strategy 1
197 Spawner recruit or stock productivity relationships can be developed to establish appropriate harvest rates for each discrete stock component.	Harvest Strategy 1
37 A harvest monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	Harvest Strategy 1

Table 5.4.
Resolvable Uncertainties related to management of Yakima Spring Chinook that can be addressed in long-term YKFP studies

Assumption	Strategy Relationship
199 The survival of fish reared in the artificial environment (from spawner to smolt) will be at least five times higher than average survival in the natural environment.	Experimentation Strategy 1
200 Release of smolts that mimic natural fish ensures that post-release survival is greater than half the survival of wild smolts.	Experimentation Strategy 1
201 The Optimal Conventional Treatment will not produce the same kind of fish as the New Innovative Treatment.	Experimentation Strategies 2 & 3
202 New Innovative Treatment fish have a post-release survival 50% better than Optimal Conventional Treatment fish.	Experimentation Strategies 2 & 3
203 Experiments can be designed that are statistically powerful enough to detect a 50% difference between treatments with a 90% certainty.	Experimentation Strategy 9
327 Average straying rates will not exceed 5%, and straying in excess of 10% will not occur. Straying rate is the annual percent of non-local spawners in the spawning escapement of the recipient stock.	Genetic Strategy 5
328 Smolt-to-smolt survival for all natural stocks (and for hatchery fish) decreases as smolt abundance increases, over the range of abundances expected under the YFP.	Natural Production Strategies 2 & 3
333 Quantity and quality of spawning and rearing habitats available in the Upper Yakima, Naches, and American rivers are equivalent to smolt capacities of about 540,000, 200,000, and 140,000 outmigrants.	Natural Production Strategies 2 & 3
334 Natural spawning escapements in excess of 200 will ensure that effective population sizes are consistent with genetic objectives.	Genetic Strategy 4
335 The proportion of hatchery- and wild-origin adults allowed to spawn naturally can be effectively managed.	Natural Production Strategies 2 & 3 Genetic Strategy 4 and 7
336 Smolt production for all stocks is controlled by spawning escapement and the availability of habitat needed by presmolts in the winter (winter capacity is about 20% of summer capacity).	Natural Production Strategy 3

Table 5.4.
Resolvable Uncertainties related to management of Yakima Spring Chinook that can be addressed in long-term YKFP studies

Assumption	Strategy Relationship
337 Habitat degradation and associated loss of life-history diversity are primary local causes of reduced productivity in the Yakima Basin.	Natural Production Strategies 1, 2, & 3
NEW # Baseline spawning escapements, representing current equilibrium conditions for the Upper Yakima, Naches, and American spring chinook stocks are; 2,260, 830, and 470, jacks not included.	Natural prod. Strategies 2 and 3

6.0 Experimental Design

The YKFP is designed to conduct experiments to test alternative supplementation treatments. These experiments were chosen to maximize the likelihood of detecting a significant difference between treatments. Three candidate treatments were identified. These treatments were chosen on the basis of the hypotheses that:

- a treatment can be designed that results in fish with characteristics approximating those of their natural counterparts,
- conventional hatchery treatments will not produce such fish, and
- by producing such fish, the likelihood of supplementation success is increased.

Treatment A is an **Optimal Conventional Treatment (OCT)** that incubates, rears, and acclimates spring chinook salmon using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin.

Treatment B is a **New Innovative Treatment (NIT)** that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrate, in-water structure) to produce fish with attributes approximating those of naturally produced spring chinook salmon.

Treatment C is a **Limited New Innovative Treatment (LNIT)** applied to spring chinook salmon that uses the OCT during the incubation to rearing phase and uses the NIT during other portions of the acclimation to release phase.

As proposed, the initial phase of implementation will be limited to upper Yakima spring chinook. The experimental design selected will test two treatments: A (OCT); and B (NIT). As the experiment progresses through years and cycles Treatment C (LNIT) or other refined treatments may be incorporated (Table 6.2).

The experimental design for upper Yakima spring chinook will be based on Design 1 as described under the "Experimental Design " discussion (p. 6.2). The design was selected based upon utility to meet experimental resolution and flexibility for application at a number of production and replication levels. The specific experimental combination is that shown by the fourth entry in Table 6.6. The number of fish per pond was increased slightly to take full advantage of pond capacity. A total of 810,000 smolts will be released with each replicate pond containing 45,000 fish. The experimental facilities and their operation are described fully in Chapter 8.

Replicates, Treatments, and Fish Per Pond

Individual treatments will be assigned to more than one rearing raceway, and fish from each raceway will be transferred to an acclimation pond, one pond per raceway. The number of raceways and associated ponds equals the number of replicates.

Numbers of replicates and treatments may differ between the Naches and upper Yakima

stocks of spring chinook salmon depending upon refined experimental needs, stock status, and relative potential carrying capacity of the two systems.

Treatment Composition

Treatments A and B are common for both stocks. Treatment C may be evaluated for either stock during subsequent year(s) of experimentation (Table 6.1).

Table 6.1. Treatment Composition for Yakima Spring Chinook

Treatment	Nature of Treatment	Treatment Initially Tested on	
		Naches Stock	Upper Yakima Stock
A	Optimal Conventional Treatment	?	Yes
B	New Innovative Treatment	?	Yes
C	New Innovative Treatment during acclimation	?	No

Unless there is a strong indication of failure in the first year's experimental releases, a preferred treatment would not be selected on returns from just one year's release. The treatment effect on adult survival from one year's release cannot be fully assessed until the age distribution of the returning adults is reasonably well represented. Therefore, a given set of treatments may be repeated over a 5-year or longer period before a new set of treatments is implemented (Table 6.2), the 5-year period being the number of years encompassed by two sets of releases through adult returns.

It is not possible to make comparisons between sets of years unless the sets are linked through common treatments. Normally, the best treatment from Set 1 would be extended into Set 2 as a common treatment for those sets. The same logic holds in extending a treatment from any set into the next set. For example, the treatment composition during a 20-year period of supplementation may look something like the information in Table 6.3.

The common treatment may differ from one stock to another. For example, a given treatment might initially to be tested only for the upper Yakima stock. If that treatment is the more successful treatment, it may be continued into Set 2 as a common treatment for the upper Yakima stock and may also be included as a new treatment in Set 2 for the Naches stock. Other treatments would then be used as the common treatment for the Naches stock.

More than one common treatment can be used to link sets for the upper Yakima stock. For example, Treatments B and C can be held as common treatments between sets, and a new treatment can be substituted for Treatment A.

Experimental Design

For an experimental design to be effective over many years of use, it must be adaptable to changing conditions. Two alternative experimental designs are compared according to their flexibility. The ***flexibility*** of each design is measured by the minimum requirements in number of smolts, in baseline survival of OCT fish, and in required sampling rate. A design that requires fewer smolt, lower survival, and lower sampling rates is applicable to more conditions and is, thus, more flexible.

The two designs different in absolute number of acclimation ponds and number of smolt per pond. The recommended design is the most flexible one and has more acclimation ponds and fewer fish per pond. However, both designs are described for the case that cost considerations should preclude the adoption of the recommended design. For each design, a set of guidelines is given that directs how the design should be adapted for various levels of broodstock and baseline survival rates. The set of guidelines illustrates the flexibility of each design. Simulation studies used to evaluate prospective designs and develop the guidelines are detailed in Hoffmann, Busack, and Knudsen (in prep.). The results of the simulation studies are based on a single release year and multiple return years.

For both designs, ponds will be constructed in clusters, three or five, depending on stock status, site criteria, and production levels necessary to meet underlying assumptions for survival and sampling rates. Within each cluster, there will be either one or three replicates where a replicate consists of a full complement of treatments. A replicate will consist of two ponds each containing one of two treatments (OCT, NIT), or three ponds each containing one of three treatments (OCT, NIT, LNIT). The acclimation ponds for a treatment complement are located in the same vicinity to reduce the pond-to-pond variation. The clusters will be distributed spatially over the stock's rearing area. This distribution is designed to return adults from each treatment over the natural spawning area.

Table 6.2. Expected Age Composition of Adult Returns of Yakima Spring Chinook

Experiment Year	Treatment Year									
	First Set of Treatments					Second Set of Treatments				
	1	2	3	4	5	1	2	3	4	5
1	Rearing									
2	Release	Rearing								
3	Age 2	Release	Rearing							
4	Age 3	Age 2	Release	Rearing						
5	Age 4	Age 3	Age 2	Release	Rearing					
6		Age 4	Age 3	Age 2	Release	Rearing				
7			Age 4	Age 3	Age 2	Release	Rearing			
8				Age 4	Age 3	Age 2	Release	Rearing		
9					Age 4	Age 3	Age 2	Release	Rearing	
10						Age 4	Age 3	Age 2	Release	Rearing

Table 6.3. Common Treatments Linking Experimental Sets

	Experiment					
Set	Experiment Year	A	B[a]	C[b]	D	E
1	1	x	x			
	2	x	x			
	3	x	x			
	4	x	x			
	5	x	x			
2	6		x	x		
	7		x	x		
	8		x	x		
	9		x	x		
	10		x	x		
3	11			x	x	
	12			x	x	
	13			x	x	
	14			x	x	
	15			x	x	
4	16			x		x
	17			x		x
	18			x		x
	19			x		x
	20			x		x

(a) Common treatment linking Sets 1 and 2.
(b) Common treatment linking Sets 2, 3, and 4.

Design 1

For design 1 there are three replicates per cluster and either two or three treatments per replicate (Table 6.4.). For three clusters, three replicates per cluster and two treatments per replicate, there will be 3X3X2 = 18 acclimation ponds (units). For five clusters, three replicates per cluster and three treatments per replicate, there will be 5X3X3 = 45 acclimation ponds (units).

Table 6.4. Replicates and Treatments of Design 1 for Yakima Spring Chinook.

Clusters	Replicates (r)	Treatments (t)	Units[a] (r*t)	Fish/Unit[b]
3	9	2	18	25,000
5	15	3	45	25,000

[a] The unit is the rearing raceway or the pond.
[b] Major criterion for determining no. fish per unit and the minimum number of replicates is the ability to detect a relative between-treatment-effect difference of 50 percent in adult survival (with a significance level of 0.1 and a 90 percent certainty or power).

Design 2

For design 2 there is one replicate per cluster (Table 6.5) and either two or three treatments per replicate. For three clusters, one replicate per cluster and two treatments per replicate, there will be 3X1X2 = 6 acclimation ponds (units). For five clusters, one replicate per cluster and three treatments per replicate, there will be 5X1X3 = 15 acclimation ponds (units).

Table 6.5. Replicates and Treatments of Design 2 for Yakima Spring Chinook.

Clusters	Replicates (r)	Treatments (t)	Units[a] (r*t)	Fish/Unit[b]
3	3	2	6	75,000
5	5	3	15	75,000

[a] The unit is the rearing raceway or the pond.
[b] Major criterion for determining no. fish per unit and the minimum number of replicates is the ability to detect a relative between-treatment-effect difference of 50 percent in adult survival (with a significance level of 0.1 and a 90 percent certainty or power).

Guidelines for Adapting the Designs

Each of the two designs can be adapted to various number of smolt available and to various anticipated survival rates for OCT fish. The survival rates are gauged in terms of OCT survival since NIT survival is assumed to be 50 percent greater. The number of broodstock available will not affect the layout of the ponds, but will affect the number of fish per pond and the number of treatments compared. If the number of fish per pond is too low for the power specifications, then the number of treatments compared can be reduced from three to two to compensate. Although both designs were described with five clusters, the number of clusters using Design 1 can be reduced to three under the appropriate conditions. The adaptations are described in Table 6.6 and Table 6.7.

Table 6.6. Guidelines for Adapting Design 1 to Varying Broodstock Numbers.

Number of Smolts Available	Treatments Compared	Optimal Experimental Use of Ponds		
		# Sites	# Ponds/Site	# Fish/Pond
1,125K	NIT, LNIT, OCT	5	9	25,000
1,125K	NIT, OCT	3	6	62,500
750K	NIT, OCT	5	6	25,000
750K	NIT, OCT	3	6	42,500
500K	NIT, OCT	5	6	17,000
500K	NIT, OCT	3	6	28,000

Table 6.7. Guidelines for Adapting Design 2 to Varying Broodstock Numbers.

Number of Smolts Available	Treatments Compared	Optimal Experimental Use of Ponds		
		# Sites	# Ponds/Site	# Fish/Pond
1,125K	NIT, LNIT, OCT	5	3	75,000
750K	NIT, OCT	5	2	75,000
500K	No Experiment	-	-	-

For the design layout in each of the row of Tables 6.6 and 6.7, there are survival and sampling rate requirements to guarantee detecting a 50 percent difference in survival with 90 percent

power. These requirements are specified in Tables 6.8 and 6.9 and relate to OCT survival rates and the minimum required sampling effort. The survival requirements pertain to survival of OCT fish. Because the NIT survival was assumed to be 50 percent greater than the OCT survival, the absolute difference in survival probabilities between NIT and OCT increases as OCT survival increases. Therefore, with higher OCT survival, the power increases and the required sampling effort decreases (compare the sampling efforts in each row).

The sampling effort pertains to the set of "successful" fish. A successful fish is one that either is recruited into a fishery or returns to a specified location such as Roza Dam or the spawning grounds. Therefore, a 100 percent sampling rate at Roza Dam is not a 100 percent sampling rate unless all fisheries occur above the dam. Three levels of sampling rates on the set of successful fish were considered: 33, 67, and 100 percent.

Table 6.8. Sampling Rates Required to Achieve Experimental Objectives Using Design 1.

Number of Females at Collection Site[a]	Number of Smolts Available	OCT Survival Rates		
		0.0001	0.0002	0.0003
632	1,125K	-[b]	67%	33%
632	1,125K	-	33%	33%
421	750K	-	33%	33%
421	750K	-	67%	33%
281	500K	-	-	33%
281	500K	-	-	67%

[a] The number of females required at the broodstock collection site to produce the specified number of smolts was calculated according to the Biological Specifications Work Group recommendations (BSWG, October 1993).

[b] "-" indicates that at no sampling rate used were the power specifications met.

Comparison of Candidate Experimental Designs

With Design 1, as few as three clusters (Table 6.6) can be used whereas with Design 2, five clusters are required (Table 6.7). However, in order to reduce the number of clusters from five to three with Design 1, the number of treatments compared must also be given the appropriate conditions, this attribute of Design 1 can be used to phase in the project during the first few years.

Table 6.8 and 6.9 show how the sampling effort can be increased to compensate for lower OCT survival rates. From Table 6.8, it appears that at an OCT survival of 0.002, the sampling effort

decreases as the number of smolts decrease (compare rows 1 and 3). However, the number of treatments compared in row 1 is three vs. two treatments in row 3 (Table 6.6). The increase in power due to reducing the number of treatments from three to two is enough to compensate for the reduced number of fish to the extent that even a decreased sampling effort is required.

Designs 1 and 2 are compared based on minimum requirements (Table 6.10). Design 1 is the most adaptable to varying conditions because it has lower minimum requirements than Design 2 and is, therefore, the recommended design.

Table 6.9. Sampling Rates Required to Achieve Experimental Objectives Using Design 2.

Number of Females at Collection Site[a]	Number of Smolts Available	OCT Survival Rates		
		0.0001	0.0002	0.0003
632	1,125K	-[b]	-	33%
421	750K	-	-	33%
281	500K	-	-	-

[a] The number of females required at the broodstock collection site to produce the specified number of smolts was calculated according to the Biological Specifications Work Group recommendations (BSWG, October 1993).

[b] "-" indicates that at no sampling rate used were the power specifications met.

Table 6.10. Comparison of the Candidate Experimental Designs.

Minimum Requirements	Design 1	Design 2
Number of Clusters	3	5
Number of Acclimation Ponds	18	10
Total Number of Smolt	500K	750K
Survival Rate of OCT	0.0002	0.0003
Sampling Effort	33%	33%

Experimental Layout of Raceways and Incubation Facilities

It may be necessary to "block" the rearing raceways according to potential differences in operations or management. If so, the number of raceways per group would equal the number of treatments, and treatments would be randomly assigned to the raceways within groups. Groups of raceways will be randomly assigned to pond replicates.

For the incubation treatments to be included in the replication process, it will be necessary to have a unique set of incubation trays associated with each raceway.

7.0 Risk Analysis

The 1993 Risk Analysis for Yakima spring chinook salmon follows.

Uncertainty and Risk Analysis Applied to Supplementation of Upper Yakima Spring Chinook Salmon

Introduction

This report presents an assessment of the uncertainties and risks of supplementing spring chinook salmon in the upper Yakima River Basin. The purpose of supplementation is to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources. This assessment is based on a systematic method for considering (1) the objectives, (2) the strategies to achieve the objectives, (3) the operating assumptions needed to accept the strategies, (4) the uncertainties associated with these assumptions, (5) the risk of meeting stated objectives if the assumptions are false or the strategy is not feasible, and (6) the need to manage the uncertainty and risk associated with supplementation.

The Bonneville Power Administration, the State of Washington, and the Yakama Indian Nation must weigh these perceived risks and benefits through a variety of complex processes, which typically include intuitive and values-driven considerations. The process we used to identify the uncertainties and risks is illustrated in **Figure 7.1.**

Objectives

The objectives for supplementing upper Yakima spring chinook salmon are listed in the May, 1995 Planning Status report for the Yakima/Klickitat Fisheries Project. They are listed according to four general components: genetics, natural production/ecological interactions, experimentation, and harvest. These objectives will be accomplished while minimizing adverse genetic and ecological impacts to non-target species of interest. The objectives should be accomplished before existing threatened stocks reach extinction.

Strategies

The strategies under consideration are listed in the May, 1995 Planning Status Report for the Yakima/Klickitat Fisheries Project.

Assumptions

Certain assumptions must be "accepted" or resolved before adopting a suite of supplementation strategies to test whether new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources. Acceptance implies a range of actions. Here, we mean that an individual or agency (1) agrees or consents, (2) accommodates or reconciles, and, most importantly, (3) regards the assumption as true, valid, normal, or usual. If one does not accept the following statements as true, then one may need to find other strategies or, at least, monitor the results of implementing the strategies.

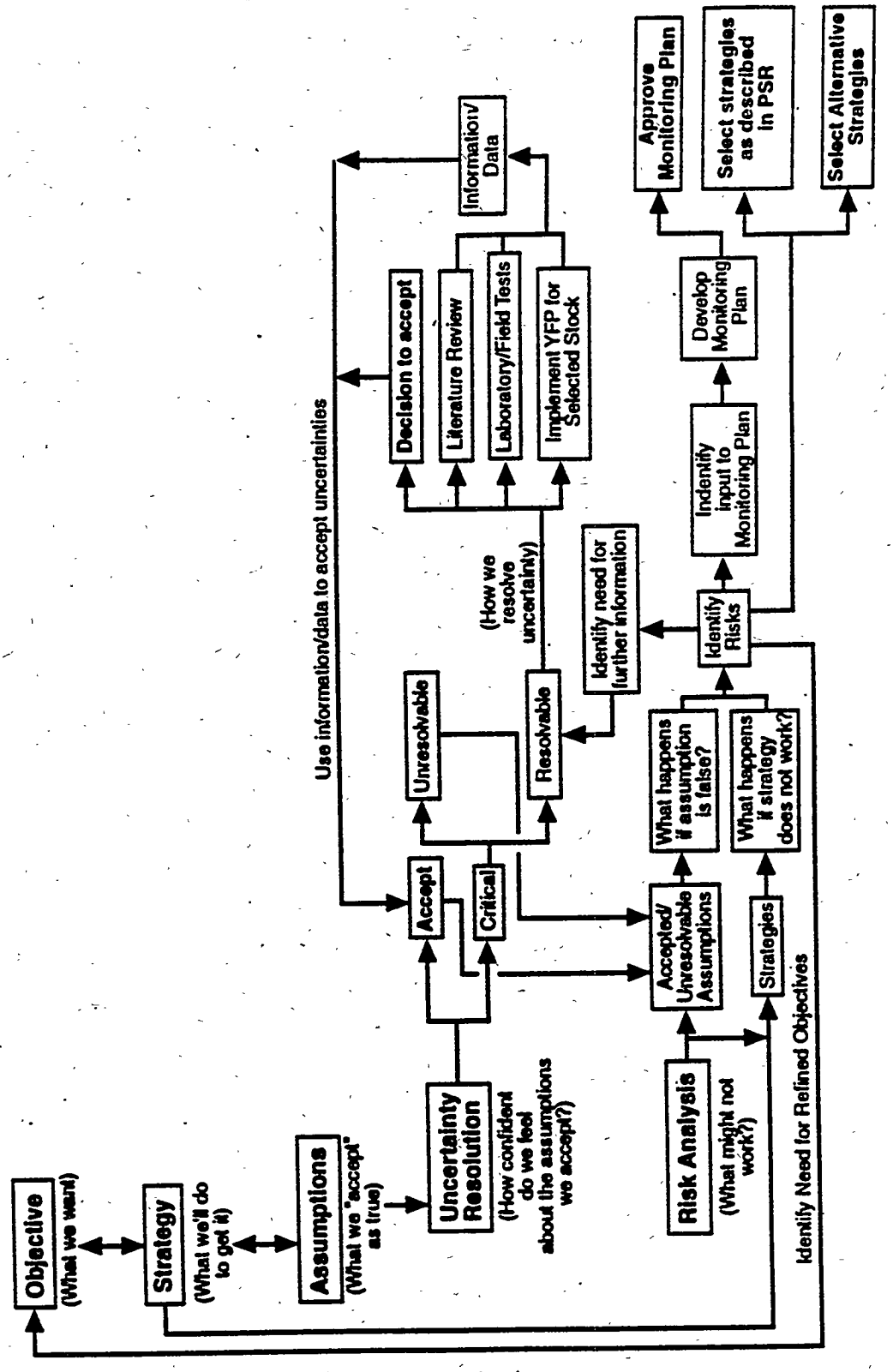


Figure 7.1 Structure of uncertainty and risk identification within the project management framework.

Uncertainty

Any statement of an assumption implies some degree of uncertainty; e.g., supplementation may not be definitely achievable within a planned time-frame, or for a given quantity or frequency of occurrence. The implication of errors in these assumptions is important. If supplementation is the wrong strategy, it could result in serious damage to all fish and other aquatic resources in the Yakima River or in the fruitless expenditure of monies. Before implementing supplementation as the strategy to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources, either the uncertainties must be resolved,or the associated risk(s) identified and a monitoring plan to contain or manage the risk must be in place.

Uncertainty Resolution The manner in which uncertainty is resolved depends on its particular place in the uncertainty management structure (**Figure 7.2**). Some assumptions related to supplementation are "accepted" on the basis of existing knowledge and information, pending documentation. "Acceptance" is a statement that:

- the uncertainty related to a given assumption has so little chance of adversely affecting the realization of meeting the objective (to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources) or

- we know so much about this particular biological/ecological/engineering relationship that it is not worth studying any further in the context of supplementing spring chinook salmon in the Yakima River Basin.

Accepted assumptions. Even if one of these assumptions is false, we will still be able to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources of the Yakima River Basin.

Unresolvable uncertainties. Some critical uncertainties are not expected to be resolved before a decision to supplement the Yakima River spring chinook salmon is made or even if the uncertainty is studied during supplementation. For most of these, resolution is not feasible, and all extend beyond the scope of the Yakima Fisheries Project. The risk that any of these assumptions are false must be assessed and managed through monitoring. While these uncertainties cannot be resolved, the health and condition of the Yakima River fisheries can be monitored for signs of unexpected change. On the basis of new information and other evidence, supplementation (any other strategy) to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources will have to be continually reevaluated. If there are other factors that limit the production of Yakima River spring chinook salmon, these factors could not be defined or quantified before a decision to use supplementation is implemented. Additionally, the cost required to quantify every causal relationship to supplementation is prohibitive.

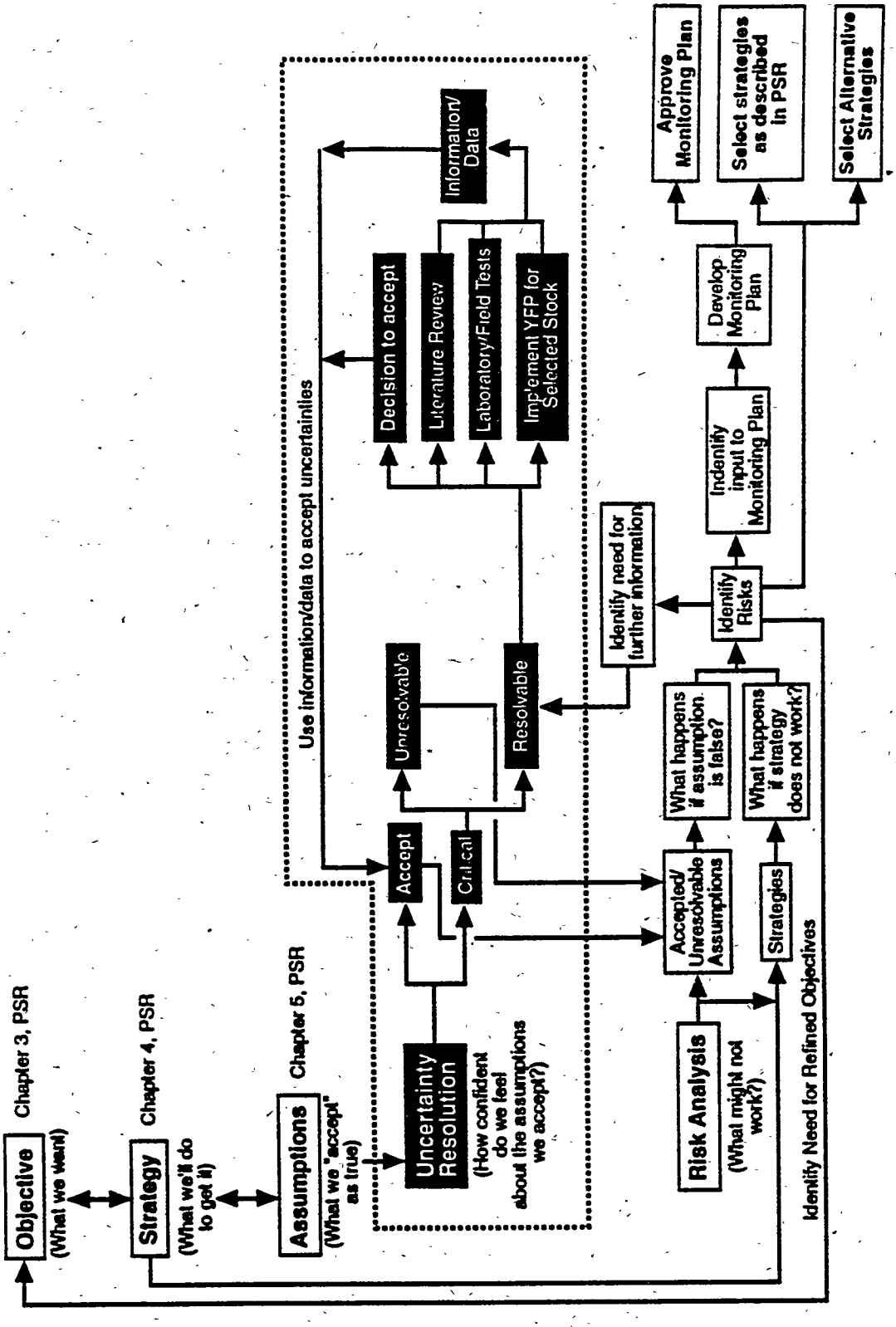


Figure 7.2. Structure of uncertainty resolution within the project management framework.

Resolvable uncertainties. Some uncertainties are critical and should be resolved before a decision to implement is made. (The ultimate decision related to resolution may require that an assumption be accepted). This will happen if new information is identified, if fiscal or temporal restraints preclude timely resolution, or if risk management is feasible.) Three methods can be used to manage those critical uncertainties that can be resolved: (1) review the scientific literature to determine how others have resolved or managed them; (2) conduct small-scale studies (i.e., short-term experiments in the field and laboratory, with models, engineering analyses); and (3) learn from supplementation projects from outside the Yakima River Basin.

If a critical assumption is false, then supplementation will not provide the information needed to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources. The cost and time required to (1) conduct a literature review, (2) conduct a laboratory, field, modeling, or engineering study, or (3) study supplementation in another basin should provide enough information to resolve the uncertainty associated with these assumptions. This information is necessary to make a decision about supplementing chinook salmon in the upper Yakima River Basin.

Near-term Uncertainty Resolution. Uncertainties that may be resolved are a high priority in the near term, because they affect the ability to select supplementation as a viable strategy to increase harvest and enhance natural production while maintaining genetic resources. While the outcomes of literature reviews, small-scale tests, or studies in other basins can modify details of the selected strategy to increase harvest and enhance natural production while maintaining genetic resources, these short-term results are not expected to fundamentally change the objective but rather help ensure its success. The purpose of the small-scale studies and planning is to "set up" the selected strategy. Consequently it will be important to define a selected strategy in sufficient detail to make the planning focus on the objective.

Long-term Uncertainty Resolution. If the assumption is false, then supplementation will not provide the information needed to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources. These assumptions, however, cannot be resolved in the near term. Their only apparent means of resolution is to implement supplementation in the Yakima Basin. Resolution of these uncertainties is the basis for the experimental aspects of the project. The resolution of these uncertainties will result from hypothesis testing during the implementation phase of the Yakima Fisheries Project.

To summarize the uncertainty management process: The objective is known (to increase harvest and enhance natural production while maintaining genetic resources). The strategy (supplementation) and the assumptions have been stated. The uncertainties have been examined and those uncertainties that must be resolved have been identified. Now, we must identify the risk of having selected the wrong strategy or accepting false assumptions.

Risk Analysis

The risk of using supplementation to test the assumption that new artificial production methods can be used to increase harvest and enhance natural production while maintaining genetic resources lies in the strategies and their associated assumptions (**Figure 7.3**). If a strategy does not work or is not feasible, harvest and natural production will not increase. (At least, production will not increase because of supplementation.) Additionally, if the assumptions are false, then production

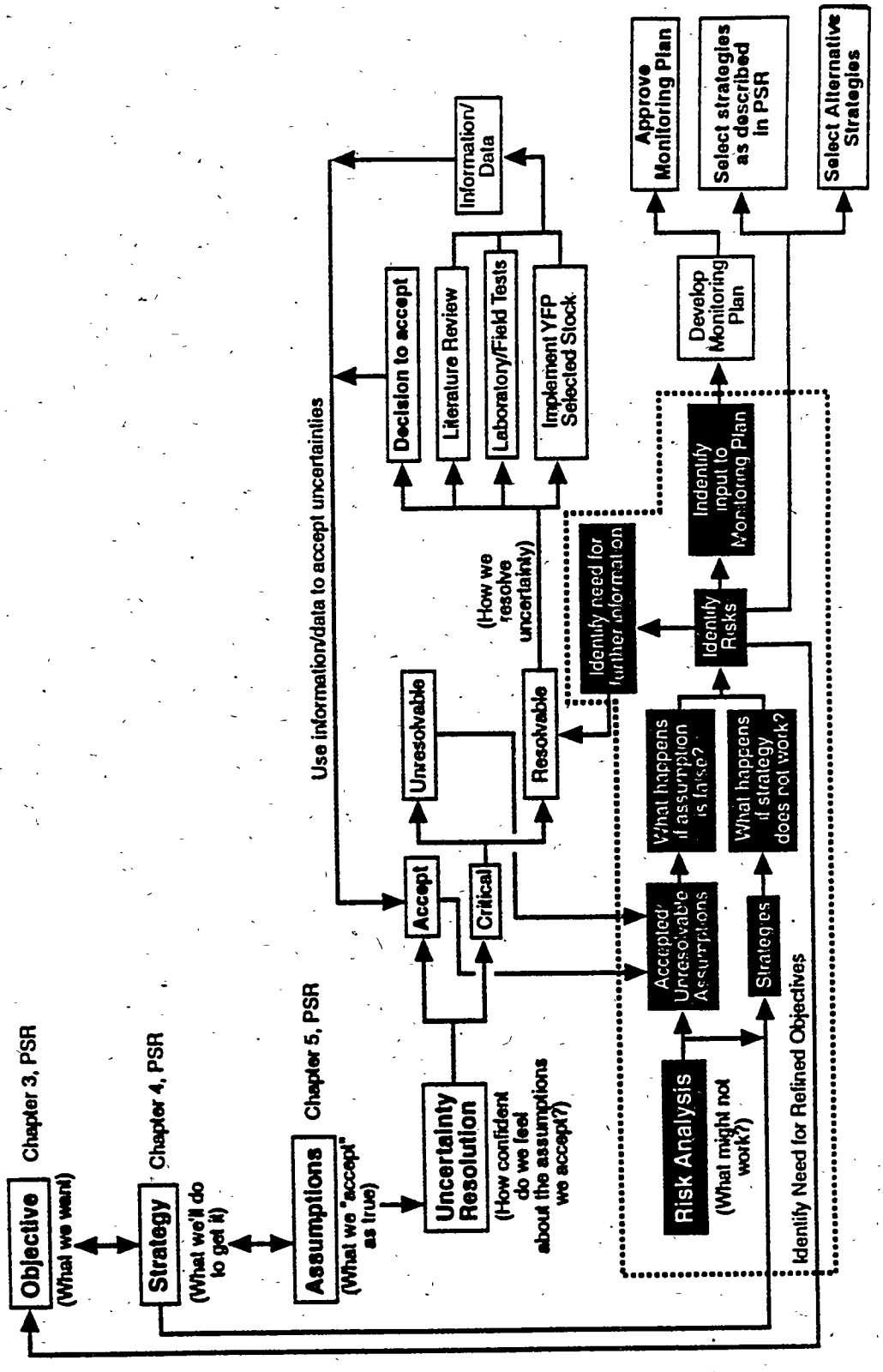


Figure 7.3. Structure of risk analysis within the project management framework.

may not increase and, in fact, production may decrease or some other unwanted result may occur.

Each decision maker will determine which risks apply to the possibility of supplementation not working or the probability that one or all of the assumptions are wrong. The decision maker must weigh the risks and decide how to proceed in the face of uncertainty. Implementation of supplementation must be preceded by a systematic evaluation to detect and permit correction of unforeseen errors. The following sets of questions related to feasibility, uncertainty, alternatives, and monitoring define a process for evaluating the strategies for supplementation.

Feasibility *Are the strategies sufficiently well defined and are they feasible? If not, why not? What is missing? Are assumptions related to feasibility of facilities and operations (including monitoring) accepted? (If they are accepted; reports, documents, or study results that address the specifics are available.)*

Uncertainty *What are the risks associated with uncertainties? (Risk refers to the likelihood of failing to meet the objectives stated for using supplementation to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources.) What are the implications to using supplementation to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources, if these assumptions are wrong? What is the likelihood that some of the accepted assumptions are wrong?*

Alternatives *What alternatives to supplementation are feasible (including taking no action) and what are their implications? (Implications refer to the risks, costs, and other impacts of the alternatives.) Are there alternatives to supplementation to test the assumption that new artificial production can be used to increase harvest and enhance natural production while maintaining genetic resources for which the risks and implications are less severe? What are the implications of delaying supplementation? Can some of the critically uncertain assumptions be effectively resolved through literature review or near-term studies? If so, should they be resolved by experiments, studies, modeling before implementation of supplementation?*

Monitoring *Supplementation may be implemented using an adaptive management process, even though it poses risk of uncertain outcomes, providing this risk is contained through monitoring. Therefore, we must finally ask, are the provisions in place for monitoring the outcome(s) of using supplementation for upper Yakima spring chinook salmon in the Yakima River Basin?*

These questions were addressed by four individuals, and the their individual studies were discussed at a meeting in Seattle, Washington on October 7-8, 1993. The results of their individual studies are recorded as appendices to the Risk Analysis reported to BPA and the YKFP policy group. Appendix A ("Experimentation Risk Assessment of YKFP Spring Chinook Salmon") is authored by Dr. Annette Hoffmann from the Associated Western Universities, Richland, Washington. Appendix B ("Genetic Analysis of PSR Strategies, Assumptions, and Uncertainties") is authored by Dr. Craig Busack from the Washington State Department of Fisheries, Olympia, Washington. Appendix C ("Risk Analysis Harvest") is authored by Dr. Lars Mobrand from Mobrand Biometrics, Inc., Vashon, Washington. Appendix D (Evaluation of Strategies and Assumptions to Meet Natural Production Objectives for Upper Yakima Spring Chinook Program") is authored by Mr. David Geist from the Pacific Northwest Laboratory, Richland, Washington.

Two types of experimentation risk were identified: (1) ability to test production levels relative to supplementation, and (2) ability to learn about the quality of supplemented fish and their impacts to the ecosystem. Four types of genetic risk were identified: (1) extinction, (2) loss of interpopulation variability, (3) loss of intrapopulation variability, and (4) domestication. Two types of harvest risk were identified: (1) harvest access, and (2) harvest numbers. Three types of natural production/ecological interaction risk were identified: (1) limitations of abiotic components of the environment, (2) limitations of biotic components of the environment, and (3) adverse ecological interactions.

Monitoring Plan Input

For each risk identified in the risk analyses, we identified measures that can be monitored. These measures provide possible input to develop a monitoring plan. All the measures that were identified during the risk analysis are listed in **Table 7.1**. The source of the risk associated with each measure is given in the table by the objectives.

Additionally, for each list of measures (i.e., experimentation, genetic, harvest, and natural production/ecological interactions), the most important measures were identified by the individuals who did the assessments.

For **experimentation** risks, this list included:

- Reading the marks on returning adults at Roza, Prosser, and the spawning grounds to estimate the number of spawners
- Estimating the harvest rates by stock and gear type
- An electrophoretic analysis by stock of the returning adults
- Estimating the density and distribution relative to specific habitats for both target and non-target species
- Estimating smolt-to-adult survival for wild and hatchery fish
- Estimating the number of emergent fry/redd by stock and spawning area.

For **genetic** risks, the list of most important measures included:

- Data that could be collected from adults on the spawning grounds (i.e., electrophoretic analysis, age, sex, length, timing, numbers, reading marks)
- Data related to spawner performance (i.e., number of fry/redd, fecundity, egg size, egg weight, length, weight)
- Data related to harvest (i.e., electrophoretic analysis of adults, age, read marks, length, sex, time of catch, place of catch, gear type)

For **harvest** risk, the list of most important measures included:

- Timing and identification of marks on fish in a test fishery
- Timing and identification of adults at Prosser
- Timing and identification of fish in the harvest
- Timing and identification of adults at Roza

For **natural production/ecological interactions**, the list of most important measures included:

- Density and distribution of upper Yakima spring chinook salmon relative to specific habitat types over time and space
- Density and distribution of non-target species relative to specific habitat types over time and space
- Number of upper Yakima spring chinook adults returning to the basin
- Number of upper Yakima spring chinook smolts migrating out of the basin
- Occurrence of prey items in target and non-target predators
- Harvest estimates

Based on the list of priority measures, four sets of data or information are identified: (1) estimates of the number of adults returning to the basin, (2) early-life-history survival, (3) spawning performance, and (4) ecological interactions among spring chinook salmon and other fish species in the basin. These data/information sets can and should be used to develop a monitoring plan to manage or contain the risk of supplementing upper Yakima spring chinook salmon. However, as indicated in the figure illustrating the process used to define risks, not all the measures are feasible nor are they focused on specific objectives. Measures that are not feasible must be considered for future research and development. Measures that are not focused because of a lack of defined objectives must be reconsidered in light of more specific objectives.

Estimating the number of adults that return to the basin can be accomplished by a number of measures (e.g., electrophoretic analysis, reading marks, age analysis, enumeration at specific facilities or areas within the basin). Early-life-history survival can be accomplished for hatchery fish and for those life-history types that migrate out of the upper basin as age 1+ fish. Early-life-history survival for life-history types that migrate out of the upper basin as 0-age fish is not possible. They are too small to be marked with individual tags before they pass Roza Dam. After passing Roza Dam, outmigrating upper Yakima spring chinook salmon cannot be distinguished from spring chinook salmon from the Naches or American rivers.

Spawning performance can be monitored in part. Meristic and morphometric measures can be collected from spawning adults, eggs, and emerging fry. Straying rates can be estimated from reading marks on first-generation hatchery fish. (Straying rates from second-generation or unmarked hatchery fish can ot be estimated.)

Ecological interactions are difficult to define at this time. The Yakima Fisheries Project has not defined objectives for the non-target species. Estimating the density and distribution of key non-target species relative to specific habitat types over time and space can only be used to contain or mange risk when the project defines or identifies the objectives for these key species.

Therefore, the measures that define the priority input to the preliminary monitoring plan for the upper Yakima spring chinook salmon supplementation program are:

- Estimate adult returns at strategic locations within the basin. The locations suggested by the risk assessment include a test fishery in the lower basin, Prosser Dam, Roza Dam, at the hatchery, and on the spawning areas.
- Estimate early-life-history survival for hatchery fish in the basin.
- Describe some measures of spawning performance on the spawning grounds throughout the basin.

Five levels of monitoring are defined for the Yakima Fisheries Project. They are (1) quality control, (2) performance, (3) hypothesis testing, (4) comprehensive monitoring, and (5) stock status monitoring.

Quality control ensures that supplementation is conducted as intended and record keeping is accurate and complete. Performance monitoring is the measurement of smolt attributes, especially as it relates to smolt survival. Hypothesis testing is the monitoring of "statement of the objective" for supplementation. By stating the hypothesis for supplementation, we will be able to statistically design the collection of monitoring data to examine likenesses and difference between survival related to different risks that were identified in the risk analysis. Comprehensive monitoring relates to the determination of whether supplementation is progressing toward the objective of increasing harvest and enhancing natural production while maintaining genetic resources. This also contributes to a sensitivity analysis, which helps determine how critical an assumption is to the success of a particular strategy. Monitoring of stock status provides information to track long-term performance and fitness. This is defined as the estimated annual spawning escapement and attributes that profile changes in the populations over time.

The input from the risk assessment will be provided to project individuals who are developing the monitoring plan. They will consider the measurements and incorporate them along with input from other project planning activities (e.g., the biospecifications, treatment definitions, and hypothesis analysis). Measures to contain and manage risk comprise only a part of the monitoring plans.

Summary

The risk assessment for supplementing upper Yakima spring chinook salmon to test the assumption that new artificial production will increase harvest and enhance natural production while maintaining genetic resources has been completed. The assessment indicates that all the risks can be identified and that supplementation of upper Yakima spring chinook salmon can proceed and accomplish the testing of new artificial production methods.

The risks to upper Yakima spring chinook salmon have been identified relative to the experimentation, genetic, harvest, and natural production/ecological interaction objectives. They are: inability to test production levels relative to supplementation, inability to learn about the quality of

supplemented fish and their impacts to the ecosystem, extinction of the stock, loss of inter- and intrapopulation variability, domestication, inability to control harvest access, inadequate harvest numbers, limitations by abiotic components of the environment, limitations by biotic components of the environment, and adverse ecological interactions.

Between 75 and 100 measures were identified to manage or contain these risks. The priority measures that are being developed in the preliminary monitoring plan are to: estimate adult returns at strategic locations within the basin, estimate early-life-history survival for hatchery fish in the basin, and describe some measures of spawning performance on the spawning grounds throughout the basin.

Four new or redefined strategies were identified for meeting the genetic objectives. They are: (1) acclimate and release fish from sites dispersed throughout the natural spawning range of the upper Yakima stock, (2) keep American and Naches River escapements at a minimum harmonic mean of 250 fish per year, (3) keep straying of upper Yakima chinook salmon into the American and Naches rivers at less than 5% of the recipient population, and (4) limit proportion of first-generation hatchery fish on spawning grounds to 50%. The managers of the Yakima Fisheries Project should consider amending the Project Status Report to include these strategies.

Measures to estimate early-life-history survival of wild or naturally spawning fish are not feasible at this time. The potential risks to the Yakima Fisheries Project can be managed without this technology; however, the managers of the Columbia Basin Fish and Wildlife Program should consider directing the research and development needed to estimate early-life-history survival of all life-history types of wild and naturally spawning fish.

A monitoring plan to contain or manage the risks of adverse ecological interactions can only be developed after specific objectives for key non-target species have been defined or identified. The key non-target species that were identified during the risk assessment are: coho salmon, fall chinook salmon, rainbow trout and steelhead, cutthroat trout, bull trout, redside shiner, sculpins, northern squawfish, and smallmouth bass. The managers of the Yakima Fisheries Project should define or identify objectives for these species.

The risks have been identified relative to the objectives, strategies, and assumptions stated in the long-range plan for the Yakima Fisheries Project (Project Status Report, February 1, 1993). Measures to contain or manage the risks have been input to a monitoring plan for supplementation of upper Yakima spring chinook salmon.

Table 7.1
Complete List of Measures Identified to Manage Risk Associated with Supplementation of Upper Yakima Spring Chinook Salmon

Measure	What	Where	When	Objective[1]
Electrophoretic analysis by stock	Adult/Upper Yakima, Naches, American	spawning grounds	during spawning	E,G,N
hatchery v. wild	Upper Yakima	spawning grounds	during spawning	G
Electrophoretic analysis by stock	Juvenile/Upper Yakima, Naches, American	spawning grounds	during spawning	G
hatchery v. wild	Upper Yakima	wild at Roza	presmolt & smolts	G
	Upper Yakima	hatchery at hatchery	smolt	G
Scale analysis (age) analysis by stock	Adult/Upper Yakima, Naches, American	spawning grounds	during spawning	G
Size (L)	Adult/Upper Yakima	spawning grounds	during spawning	G
Age structures	Adult/Upper Yakima	spawning grounds	during spawning	E,G
Spawn timing (date)	Adult/Upper Yakima	spawning grounds	during spawning	E,G
No. of Spawners	Adult/Upper Yakima Naches, American	hatchery	during spawning	E,G,H,N
Read Marks	Adults/Upper Yakima, Naches, American	spawning grounds, Prosser, Roza	during spawning	E,G,H,N
Electrophoretic analysis	Upper Yakima Naches, American	usual/ customary sites & test site	during harvest	E,G,H,N
Read scales analysis	Upper Yakima Naches, American	usual/ customary sites & test site	during harvest	E,G,H,N
Read marks analysis	Upper Yakima	usual/ customary sites & test site	during harvest	E,G,H,N

(1) E=Experimental
G=genetics
H=harvest
N=natural production/ecological interactions

Table 7.1 (cont.)

Measure	What	Where	When	Objective
Size (L) analysis	Upper Yakima	usual/ customary sites & test site	during harvest	G,H,N
Sex	Upper Yakima Naches, American	usual/ customary sites	during harvest	E,G,H,N
Time of Catch	Upper Yakima Naches, American	usual/ customary sites & test site	during harvest	E,G,H,N
Place of Catch	Upper Yakima Naches, American	usual/ customary sites & test site	during harvest	E,G,H,N
Gear Used	Upper Yakima Naches, American	usual/ customary sites	during harvest	E,G,H,N
No. Emergent Fry/Redd	Upper Yakima Naches, American	spawning at grounds	emergence	E,G,N
Origin of spawners on selected redds (hatchery v. natural)	Upper Yakima	spawning grounds	during spawning	G
egg #/female	Upper Yakima	Roza	during spawning	E,G
egg size	Upper Yakima	Roza	during spawning	G
egg volume	Upper Yakima	Roza	during spawning	G
Size (L)	Upper Yakima	Roza	during spawning	G
Size (W)	Upper Yakima	Roza	during spawning	G
smolt-smolt survival (hatchery fish)	Upper Yakima	Horn Rapids McNary	spring	E,G,H,N
smolt-smolt survival (Wild)	Upper Yakima, Naches	Horn Rapids McNary	spring	E,G,H,N
smolt-adult(hatchery)	Upper Yakima	Prosser	fall	E,G,H,N

Table 7.1 (cont.)

Measure	What	Where	When	Objective
smolt-adult (wild)	Upper Yakima,Naches	Prosser	fall	E,G,H,N
collect gametes	Upper Yakima	hatchery/ spawn	spawning (every 3 yrs)	G
collect liver samples for DNA analysis	Upper Yakima,Naches	hatchery/ spawn	spawning (every 3 yrs)	G
total area	land use type (e.g,ag,timber, urban)	basin	every 5 years	N
miles stream access during upstrm passage	Upper Yakima, Naches	basin	every 5 years	N
channel depth (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
width channel (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
volume (m^3) of pools (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
volume (m^3) of riffles (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
volume (m^3) of runs (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
volume (m^3) off-channel, wetlands (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
gradient (depth,elevation)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
flow (m^3/s) (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
velocity (surface) (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
velocity (subsurface) (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of boulders (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of cobble (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of overhanging bank (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of canopy cover (min. max,av.)	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N

Table 7.1 (cont.)

Measure	What	Where	When	Objective
area of near shore vegetation	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of large organic debris	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of small organic debris	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
area of fine material in substrate	Upper Yakima, Naches	basin	4 times/yr every 3 yrs.	N
water temperature	Upper Yakima, Naches	basin	continuous	N
density & distribution relative to specific habitat	Upper Yakima and Naches spring chinook	basin	all life stages annually	E,N,H
density & distribution relative to specific habitat	coho salmon	basin	all life stages annually	E,N
density & distribution relative to specific habitat	fall chinook salmon	basin	all life stages annually	E,N
density & distribution relative to specific habitat	rainbow trout & steelhead	basin	all life stages annually	E,N
density & distribution relative to specific habitat	cutthroat trout	basin	all life stages annually	E,N
density & distribution relative to specific habitat	bull trout	basin	all life stages annually	E,N
density & distribution relative to specific habitat	redside shiner	basin	all life stages annually	E,N
density & distribution relative to specific habitat	sculpins	basin	all life stages annually	E,N
density & distribution relative to specific habitat	northern squawfish	basin	all life stages annually	E,N
density & distribution relative to specific habitat	smallmouth bass	basin	all life stages annually	E,N

Table 7.1 (cont.)

Measure	What	Where	When	Objective
weight/volume	terrestrial,benthic & near benthic organisms	basin	4 times/yr every 3 yrs.	E,N
#/volume	terrestrial,benthic & near benthic organisms	basin	4 times/yr every 3 yrs.	E,N
Length	Upper Yakima spring chinook (emergent through smolt)	basin	annually at all life stages	N
Weight	Upper Yakima spring chinook (emergent through smolt)	basin	annual ly at all life stages	N
Age	Upper Yakima spring chinook (emergent through smolt)	basin	annual ly at all life stages	N
occurrence of fin nips	Upper Yakima spring chinook (emergent through smolt)	basin	annual ly at all life stages	N
incidence of BKD black spots,parasites	Upper Yakima spring chinook (emergent through smolt)	basin	annual ly at all life stages	N
occurrence of prey items (stomach contents)	Upper Yakima spring chinook (emergent through smolt)	basin	annual at all life stages	E,N
occurrence of prey items (stomach contents with special note of hatchery v. wild upper Yakima spring chinook)	key non-target species (coho,fall chinook, rainbow trout/steelhead, cutthroat trout,bull trout, redside shiner,sculpins, northern squawfish, smallmouth bass)	basin	annual ly	E,N
occurrence of behavioral displays (nips,crowds, charges)	Upper Yakima spring chinook (emergent through smolt)	basin	annual ly at all life stages	N
number of adults	Upper Yakima Naches, American	Roza Prosser Horn Rapids (?) spawning grounds	upon return	E,H,N
number of pre-smolts	Upper Yakima	Horn Rapids	outmigration	E,N
Weight of pre-smolts	Upper Yakima	basin	outmigration	E,N
number of smolts	Upper Yakima	basin	outmigration	E,N

Table 7.1 (cont.)

Measure	What	Where	When	Objective
number of non-target species	(coho,fall chinook, rainbow trout/steelhead, cutthroat trout,bull trout, redside shiner,sculpins, northern squawfish, smallmouth bass)	basin	every 5 yrs.	E,N
weight of non-target species	(coho,fall chinook, rainbow trout/steelhead, cutthroat trout,bull trout, redside shiner,sculpins, northern squawfish, smallmouth bass)	basin	every 5 yrs.	E,N
number of fish entrained in diversion canals	Upper Yakima spring chinook	basin	annual	E,N
number of fish entrained in diversion canals	(coho,fall chinook, rainbow trout/steelhead, cutthroat trout,bull trout, redside shiner,sculpins, northern squawfish, smallmouth bass)	basin	annual	N
number of spring chinook harvested	Upper Yakima,Naches American	Horn Rapids to Roza, all harvest sites	season	E,G,H,N
number of Upper Yakima spring chinook harvested by gear type	Upper Yakima,Naches American	Horn Rapids to Roza,all harvest sites	season	H

8.0 Facilities and Operations

Facilities and operations are planned to accommodate the supplementation of two Spring chinook salmon stocks: the Naches and upper Yakima stocks. Facilities are to be designed, constructed, and operated for broodstock collection, adult holding, spawning, incubation, rearing, acclimation and release, and monitoring activities of the spring chinook salmon project. These facilities will be designed to accommodate and conduct supplementation experiments. The facility currently being designed will test supplementation of upper Yakima spring chinook and will accomodate two experimental treatments: the Optimal Conventional Treatment (OCT), and the New Innovative Treatment (NIT). The Limited New Innovative Treatment (LNIT) may be tested in later years for either upper Yakima or Naches spring chinook. Monitoring facilities are to be designed and operated to meet the requirements for five levels of experimental monitoring.

Broodstock of upper Yakima spring chinook salmon will be trapped at Roza Dam from late May through September. Adults will be transported to the Cle Elum Facility for spawning, where egg incubation and fry and juvenile rearing will occur. Fry will be ponded and reared in raceways. Satellite acclimation ponds will be used for smolt acclimation and release. Each acclimation satellite will release OCT, and NIT, treatments. Five candidate satellites have been identified and surveyed (Keechelus Dam, the town of Easton, Cle Elum River, Teanaway River, and Clark Flat). The program calls for the release of 810 thousand upper Yakima spring chinook salmon smolts.

Naches Spring chinook salmon broodstock will be collected from July through September, either on the spawning grounds or at a collection facility (if Naches stock can be effectively discrimated from American stock), and transported to the Oak Flats Facility and held for spawning. Adult spawning, egg incubation, and fry and juvenile rearing will also be conducted at Oak Flats continuing into October. Three acclimation satellites are planned: the Little Naches River, Naches River, and Rattlesnake Creek locations. The program calls for the release of 450,000 Naches spring chinook salmon smolts.

Prior to initiating final design of facilities, treatment definition and biological specifications documents will be provided to the project managers and designers as guidelines for determining scientific and biological requirements for implementing and conducting the experimental treatments. Prior to facilities operations, scientific and biological operations manuals that set forth protocols, methods, and procedures for conducting experimental treatment activities (broodstock collection, adult holding, spawning, incubation, rearing, acclimation and release, and monitoring), will be institutionalized within the project.

1. Treatment Definitions And Descriptions

Introduction

The Yakima Fisheries Project (YFP) is designed to test the assumption that supplementation can be used to increase natural anadromous fish production and improve harvest opportunities while maintaining genetic resources. This document will focus on upper Yakima spring chinook salmon, one of three genetically distinct chinook salmon stocks in the Yakima basin (Busack 1993, Appendix A).

Facilities will be constructed in the Upper Yakima River Basin to serve as a production scale laboratory to resolve critical uncertainties related to supplementation. Scientists will use this laboratory to evaluate the alternative fish culture techniques that can be used in supplementation programs. These evaluations will generate improved fish culture and release techniques that yield high survival of wild-like fish that is assumed to be needed for supplementation to contribute to rebuilding depleted wild salmon and steelhead stocks throughout the Columbia River Basin.

Naturally-produced fish have or display a broad array of characteristics believed to be important indicators of pre-smolt and smolt status. These attributes (fish health, morphology, behavior, and survival) will serve as target specifications for monitoring and evaluating the effectiveness of artificial culture methods in producing fish with the appropriate wild-like characteristics (Table 1).

It is crucial that the facility be designed to scientifically resolve current and future critical uncertainties regarding the culture and release of fish for use in supplementation programs. Therefore, to provide the maximum statistical power in the most cost effective manner, the biological specifications require that the facility be planned so that treatments can be statistically blocked throughout broodstock holding, incubation, rearing, and acclimation phases. This will enable researchers to apply experimental treatments at any level of fish culture from broodstock management through release, as new critical uncertainties emerge.

The main value of the scientific information obtained from this facility over the next several decades is its adaptive management application to other programs within the Columbia River Basin. Therefore, the biological specifications require that certain aspects of the facilities (e.g., raceways) be designed as models of most of the other hatcheries. This will allow those concepts that are demonstrated scientifically to be valuable to be readily retrofitted to existing facilities.

The biological specifications define facilities in which two (2) experimental treatments can occur. At acclimation there are nine (9) replicate vessels/treatment. For this level of replication to be maintained in any given experiment, there must be nine (9) or more vessels/treatment available from the time the treatment is applied. Therefore to maximize experimental flexibility, statistical power, and facilitate fish handling the biological specifications must provide at least nine (9) incubation, rearing, and acclimation vessels/treatment. The design must also provide some capability to accommodate other research needs.

The project experimental design requires that each experiment be conducted over one life cycle. Thus with spring chinook salmon, the facility will be dedicated to comparing treatment effects over five year blocks. The first five-year block will compare the effectiveness of conventional rearing methods and semi-natural rearing methods for producing spring chinook salmon suitable for supplementation

programs. The two treatments to be applied are Optimal Conventional Treatment (OCT) and New Innovative Treatment (NIT), (Fast 1992, Appendix A; BPA 1992). Experimental treatments will be applied to the particular study groups at the start of feeding and continued until the smolts leave acclimation ponds.

Table 8.1. Target biological attributes for upper Yakima spring chinook.

ATTRIBUTE	PARAMETER	MEASURES	SAMPLING INTERVAL (VARIES PER NEED)
FISH HEALTH	PHYSIOLOGY	GILL Na+/K+ ATPase	MEAN $= x_{1..n}$ SD $= y_{1....n}$
		THYROXINE	"
		CORTISOL	"
		LIVER GLYCOGEN	"
		IMMUNO COMPETENCE	"
		HEMATOCRIT	"
		WHITE CELL COUNT	"
	PATHOGEN PREVALENCE	IHN VIRUS	"
		ERYTHROCYTIC INCLUSION BODIES	
		Renibacterium salmoninarum	
		Ceratomyxa shasta	"
		Chondrococcus columnaris	"
		Aeromonas salmonicida	"
		Yersinia ruckeri	"
		Cytophaga spp.	"
		ENDOPARASITES	"
		Ceratomyxa shasta	"
		ECTOPARASITES	"

	CONDITION	% FAT	"
		% PROTEIN	"
		PROTEIN:FAT RATIO	"
		CONDITION FACTOR (K)	"
		EYE CONDITION	"
		GILL CONDITION	"
		FIN CONDITION	"
		PARASITIC SCARRING	"
MORPHOLOGY	CRYPSIS	DORSAL COLORATION INDEX	"
		PARR MARK/TOTAL BODY INDEX	"
		PARR MARK DARKNESS INDEX	"
		NO. DORSAL SPOTS	"
		LATERAL IRIDESCENCE INDEX	"
	MORPHOMETRICS	FORK LENGTH	"
		STANDARD LENGTH	"
		WEIGHT	"
		TRUSS MEASUREMENTS (INDEX)	"
BEHAVIOR	MIGRATION	FROM ACCLIMATION PONDS	"
		SUSTAINED SWIMMING SPEED	"
		UPSTREAM/DOWNSTREAM MOVEMENT	"
	HABITAT PREFERENCE	% TIME SPENT IN COVER	"
		DISTANCE FROM BOTTOM	"
		DISTANCE FROM STRUCTURE	"
		DISTANCE FROM SIDE	"
		DEPTH PREFERENCE	"

		VELOCITY PREFERENCE	"
BEHAVIOR	FORAGING PREFERENCE	#TEST PREY/TAXON CONSUMED	"
	FORAGING EFFICIENCY	PREY ATTACK:STALK RATIO	"
		PREY CAPTURE:ATTACK RATIO	"
		PREY INGESTION:CAPTURE RATIO	"
		PREY ACQUISITION/UNIT TIME	"
		PREY HANDLING TIME	"
	FORAGING ABILITY	TOTAL CONTENTS/WEIGHT/STOMACH	"
		% FOOD ITEMS (BY WGT)/STOMACH	"
		% NON-FOOD ITEMS " "	"
	PREDATOR AVOIDANCE	PREDATOR RECOGNITION INDEX	"
		PREDATOR EVASION INDEX	"
		RESPONSE TIME:COVER RATIO	"
	GENERAL SOCIAL	NIPS/UNIT TIME	"
		DISPLAYS/UNIT TIME	"
		INTER-FISH DISTANCE	"
		POLARIZATION INDEX	"
SURVIVAL	SUPPLEMENTATION FISH	EMERGENT FRY:SMOLT SURV RATE	"
		SMOLT:SMOLT SURV RATE TO ROZA	"

Production Objective

The experimental design requires the production of 18 separate lots of 45,000 smolts for release as experimental groups into the watershed above Roza Dam (Table 8. 2). These fish will be 15 per pound at release and, in total, weigh 54,000 pounds.

Table 8.2. Production requirements for Upper Yakima spring chinook salmon research (BPA 1990).

No. of release groups	18
No. of smolts/group (approx.)	45,000
Total programmed for release	810,000
Release size (fish per pound)	15
Total pounds to be released	54,000

Standard Treatment Methods

This section presents anticipated culture methods that will be applied to all experimental treatment groups from broodstock collection to the start of fry feeding. It also provides biological and operational criteria for associated fish culture and monitoring facilities.

A. Adult Collection and Monitoring

Adult spring chinook salmon will be trapped at Roza Dam and transported to Cle Elum Hatchery (ibid.).

The U. S. Bureau of Reclamation designed the Roza Dam adult collection facilities, and began construction during 1992 with a scheduled completion in 1993 (USBR 1992). The scientific basis for facility design was provided in a memorandum (Easterbrooks 1991, Appendix B). Scientific requirements and specifications were:

- 6 holding compartments for fish segregation: (a) 4 for holding 25 unsampled fish each, (b) 2 for holding 50 sampled fish each
- Holding volume - 10 cubic feet per fish
- Minimum pool depth - 5 feet
- Sorting flume with mounted coded wire tag (CWT) (Jefferts et al. 1963) detector equipped with auto-sorting instrumentation (operating procedures and protocols included)
- Crowding capability and "immobilization" brail to facilitate fish handling by use of plastic (pvc) tubes.

- Bio-sampling work area including anesthetic tank, processing table, recovery tanks, and chutes for sorting fish that are either held or returned to the Roza pool

- Off-ladder holding pool and features, assuming a Denil fishway design

The minimum flow per adult requirement is 1 gallon per minute at 50°F (assuming a 15 pound/fish average weight) with the inflow adjusted at 5% per degree of average water temperature departure from the standard(Senn, et al. 1984). Flow must be provided so that the holding vessel outflow dissolved oxygen level is 7 mg/L or greater (ibid.).

The new adult trapping facility incorporates proven design features and is located on the left bank of the Yakima River (Roza pool) approximately 300 feet upstream of Roza Dam (General Plan, Appendix B). It is hydraulically connected to the existing fishway by a flow control structure and a light-ported spiral-ribbed aluminum pipe which serves as a lake level fish transport channel (following Cowlitz Hatchery design). An intake provides a gravity source for the transport channel and a river water source, via pumps, for the trapping facilities. The head end of the transport channel is a collection area consisting of a "V" trap entrance, crowder, and a Bonneville-Hatchery style fish lock and lift. From the top of the fish lock, a fish sorting flume (Prosser Dam design) descends past four holding tanks and exits as a river return line. Access to each holding tank is provided by remotely or automatically controlled quick acting power gates. Holding tanks are provided with a crowder channel access port and individual crowders. The common crowder channel is provided with a crowder that is used to separate/crowd fish retained for hatchery transfer or for crowding to a fish-handling "scalloped" brail. A water-to-water fish transfer brail is used for lifting fish from the crowder channel and for fish transport truck loading.

Fish will ascend the Roza fishway and enter the trap via the transportation pipe. Trapped fish will be crowded into the fish lock that will subsequently be closed and flooded to the elevation of the fish sorting structure. A false floor (lift) will be raised to crowd the fish upward within the lock. Fish sorting will be managed by an operator controlling the lock and lift operation. Fish will have the opportunity to exit the lock volitionally over the false weir as flow is increased or will be otherwise encouraged to exit by the raising of the false floor which serves as a brail. The individual controlling the fish lock will also be responsible for either sorting fish (by species) into holding tanks, or directing fish to pass through and exit into the Roza pool.

Processing of collected adults will entail: (1) crowding from the holding tanks, (2) crowding to the head of the crowding channel, and (3) crowding via brail for handling adults. Handling will involve: (1) placing captive fish into plastic tubes (while on the brail) for control during anesthetizing, (2) examination for specific identifiers (tags, fin-marks, brands, etc.), and (3) other project-related sampling. Fish selected for hatchery use will, while anesthetized, be injected with an antibiotic before transfer to adult holding ponds at Cle Elum Hatchery.

Following Genetic Hatchery Guidelines (GHG), only naturally produced (non-marked) fish will be selected for hatchery use and no more than 50% of the available non-hatchery fish can be used for broodstock (Kapuscinski and Miller 1993). The adult population will be sampled such that the collected adults represent population parameters including arrival time, age, size, etc. (ibid.; Busack 1993a, Appendix A).

The project report "Optimal Conventional and New Innovative Treatments for Upper Yakima Spring Chinook Salmon Supplementation Project" (BSWG, 1994) and Planning Status Report (1995) provide

the experimental basis for the number of adult spring chinook salmon broodstock required to support the supplementation program. It will be necessary to collect and transport 1,108 adult fish (Table 8.3).

Fishway, trap, and transport pipe will be in continuous operation under gravity water flow, except per a BPA/USBR agreement related to winter operations (Appendix B). Adult collection and monitoring facilities requiring pumped water will be operated on a daily basis with no fish being held overnight.

1. Sorting & Enumeration The facility operator will have the responsibility for operating the fish lock/lift and sorting flume gates. This person will discriminate the fish by species entering and passing down the sorting flume either to holding tanks or to the Roza pool. It is expected that electronic tag detection and automatic sorting devices will eventually be incorporated into the sorting process. An assistant may be required to operate the trap crowder to haze fish into the lock chamber for holding until the access port is closed.

2. Biological Processing Biological processing will involve anesthetizing (MS-222, 130-260 mg/L - Collinsworth and Moberly 1983), handling the fish as necessary to verify and record species, fish origin (experimental of "wild") by the presence of fish identifiers, and to further observe fish to assure appropriate broodstock collection.

Adults selected for hatchery use will be injected with an antibiotic during bio-processing. Adult mortality and juvenile disease related to bacterial kidney disease (BKD) is reduced by injection of an antibiotic, erythromycin. Treatment methodology presently involves injecting 20-30 mg/kg fish weight of "Erythromycin-200" into the dorsal musculature (Harrell 1993; Moffitt, et al. 1993).

3. Broodstock Acquisition Returning adults will be sampled to assure that fish selected for broodstock are representative with respect to time of arrival, age, size, sex-ratio, etc. (Busack 1993a; Kapuscinski and Miller 1993). Fish taken for hatchery broodstock will be transferred to adult holding facilities the day of collection.

Fish Transportation - Adults Fish transport support will be accomplished by a combination of large and small equipment for an estimated 150 96-mile round-trips. Tank trucks, tank bearing utility trucks, and truck/trailer combinations are routinely used to transport salmon and steelhead adults at public fish production facilities.

The adult transport tank loading rate is 1.0 pounds of fish per gallon at 50°F. Generally, loading should be decreased as temperature increases above 50°F and should be reduced by 10% for each degree of increased temperature above 60°F (Bell 1990). The loading rate can be increased by up to 30% for short hauls. Tempering is required where temperature differences between tank and receiving water exceed 10°F (note: the change upward has the greatest potential for reducing survival of transported fish). Ice used for tempering must be free of residual chlorine (Bell 1986).

Oxygen will be provided using liquid or gaseous oxygen and ceramic or carbon rod diffusers. The rate of oxygen delivery at 10°C of 3 Lpm (@ 80 psi) per 1m carbon rod normally supports up to 550 pounds of fish (Weydemeyer 1992). Other transport tank features will include electrical agitators for recirculation, insulation for temperature control, water level sight gauge for volumetric measurement of loaded fish, and oxygen delivery controls and monitoring system to assure proper tank conditions (OPTT 1992).

Adult fish will be transported by tank truck to Cle Elum adult holding ponds. The transport tank will

be discharged via a rear-located spring loaded gate. Considering the characteristics of the adult holding vessels, the tank contents (adult fish) will be released via a flume to direct fish away from pond walls and bottom. Flumes are commonly used for this purpose.

B. Broodstock

1. Adult Holding/Handling A maximum of 1,110 Upper Yakima spring chinook salmon adults is required to be collected at Roza Dam and transported to Cle Elum Hatchery for spawning retention (Table 8.3). The assumptions used to derive the preliminary estimate of the numbers of broodstock are: egg to smolt survival - 65%, adult mortality - 20%, and eggs per female -4,300 (BPA 1990). The mean fecundity estimate has subsequently been revised downward to 3,500 eggs per female (Knudsen and Busack 1993, Appendix A).

Table 8.3. Egg and broodstock requirements

Eggs required (assumed 65% survival)	1,242,000
Eggs per female	3,500
Females required (assumed 20% mortality)	444
Sex ratio (male:female)	1.5:1
Adults required	1,110

Holding Volume The adult spring chinook salmon holding volume is 10 ft^3 per adult following the design standard recently implemented at upper Columbia basin projects, such as Eastbank and Methow hatcheries (Scribner 1993). A minimum volume of 11,100 ft^3 of adult holding space will be required to retain adult fish from collection to spawning.

Two adult holding vessels are required to provide operational flexibility and the opportunity for retention of broodstock separately by experimental treatment (e.g., OCT, NIT).

Inflow The minimum inflow requirement (1,110 gallons per minute) for adult spring chinook salmon holding is derived from the criteria of 1 gallon per minute, at 50°F, per fish (Senn, et al. 1984). The inflow is adjusted at a 5% rate per degree of average water temperature increase from the 50°F standard (ibid.).

Water Quality Adult holding success is dependent upon water quality. Water quality must be sufficient for adult holding in terms of both water chemistry, pathogens, and temperature. The availability of pathogen-free water, typically from groundwater, can enhance adult holding by reducing mortality and, correspondingly, the number of broodstock required to support the supplementation program.

Project water quality standards determine the fish culture utility of potential/candidate Cle Elum Hatchery water sources. Results of biological studies and water quality analyses indicate that

characteristics "appear quite suitable for fish production" (Dauble and Mueller 1993, Appendix C). In addition, water quality information summarized by Dauble (1993, Appendix C) indicates fish culture suitability of water sources where upper Yakima River acclimation sites may become established.

With respect to dissolved gases in groundwater, it is recommended "that waters be stabilized before use in a fish hatchery if the dissolved oxygen is less than 90% saturation, or if the dissolved nitrogen is greater than 102% saturation" (Senn, et al. 1984). Ideally, the total gas saturation should not exceed 100%.

Concern exists as well for the presence of supersaturated gas in surface water. This is of particular importance in the case of upper Yakima River facility planning since nitrogen supersaturation was measured in the Cle Elum River 1993 and was known to cause losses of captive fish below Cle Elum Dam (Harrell 1993a, Appendix C). Colt, et al. (1991) reported reduction of the impact of surface water gas supersaturation in hatchery water supplies through the use of degassing structures.

In anadromous fish culture, process water that has been used for rearing a single group of juvenile fish (first-pass) is generally accepted as an alternate adult holding water source if pathogen, chemical, and temperature requirements are met. Such water may require aeration in order to re-establish dissolved oxygen levels sufficient to allow maximum inflow loading (1 adult per gallon per minute at 50°F.). Alternatively, flow must be increased to maintain dissolved oxygen levels if aeration is not provided.

The YFP has accepted the use of 2nd or 3rd-pass water for adult holding for facility design purposes when constrained by water availability (BPA 1990). However, water re-use will only be considered as a contingency action.

Water Temperature The recommended adult salmon holding temperature range is 43°F (Leitritz and Lewis 1980) to 55°F (Piper et.al 1982; OPTT 1992a). In nature, adult spring chinook salmon ascend rivers, select and hold in environments of their preference and generally spawn in water temperatures ranging from 42°F to 51°F (Bell 1990). Stuehrenberg (NMFS, personal communication) indicated that radio-tagged spring chinook salmon holding in the upper Yakima drainage is commonly associated with dense cover (woody debris, primarily) but that associated temperature data on adult holding areas have not been gathered. In another Yakima River study, Berman and Quinn (1991) observed behavioral thermoregulation in which spring chinook salmon adults maintained an average internal temperature of 2.5°C below ambient river temperature.

Fish Health Several diseases occur in adult salmon and will probably occur in fish held for broodstock. The most prevalent external and internal diseases are discussed below.

Fungus: Fungus (*Saprolegnia sp.*) is expected to be the most prevalent external disease of adults at Cle Elum Hatchery. This disease is a secondary invader of external lesions, abrasions, and external bacterial infections and is a common factor in mortality of salmonid broodstock.

The contemporary treatment practice involves the use of a formalin (37% formaldehyde) "bath" in which fish are regularly exposed to the chemotherapeutant for a prescribed period. Harrell (1993) indicated that fungus control in spring chinook salmon held at the Washington Department of Fisheries (WDF) Hupp Springs Rearing Facility was realized with a 1:6000 treatment applied every other day from ponding until the adult fish showed obvious signs of sexual dimorphism. Safe application of formalin will require the use or construction of a distribution system which meets

workplace safety standards (State of Washington 1992) and prevailing fire codes. In addition, proper storage for formalin must be provided on site.

Bacterial Kidney Disease (BKD): BKD is caused by a ubiquitous systemic bacterium (*Renibacterium salmoninarum*). Under some conditions, this disease can cause extensive mortality in salmon broodstock. The disease may also be transmitted from infected female salmon (via eggs/ovarian fluid) to offspring.

As noted previously, adults selected as broodstock will be injected with erythromycin at Roza Dam during bio-processing activities. They will also receive a second such treatment before being spawned. These injections should minimize adult mortality due to BKD and may mitigate vertical transfer (parent to offspring) of the disease.

Ceratomyxa: Research of project Fish Health Specialists has shown the presence of the protozoan *Ceratomyxa shasta* in returning salmon, however, to date the organism has not been found in juvenile salmonids held in liveboxes or recovered from migrants sampled at Prosser Dam (Harrell and Snell 1992). Currently, the organism is not expected to pose management problems.

Others: Parasitic copepods (Anchor Worms) of the genus *Lernea* have been found on most maturing spring chinook salmon observed in the Yakima River (Harrell and Snell, 1993). These parasites have been reported to predispose adults to *Saprolegnia* and/or cause additional stress on adults held for broodstock (Phyllis Barney, USFWS, pers. comm.). There is no known treatment for anchor worms at this time, however, treatment options will be investigated if these copepods pose a threat to adult survival.

Monitoring: A technical support room will be provided for diagnostic/routine fish health monitoring activities as well as other project-related research activities.

Physical Features The facility design will include physical features that minimize the mortality of adult spring chinook salmon held as broodstock and consequently the number of fish to be removed from the natural spawning escapement.

The construction of an upwelling process water supply, overhead spray, and provision of features which otherwise eliminate loss through jumping or injuries are required (Senn, et al. 1984). Water upwelling reduces a tendency of adults to jump and the overhead spray serves to act as a cover, possibly refracting light. These features are incorporated into adult holding ponds of the recently constructed Snake River and upper Columbia salmon hatcheries (e.g., Lyons Ferry and Eastbank).

Flexibility will be designed into the holding and fish handling facilities so that two primary groups of adults can be held separately and handled with minimum stress. External tags might be applied as the fish are collected at Roza Dam to provide the basis for broodstock research including the opportunity to assess time related differential mortality.

Illumination required for security will only be used as necessary to accomplish tasks safely. Otherwise, fish held within the adult holding vessels should not be influenced by artificial illumination so that spawning is not delayed by inadvertent photoperiod extension.

Biological processing Biological processing of maturing adult spring chinook salmon requires the handling of live fish for injection, maturation testing for maturation. Fish in spawning condition will

be killed within the pond, and removed for disinfection following NMFS sockeye handling methods (Flagg, et al. 1991).

A specialized area will be provided adjacent to the adult holding vessel(s) for the completion of pre-spawned fish handling. This area shall also provide containment of killing-related waste (blood, mucous, wash-down water, disinfectant) (State of Washington 1990, Appendix 5).

2. Spawning/Mating

Mature fish will be taken from the adult holding area following sorting/killing to a designated area (refer to biological -processing Area, below) for spawning, mating, and sampling necessary to support fish health, genetics, and long-term fitness monitoring and research.

Disinfection procedures will be implemented to minimize the potential for the spread of pathogens during transfer of fish from the adult holding ponds to the spawning area. Iodophor solution of 100 ppm provides general disinfection with a 5 minute exposure (Collinsworth and Allee 1988).

Spawning Eggs will be removed from females using the incision method (Leitritz and Lewis 1980) with eggs and ovarian fluid retained together. Eggs and sperm (milt) from individual spawners will be placed in separate containers.

As necessary, gametes will be stored to prevent or minimize change from the ambient water temperature prior to fertilization. Troughs or refrigerated storage will be required to retain the gamete containers until fertilization. It is assumed that this gamete retention will be of short duration, not exceeding one hour.

Fertilization Fertilization will take place before container transfer to a disinfection room to reduce the extent to which containers and personnel must be disinfected (Carl Ross, Lyons Ferry Hatchery Manager, personal communication, 1993). Use of a similar approach to transfer samples to the technical support room will also be used to reduce or eliminate disinfection of foot traffic to and from the building.

Mating Mating will be randomized with respect to phenotypic traits, including size, within each group of adults which are ripe on the day of spawning. The mating scheme will follow Hatchery Genetic Guidelines (Kapuscinski and Miller 1993).

Biological Processing Area A biological or "bio-processing" area will be provided for research and fish health support activities (OPTT 1992b). The purpose of this area is to make the research and fish handling efficient, and worker-friendly, and to manage activities so that data accuracy is assured. Lifting will be minimized and should only be necessary for removal of carcasses from racks during spawning. There will be no requirement for lifting from the deck, except the necessity to place the killed fish onto racks. Post-spawn processing will occur on a table with the carcasses slid from work station to work station and eventually transferred to leak-proof plastic bins ("totes") as the processing is completed.
The bio-processing area will serve the following functions:

- **Technical Support Fish Identification:** Individual fish will be assigned a unique alphanumeric identifier that will support research/fish health activities. Multiple-part forms may be used to tabulate data derived during these activities (ibid.).

- **Spawning:** Identifiers will be applied to the individual gamete containers.

- **Mating:** Mating procedures will follow Hatchery Genetic Guidelines (Kapuscinski and Miller 1993). Gamete container identifiers will be integrated to provide the genetic history of the pairing.

- **Pathogen Characterization:** Cavity fluid will be sampled as eggs are removed and other appropriate tissues will be excised after spawning for the detection of infectious diseases (e.g., virus and BKD). Samples will be matched, by label, to individual incubation units. Results of the tissue analyses may determine the disposition of individual egg lots and influence fish health management practices.

- **Genetic Sampling:** Samples of heart, eye, liver, and muscle tissues will be taken for electrophoretic and other genetic analyses.

- **Morphometric Measurement:** Morphometric work involving length and weight measurements will occur during bio-processing. Some of this work may precede spawning procedures.

- **Fish Identification:** Coded wire tags, PIT tags (Prentice, et al. 1990), and other identifiers may be present in broodstock; therefore it will be necessary to keep the adults separated from the spawning process until the identifiers can be discriminated for proper matings to occur.

Biological sampling will require use of an adjacent working area (technical support room) for related information management, sample processing and storage, tag recovery and identification, other miscellaneous work, and technical equipment storage.

Carcass Handling and Storage Spawned carcasses held in totes will be loaded onto trucks by fork lift or a tractor equipped with lifting tines. Carcass disposal will be consistent with state and federal regulations and project policy.

An area will be provided for daily storage, cleaning, and disinfection of totes. This area will also be used for equipment disinfection.

C. Incubation

Two systems, isolation-buckets (Novotny, et al. 1984) and vertical incubators (Senn, et al. 1984) will be used to incubate spring chinook salmon eggs at the Cle Elum Hatchery. Wells will provide pathogen-free process water for incubation (BPA 1990). Spring chinook salmon eggs will be isolated from fertilization through the eyed stage to allow for disease certification (CH2M-Hill 1991). Incubation will occur under dark or low-light (working) conditions. Filament lighting in the incubation room is preferred to fluorescent lighting (Bell 1990).

Egg development during incubation will be controlled through using chilled water after development to the 128 cell stage (Combs 1965; Tang, et al. 1987). This provides flexibility to mimic natural conditions (BPA 1990). Managing the incubation temperature also accomplishes several objectives: (1) it regulates the number of days reared prior to transport to acclimation pond, (2) it allows growth control aimed at preventing the fish from attaining a larger than specified size, and (3) it provides opportunity to reduce the time between group ponding, and (4) it facilitates feeding of all fish through water temperature management.

Agency pathologists, per interview, (Hager 1991), preferred a facility design which provided the following:

- Isolation of incubating groups (species). The best-case design would provide separate rooms, not rooms partitioned with moveable curtains. Each room would be separately ventilated to further reduce risk of air-borne disease transfer and include other sanitation features.

- Use of isolation buckets for retaining fertilized eggs, by female, in summer chinook salmon, spring chinook salmon, and summer steelhead. This concern is driven by diseases which may be present in the adults and transmitted via gametes.

1. Disinfection and Water-Hardening

A disinfection (sanitation) room will be provided for post fertilization disinfection and water-hardening processes to increase protection from horizontally and vertically transmitted pathogens and to help control the spread of infectious agents within the incubation facility.

Fertilized eggs will be transferred from the bio-processing area to the disinfection room. Eggs will be dipped for 5 seconds in 100 mg of active iodine per liter of pathogen-free water prior to placement into iso-buckets for 1 hour water-hardening in 100 ppm iodophor to maintain the desired 100 mg/L concentration of disinfectant (Chapman and Rogers 1990). After one hour in iodophor, pathogen-free water will be circulated/introduced to the containers to rinse disinfectant from fertilized eggs. Following water-hardening, iso-buckets will be transferred to the incubation room.

<u>Isolation Bucket Incubators</u> Iso-bucket incubation capacity will be provided equal to the number of females to be collected and retained for spawning (632).

The incubation system uses a down-welling water supply and a pair of nested buckets. Eggs are retained in the upper (inner) bucket and flow is introduced at the top of the bucket and exits downward through a screened bottom. Water level is controlled by ports cut near the top edge of the bottom bucket which serves as a "trough" for the egg bucket. Water will be delivered through mist nozzles at a rate of 18 gallons per hour (Public Utility District NO. 1 of Chelan Co. Wa. 1988).

2. Incubation Through Eyeing

Water-hardened eggs in iso-buckets will be transferred to a separate incubation room for isolation of spring chinook salmon eggs. The iso-buckets will be placed into deep troughs that will be used to control wastewater.

Eggs will remain isolated by bucket until they reach the eyed stage and the parents have been characterized for important diseases (bacterial kidney disease, viruses). Chinook salmon eggs will have accumulated approximately 450 temperature units at eyeing (Senn, et al. 1984).

Chemical treatment will be necessary to control fungus. Formalin is the only effective chemotherapeutant available presently but other agents are being actively investigated and may be available in the future.

Eyed eggs will be physically shocked (Leitritz and Lewis 1980) and allowed to stand overnight before removal of undeveloped or infertile eggs("picking"). Picking and enumeration tasks will be accomplished by a mechanical egg sorter (ibid.).

3. Eyeing Through Emergence

Vertical incubators will be used for the final phase of incubation to facilitate genetic research with up to 50 individual families (Busack 1993a). Hatching fry will be provided substrate within trays (BPA 1990). While there are several alternatives, the shallow tray incubation substrate of choice is heavy plastic netting which is folded and retained in four layers to fit within the trays (Fuss and Seidel 1987).

Following shocking and removal of dead eggs, eyed eggs from each iso-bucket (mating) will be placed into vertical incubator trays that will be arrayed in two stacked 8 tray cabinets as a "stack". In normal production use, each tray has a carrying capacity of 5,000 eggs and each 16 tray stack is provided with up to 10 gallons per minute (gpm) (Senn, et.al. 1984). The number of available vertical incubator trays should match the planned number of iso-buckets (632).

At swim-up, fry will be transferred by pipe or by tray to rearing vessels with the actual ponding date determined by visual observations, condition factor, or ventral slit measurement (Fuss and Seidel 1987). In the latter case, fry are to be ponded when the ventral slit has closed to 1-3 mm in width.

Monitoring flow and temperature of incubation process water is mandatory.

Fish Health Bacterial Kidney Disease (BKD) and IHN Virus: Egg takes from mating pairs with positive indication of virus will not be destroyed automatically but will be managed as necessary, including possible isolation of high titer groups.

Indoor Rearing Fifty troughs will be provided for the indoor rearing of family groups for genetic research (Busack 1993a). The troughs will have sufficient volume to rear each group (assuming a maximum of 5,000 fish) to a size large enough for application of coded wire tags and fin-marks (approximately 250 fish/lb).

The rearing density index will be .175 lbs/ft^3/inch of body length (BPA 1990). Assuming an average length at marking of 2.37", maximum rearing density will approximate .41 lbs per ft^3. The volume requirement per group 250/lb is 48.8 ft^3.

The maximum inflow loading rate is 2 lbs/gpm. It is approximately one-half of the recommended value cited by Piper, et al. (1982) for chinook and coho salmon at 50°F because of handling and marking stress-related considerations. Accordingly, the maximum flow requirement per trough will be 10 gpm. (Note: This quantity is only partially additive to the total flow requirement for the facility since vertical incubator flow will be available in 10 gpm increments for use as fry are ponded.)

EXPERIMENTAL TREATMENTS - FISH REARING

Spring chinook salmon juveniles will be reared under a variety of conventional and experimental conditions (treatments) in hatchery vessels and acclimation ponds. The following discussion encompasses aspects of both experimental and controlled variables (those common to all treatments) to be applied to OCT, NIT, and LNIT treatment groups.

A. Optimal Conventional Treatment

The Optimal Conventional Treatment (OCT) is a treatment that incubates, rears, and acclimates salmonids using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin.

1. Hatchery Rearing

The spring chinook salmon production goal of the Cle Elum hatchery is 810,000 spring chinook smolts weighing 54,000 pounds (Table 8.2). The production population will be separated into 18 groups, nine of which will be reared under the Optimal Conventional Treatment. The OCT fish will be reared under conditions in the hatchery and at off-site acclimation ponds that are expected to produce the highest quality and most fit hatchery fish.

Prior to the end of their rearing cycle (approximately one year post swim-up), all experimental groups will be transferred to off-site rearing ponds for acclimation and release (BPA 1990). This transfer will occur in January to assure their presence at the release site before the increase in thyroxine and other physiological indicators associated with smoltification (and effective homing)(Maynard 1993 and 1993a, Appendix A).

By the end of the hatchery rearing cycle, OCT groups will have essentially attained their maximum size per fish (15 fpp) (BPA 1990, Senn 1993) and maximum biomass of approximately 3,000 pounds. The planned size at release is within the range of release size criteria common throughout the region (Hopley 1993; Scribner 1993a; Maynard 1993b, Appendix A).

Rearing Density: controlled variable (applied to all treatments)

The maximum rearing density is 0.75 lbs/ft^3 of rearing space following the chinook salmon yearling rearing standard adopted for the design of upper Columbia basin facilities including Eastbank Hatchery (Public Utility District NO. 1 of Chelan Co. Wa. 1988). Maynard (1993c, Appendix A) summarized the results of spring chinook salmon rearing density experiments showing survival and contribution advantages provided by lower than normal pond loading rates.

Rearing Vessel: controlled variable

By definition, OCT rearing vessels should represent the current Pacific salmon production standards in length, width, depth, and inflow. Raceway vessels typically conform to a ratio of 30:3:1 for length, width, and depth, respectively (Piper, et al. 1982).

Following a literature review and a review of the PDR, Maynard (1993d, Appendix A) concluded that the recommended length and width were common to current design but the depth of 5 feet as represented in the PDR (BPA 1990) was non-conventional. He further concluded that water depth should be maintained at about 3.0 feet. The experimental design will assume a raceway design standard of 100' x 10' x 3.5' (operating depth) as the optimal conventional treatment in keeping with the Lyons Ferry raceway dimensions and current WDF design.

Raceways will be installed as separate but adjacent units. Standardization of vessels is a critical factor needed to reduce experimental variation among the vessels. Maynard (1993e, Appendix A) provides the experimental rationale for the arrangement of vessels on-site.

Vessels will, for experimental flexibility, be dividable into four equal sections and will have infinitely variable water level control. Surface skimming is required to maintain proper fish health and will be provided by two surface level overflow weirs. These will be designed to provide a means of routinely assessing pond inflow.

Inflow: controlled variable

Flow will be provided as necessary to maintain a high level of dissolved oxygen (not less than 7 ppm) (BPA 1990). In particular, raceways will be supplied with 1.44 cfs (650 gpm) through a pond-width manifold following current WDF facility design. In addition, outlet screens will also span the width of the vessel.

The fish growth model provided in the PDR (BPA 1990) uses a variable temperature profile with constant temperature from May into September for spring chinook salmon culture. Accordingly, two water supplies will be required for the culture of spring chinook salmon at Cle Elum Hatchery: (1) a production quantity surface water source to provide a fluctuating environment (water quality and temperature) needed to properly induce smoltification, and (2) a groundwater system to support production during the summer when surface water temperatures exceed the desired range for spring chinook salmon production.

General Fish Culture: controlled variables

The objective of the fish culture program is to produce high quality fish. The program will follow or modify standard practices which will be detailed or specifically referenced in facility and operations manuals.

The project will rely heavily on the collective fish culture experience of management agencies, individuals, and on current salmonid culture literature including Leitritz and Lewis (1980), Piper, et al. (1982), Senn, et al. (1984), Wood (1979), Fowler (1989), and Collinsworth and Moberly (1983).

Fish Feed/Diet *experimental variable*

"The health and well being of artificially reared fish is directly correlated with proper nutrition and feeding" (Fowler 1989).

Fowler (ibid.) summarized general nutritional recommendations, quality control, and feed-related management practices. Specific spring chinook salmon nutritional requirements are presented in Appendix D (Hardy 1993), including storage criteria related to feed moisture levels. In particular, diets available for fish production fall into general categories based upon their general moisture content as follows: "dry" - less than 11% moisture; "semi-moist" - 12-16% moisture; and, "moist" - greater than 16% moisture (ibid.).

The majority of spring chinook salmon reared at public fish culture facilities are presently started and reared to approximately 400/lb using "closed-formula" semi-moist diets. The remainder of the production is usually accomplished through the use of Oregon Moist Pellet (OMP;Hublou 1963) formulations following bid specifications. Use of semi-moist feed in full-term rearing of spring chinook salmon has been limited and not fully evaluated. Semi-moist diet trials have, however, provided favorable comparisons (growth, conversion, size variation, physiological measures) between spring chinook salmon reared on OMP and semi-moist diets (Hager, et al. 1992).

Diet Recommendations for OCT-reared fish (ibid.) are:

1. Start fry on moist or semi-moist diets.
2. Rear juveniles on moist or semi-moist diets until approximately 1 gram average size.
3. Complete rearing on OMP or similar project-specific formulations.

The upper Yakima spring chinook salmon production program will require approximately 136,000 pounds of feed annually (BPA 1990). Diet procurement will follow project-specific manufacturing and nutritional specifications as detailed in Appendix D.

Feeding Methods, Growth Schedule *experimental variable*

First feeding of spring chinook salmon will occur following yolk absorption when at least 90% of the population is free swimming (Fowler 1989). Approximately 1,665 temperature units at 50°F are required for chinook salmon fry development prior to the time of first feeding (Senn, et al. 1984).

Fish feed is commonly delivered by hand and use of several types of feeders that have a wide range in complexity and application (ibid.). Fish will be fed following Piper, et al. (1982) and Fowler (1989), at frequencies recommended by manufacturer's feeding tables, or as otherwise determined by project fish health/quality control staff.

The fish will be reared in concert with the planned temperature regime (BPA 1990) such that the projected growth schedule is followed and the desired size target is met at the appropriate time.

Pond Cleaning/Pollution Abatement: controlled variable

Pond cleaning will be a manual task. Typically, accumulated solids are removed by suction (vacuum) hose that discharges to an "off-line" pollution abatement system. Cleaning will be accomplished in a manner which will not condition fish to become attracted to large moving objects.

A "General Upland Fin-Fish Hatching and Rearing National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit" from the State of Washington Department of Ecology is required to operate fish culture facilities (Appendix D). This permit requires facilities using "off-line" waste treatment to monitor discharge to assure meeting discharge standards shown in Table 8.4 and the system performance criteria shown in Table 8.5.

Table 8.4. Effluent Limitations-- Draft NPDES permit (ibid.: SII, A, 1a.).

Parameter	Monthly Average	Instantaneous Max.
Settleable Solids	0.1 (net ml/L)	
Total Susp. Solids	5.0 (net mg/L)	15 (net mg/L)

Table 8.5. Treatment system operational criteria - Draft NPDES permit (ibid.: SII, A, 2a.).

Parameter	Monthly Average	Instantaneous Max.
Settleable Solids (% removal)	90	
Total Susp. Solids		100 (mg/L)
Total Susp. Solids (% removal)	85	

Besides meeting the above-mentioned operational/performance criteria, the off-line system must be designed to provide 24 hours hydraulic retention for the cleaning system discharge (State of Washington 1990).

2. Acclimation Rearing

Following the preferred experimental design (Hoffman et. al. IN PRESS), five acclimation sites with six ponds per site will be constructed. All ponds on each site will be supplied from a common water source and will represent each of the two treatments (OCT, NIT,). Two of these sites will be located on the Yakima River between Ellensburg and Keechelus Dam and the other on the Teanaway River. The site selection process will consider biological and environmental criteria important to supplementation objectives.

The acclimation ponds will be sized to hold 45,000 spring chinook salmon. These ponds will be of a common design with a rearing volume of approximately 4,500 cubic feet (BSWG). They will be designed with operational flexibility sufficient to accommodate experimental design requirements and, by site, will have common water supplies and drains. Smolts exiting from the ponds will access the receiving water by the pond drain system. Predators will be controlled to assure fish inventory and experimental integrity.

Sites also feature security fencing, and an alarm system with flow/level sensors. The security fencing will be installed to provide protection from furbearers and bird predation systems will be installed to assure inventory important to experimental needs. The pond outlet structure will be designed for electronic monitoring of outmigrants (smolts).

All ponds will be supplied with surface water with fluctuating temperature. Water delivery systems

will use both pumped and gravity supplies.

These vessels will be in use from January through May. Following post-release cleaning, the ponds will be drained and allowed to stand dry until the next rearing cycle.

The OCT groups will be reared in acclimation ponds without any modifications thereby representing normal practices. One of these groups will be represented in separate vessels within each of the five acclimation clusters to meet experimental design needs.

General Fish Culture: controlled variable

All acclimation ponds will be visited daily by project staff to assure project integrity and to do routine fish culture work (fish feeding, cleaning intake and outlet screens, verifying flow, recording temperature and other factors, etc.).

Rearing vessels will not be cleaned during use except as required for fish release. Mortality will be removed and counted daily and otherwise processed as necessary to meet project objectives (saving fish for later tag recovery, etc.).

Because of the rearing density and anticipated low water temperatures, it is unlikely that disease treatment will be required during the acclimation and release phase of their culture. Any disease treatment, however unlikely, will be applied consistently with proper experimental methods.

Rearing Procedures: controlled variables

The planned maximum rearing density index for acclimation ponds is 0.11 lbs/inch/ft^3 (BPA 1990). By mid-April, fish size is projected to be 15/lb attaining a peak acclimation pond loading of 3,000 lbs. (BSWG.). Volitional outmigration is expected to offset the impact of increasing water temperature on the pond loading density through mid-May.

Fish will be fed daily by hand such that nutritional needs for health and growth are met. Sampling for size and consideration of water temperature profiles will provide the basis for reducing size variability across ponds and clusters of acclimation ponds.

Predator Control: controlled variable

Predation by birds and furbearers will be controlled by the construction of fencing and bird covers to assure control of population inventory and experimental integrity.

Monitoring: controlled variable

Pond level and inflow will be monitored continuously by use of electronic technology (monitoring and telecommunication systems).

Pre-release Activities: controlled variables

Pre-release activities will involve pond cleaning next to the outlet one week prior to release to meet pollution discharge standards if pond levels are lowered to induce migration (DOE, Appendix D).

Post-release Activities: non-experimental

Post-release activities will involve removal of support equipment, pumps, intake and outlet screens, stoplogs, and any other items that could be readily taken by vandals. All exposed supply and drain piping structures will be covered.

Additionally, the ponds will be cleaned and allowed to stand dry until the next rearing season. Pond cleaning will range from addition of commercially available bacterials for aerobic digestion of fish waste to physical removal of accumulated material.

On-site waste management opportunities will be developed in concert with the State of Washington Department of Ecology such that water quality standards are not compromised. If fish are released via pond drawdown, the following effluent limits apply (ibid.):

Parameter	Instantaneous Max.
Settleable Solids	1.0 ml/L
Total Susp. Solids	100 mg/L

Accumulated solids will be hauled off-site for disposal or must be otherwise processed "so as to prevent such materials from entering waters of the state" (ibid.). Senn, et al. (1984) detailed concerns regarding the presence of the botulism organism, *Clostridium botulinum* (Type E), which may weigh against the use of fish pond waste as fertilizer. They further suggest that a fish health specialist be contacted regarding disposal of the sludge.

Fish Transportation - Juveniles: controlled variable

Spring chinook salmon juveniles will be transported from the Cle Elum Hatchery to off-site acclimation ponds for release. Preliminary planning for the project envisioned the use of a variety of fish transportation systems (BPA 1990). Hauls from Cle Elum average 20 one-way miles (ibid.). Considering haul length and loading time, fish hauling time will probably not exceed 1.5 hours.

The recommended maximum loading rate for transporting spring chinook yearlings (15 fish/lb) is 1.0 pounds per gallon at 50°F (OPTT 1992). This rate is at the lower end of the range noted by Piper, et al. (1982) for 215 fish/lb chinook salmon.

3. Research Support

Fish Marking: controlled variable

Knudsen (1993) summarized experimental and operational considerations associated with a wide variety of internal and external fish tags, visible implants, fin marks, and elemental scale marks.In addition to providing space for tag recovery as previously noted, hatchery facilities will also be designed to accommodate mobile marking units.

Use of rare earth or elemental solutions will require provisions for neutralization such as activated charcoal filters(ibid.).

Fish Handling: controlled variable

Juvenile fish handling will be accomplished using the method imposing the least stress or risk to fish health. Piper, et al. (1982) noted the importance of assuring an adequate oxygen supply, a clean handling vessel and avoidance of over-loading nets and containers, water temperature shock, etc. Transport tank loading will be mechanized using fish pumps or Archimedes screw technology.

Randomization

Zero-age fish, including family groups will be randomly distributed into each of the treatment sub-populations (groups) before placement into separate vessels (treatments). Randomization will occur at the eyed-egg stage concurrent with automated removal of dead eggs and enumeration of viable eggs. Use of automatic systematic random sampling equipment is envisioned.

4. Behavior Techniques: *experimental variable*

Does not apply.

5. Exercise: *experimental variable*

Does not apply.

6. Vessel Modifications

Raceway Color: *experimental variable*

Does not apply.

Overhead Cover: *experimental variable*

Does not apply.

7. In-water Structure: *experimental variable*

Does not apply.

8. Substrate: *experimental variable*

Does not apply.

9. Subsurface filtration: *experimental variable*

Does not apply.

B. New Innovative Treatment

New Innovative Treatment (NIT) is a treatment that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrate, in-water structure)to produce

fish with attributes that approximate those of naturally produced spring chinook. [2]Details of this treatment are being further developed.

This section describes the New Innovative Treatment of planned upper-Yakima River spring chinook salmon supplementation research. Five groups of these fish will be reared from initial feeding through release under artificial production circumstances that have been modified physically and procedurally to fit experimental purposes.

Anticipated experimental rearing and release methods and procedures are detailed below.

1. Hatchery and Acclimation Rearing

As previously noted, the spring chinook salmon production goal of the Cle Elum Hatchery-based activities is 810,000 fish weighing 54,000 pounds. Rearing of the NIT portion (405,000 fish) will be accomplished with methods intended to allow enhancement of behavioral, morphological, and physiological characteristics that are important to survival.

Rearing Density: controlled variable

Since the benefits of lower rearing density on survival have been demonstrated (Banks 1990), and the project has chosen an optimal rearing density for OCT fish, the NIT fish will be reared at the same density as OCT fish in raceways and acclimation ponds.

Rearing Vessels: controlled variable

(see OCT)

Inflow: controlled variable

(see OCT)

General Fish Culture: controlled variables

Routine fish culture practices other than those discussed below will be standardized across all treatments.

Fish Feed/Diet: *experimental variable*

NIT fish diets will be supplemented with live organisms throughout their hatchery rearing period to condition released spring chinook salmon smolts to forage more effectively on naturally occurring food organisms. They will otherwise be fed with the OCT diet or possibly with an alternate prepared diet resembling the constituents of natural feed. Diets for NIT use will be manufactured following specifications that provide the desired nutrition requirements and appropriate feed delivery characteristics.

NIT fish will be fed caloric amounts equal to OCT and LNIT treatment groups.

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(2). Yakima/Klickitat Fisheries Project Planning Status Report 1992

Feeding Methods: *experimental variable*

Floating pellet feed will be introduced underwater. Feed delivery will be mechanical and sequenced to follow natural biorhythms from dawn to dusk. Feeding frequency will be appropriate to achieve proper growth.

Growth Schedule: controlled variable

(see OCT)

Pond Cleaning/Pollution Abatement: controlled variable.

a. Raceways: The raceway cleaning system will be designed to work effectively over natural substrates and will not condition fish to seek moving objects.

b. Acclimation Ponds: Cleaning will only take place as necessary to prepare the vessels for smolt release. It is expected that this will be limited to the area next to the outlet structure where settled solids could be disturbed with pond drawdown or increased exit velocity.

Fish Transportation - Juveniles: controlled variable

(see OCT)

Predator Control: controlled variable

Predation by birds and furbearers will be controlled by the construction of fencing and bird covers to assure control of population inventory and experimental integrity. Predator avoidance training is discussed below.

Monitoring: controlled variable

2. Research Support

Fish Marking: controlled variable

(see OCT)

Randomization: controlled variable

(see OCT)

3. Behavior Techniques: *experimental variables*

Predator Avoidance Training: Avoidance training methodology will be applied to NIT experimental groups to allow fish to avoid predators. Fish will be trained to avoid predaceous fish, birds, and possibly mammals.

Conditioning may: (1) follow the approach of Thompson (1966) in which fish were trained with electrified model predators; (2) the approach of Olla and Davis (1989) in which fish were conditioned

by exposure of fish to predators; or (3) be achieved by the placement of predators in cages in rearing vessels.

4. Exercise: *experimental variable*

Exercise is envisioned as a means of improving fish performance. This may be accomplished by the use of pumps or temporarily configuring vessel water supplies to create increased water velocities in raceways and acclimation ponds.

The planned exercise velocity will be one fish body length per second (Maynard 1993f, Appendix A).

5. Vessel Modifications: *experimental variable*

It is expected that standard raceways will be modified to improve fish quality and ultimately to achieve higher post-release survival ("quality").

Overhead Cover Overhead cover will be applied at a covered-to-uncovered ratio of 4:1 (ibid.).

a. Raceways: Use of overhead cover will allow fish to become adapted to natural structures to avoid predation. It is expected that the effect of an undercut bank will be achieved by using pond-width aluminum-frames covered with camouflage netting. Approximately 80% of the raceway surface will be covered.

b. Acclimation Ponds: Use of floating covers will facilitate fish culture activities and meet experimental needs as well.

6. In-water Structure: *experimental variable*

Use of in-water structures is envisioned to create a varied rearing environment in both raceways and acclimation ponds. While specifics are not available, it is expected that the materials used may be as simple as denuded vegetation or more complex, being constructed to meet the need.

7. Substrate: *experimental variable*

Vessels will be designed to allow randomization of vessels and substrate between years as required by experimentation.

Raceway Color Donnelly (1991) and Maynard (in preparation) indicate that fish exposed to a rearing environment of the color matching that of the natural background of the area into which the fish will be released can be cryptically adapted. A period of at least seven weeks is required for full chromatophore expression.

Raceways will be modified to achieve the appropriate condition as determined by field use of colorimetric methods.

Substrate

a. Raceways: The bottom of each NIT raceway will be covered with gravel substrate of color

similar to the general river substrate over which they will be released. The raceway walls will be painted to resemble stream background coloration.

b. Acclimation Ponds: Acclimation ponds will be lined with river rock.

8. Subsurface Filtration: *experimental variable*

A rough substrate has the potential to collect settleable solids and improve environmental conditions within the formal rearing vessels through the actions of decay organisms.

a. Raceways: The bottom of each NIT raceway may be equipped with a substrate biological filtration system to enhance decomposition of organic materials that cannot be removed otherwise.

b. **Acclimation:** does not apply.

C. Limited New Innovative Treatment

This report section describes the Limited New Innovative Treatment, an alternate treatment that may eventually be tested with upper Yakima spring chinook salmon supplementation research. Nine groups of spring chinook salmon will be reared from incubation through transfer to acclimation ponds under normal artificial production (OCT). Their rearing will be completed in acclimation ponds under modified physical conditions identical to NIT procedures.

LNIT is a treatment applied to spring chinook salmon that uses the OCT during the incubation and rearing phase and uses the NIT during the smolt acclimation/release phase.

1. Hatchery Rearing

As previously noted, the spring chinook salmon production goal of the CleElum Hatchery-based activities is 810,000 fish weighing 54,000 pounds. The production population will be separated into 18 treatment groups, nine of which could eventually be reared under standard (OCT) rearing conditions in raceways until transfer to acclimation ponds.

Except as noted under B (NIT) above, all variables associated with LNIT rearing will be controlled and identical to those discussed under A (OCT) above. As such, routine fish culture practices other than those discussed below will be standardized across all treatments.

Rearing Density: controlled variable

(see OCT)

Rearing Vessel: controlled variable

(see OCT)

Inflow: controlled variable

(see OCT)

General Fish Culture: controlled variables

(see OCT)

Fish Transportation - Juveniles: controlled variable

(see OCT)

Fish Feed/Diet: *experimental variable* - identical to OCT

(see OCT)

Feeding Methods, Growth Schedule: Identical to OCT

(see OCT)

2. Acclimation Rearing

The LNIT groups will be separately reared in semi-natural (NIT) condition in acclimation ponds. Rearing in acclimation ponds will be accompanied with methods intended to allow expression of behavioral, morphological, and physiological characteristics that are important to survival.

Except as noted under B (NIT) above, all variables associated with rearing will be controlled and identical to those discussed under A (OCT) above. Routine fish culture practices other than those discussed below will be standardized across all treatments.

Fish Feed/Diet: *experimental variable* - identical to NIT

Feeding Methods: *experimental variables* - identical to NIT

Growth Schedule: controlled variable - identical to OCT

3. Research Support

Fish Marking: controlled variable - identical to OCT

Randomization: controlled variable - identical to OCT

4. Behavior Techniques: *experimental variable*

Raceways: identical to OCT

Acclimation Ponds: identical to NIT

5. **Exercise:** *experimental variable*

   Raceways: identical to OCT

   Acclimation Pond: identical to NIT

6. **Vessel Modifications:** *experimental variable*

   Raceway Treatment: identical to OCT

   Acclimation Pond: identical to NIT

7. **In-water Structure:** *experimental variable*

   Raceway Treatment: identical to OCT

   Acclimation Pond: identical to NIT

8. **Substrate:** *experimental variable*

   Raceway Treatment: identical to OCT

   Acclimation Pond: identical to NIT

9. **Sub-surface Filtration:** *experimental variable*

   Raceway Treatment: identical to OCT

   Acclimation Pond: sub-surface filtration will not apply in acclimation ponds.s

STANDARD RELEASE TREATMENTS

Fish will be allowed to outmigrate volitionally from acclimation ponds and the ponds will be managed in terms of inflows and water levels to minimize residualizing fish.

Procedures Smolt release procedures will follow the experience of WDF in other upper Columbia drainages (primarily the Snake, Wenatchee, and Methow river systems). Generally, screens will be removed at the onset of migration to provide smolts an opportunity to outmigrate without interruption.

Enumeration Migrating fish will be counted as they pass out of the acclimation ponds through or past sensing heads of electronic fish counters. The outlet structure design will reflect current management agency experience with fish counters.

9.0 Monitoring

Monitoring has been planned to track project progress toward meeting objectives. Related to monitoring is the management and dissemination of information so that project results are available in a timely manner and a usable form.

The plan is organized into five sections according to monitoring: Quality Control, Product Specifications, Research, Risk Containment, and Stock Status. These groupings are not absolutely distinct; they simply provide a systematic way to present monitoring needs for each purpose. Monitoring activities to address all five purpose categories are then integrated into a single non-duplicative monitoring plan. This plan identifies measurements to be taken monitor experimental response variables and to contain risks associated with uncertainty. Future iterations of this plan will include more details on sampling methods and frequencies and a detailed quality-control program. The level of detail here is deemed sufficient to proceed with NEPA documentation and design of facilities for supplementation of Upper Yakima spring chinook .

Quality-Control Monitoring

The purpose of quality-control (QC) monitoring is to (1) assure that fish culture and monitoring activities are conducted as intended, (2) reduce to a minimum the variation from manageable sources other than experimental treatments (3) assure the validity of the data collected, (4) assure proper record keeping and access to information, and (5) provide information needed for cost-effective operation. Quality control monitors performance of the facilities and their operators. Quality standards will be established for all fish-culture and data-collection activities. Quality-control monitoring procedures will be included in the operations manuals for all facilities and field activities.

Development of quality-control standards and monitoring protocols is a part of the certification tasks described in the URP. No further details about QC monitoring are covered in this section at this time. As the certification process proceeds, this portion of the monitoring plan will be expanded.

Feedback from QC monitoring affects management and supervision of operational activities. It does not affect the treatment prescriptions. When QC standards are met, it is assumed that various treatments are being applied according to stated protocols .

QC monitoring protocols are modified in response to changes in the treatment prescription, i.e. when the "Treatment Definitions and Descriptions" section of Chapter 8 is altered (e.g., through the results of product-specification monitoring).

Product Specification[3]

Product specification monitoring is an extension of quality control, where the "product of the artificial environment" is monitored and compared with a defined template. For the NIT, this template consists of a profile describing the natural ideal in terms of a set of measurable attributes (Assumption #325). For OCT, it is the standard used in conventional culture (Assumption # 21). The product of the artificial environment for the NIT treatment is described in terms of a history of attributes (measurements) of a group of fish from the selection of their parent broodstock to their liberation from the acclimation sites. The purpose of the NIT treatment is to produce attributes similar to natural fish. For the OCT, the product definition is obtained from other facilities or from the literature.

Monitoring at this level measures how well the defined treatments (NIT/ and OCT) meet their respective product specifications. The product specifications are stated in terms of attributes describing health, morphology, behavior and survival of hatchery fish (see Vol. 3, Chap. 8).

Part of the product specification for NIT is an in-facility survival standard that requires pre-spawning and egg-to-smolt survival to exceed 80% and 65%, respectively. Survival by life stage from spawners trapped at Roza to the release of their offspring into the natural environment will therefore be monitored.

Product specification attributes include both static end-point measurements and growth and development profiles of hatchery fish over time (i.e., histories of attribute measurements). They include both population means and descriptors of diversity (frequencies and/or variances). Table 9.1 lists the measurement categories to be monitored, while the fish are still within the artificial environment.

Table 9.1. Categories of Observations needed to Monitor Product Compliance.

Attributes		at Release		monthly
		mean	frequency	record
Fish Health	Physiology Disease	x x		x
Morphology	Morphometrics Crypsis	x x	x	x
Behavior	Migration time Social	x x	x x	
Survival	by stage	x		x

Product-specification monitoring collects information about the fish. Feedback affects the

(3) The term "Performance" which was used in Chapter 9 of the PSR comes from the FWP framework terminology where e.g. "performance" of a flow strategy is measured as changes in travel time. We use "Product Specification" here to avoid confusion, since elsewhere we use the term "performance" to indicate survival, fitness etc.

Treatment Definitions and Descriptions (Chapter 8) and the Operations Manual. When specifications are met, the treatments are assumed appropriate and the supplementation strategies and experimental protocols are implemented as planned, i.e., the Treatment Definitions and Descriptions and the Operations Manual are meeting project objectives. When observations suggest that the fish do not meet the specification, a determination of the needed changes must be made. Changes are then implemented through modifications to the Treatment Definitions and Descriptions and/or the Operations Manual.

The Product Specifications are modified based on results of research and risk-containment monitoring or new policy direction affecting objectives and strategies.

Research

There are critical uncertainties regarding both the artificial and natural environments within which the YFP supplementation project operates. Research activities are planned to test alternatives in the artificial environment (treatment effectiveness testing, e.g., NIT vs. OCT) and to compare performance of artificially and naturally reared fish (e.g., NIT vs. Natural). Assumption #200[4], for example, pertains to the relative performance of supplementation and natural fish, whereas #201 and #202 pertain to differences between NITs and OCTs.

Success of the YFP also depends upon a progressively better understanding of the ecological interactions among and within species in the Yakima Basin. There are critical uncertainties about both intra- and inter-specific effects of supplementation. Research pertaining to the dynamics of the ecosystem is described under the heading of PTA (Patient Template Analysis) below.

Treatment Effectiveness Testing

A fundamental hypothesis is that new innovative hatchery treatments (NITs) will improve performance of treated fish significantly over optimal conventional treatments (OCTs) (see assumptions #201 and #202). YFP experiments are specifically designed to test this hypothesis. The monitoring requirements for testing specific hypotheses about differences between NIT and OCT in terms of measurable response variables[5] are identified in this subsection.

The different test treatments are compared in terms of performance with respect to survival, reproductive success, and in a more limited sense to long-term fitness[6] and ecological

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(4) Assumption #200: "Release of smolts that mimic natural fish ensures that post-release survival is greater than half the survival of wild smolts."

(5) The term performance refers to quantitative and qualitative characteristics of groups of fish including fitness,survival, life-history and ecosystem interactions. Performance is observed and measured in terms of response variables.

(6) While the intent of the NIT treatment is to minimize genetic effects due to supplementation, the ability to compare long term fitness among treatments is very limited. Straying rates into the Naches and American Rivers can perhaps be compared between treatments as a partial measure of adverse genetic impact. Genetic monitoring of the YFP is also covered under Risk Containment.

interactions[7]. The experiment described in Chapter 6 is designed to detect a 50% difference in survival among treatments with 90% certainty. Response variables for testing hypotheses for the NIT-OCT comparison experiment are outlined in Table 9.2. Observations required (i.e., where, what and why) to compute response variables are summarized in Table 9.3.

Comparing hatchery and natural fish

Assumption #200 is critical to the success of supplementation. The operation of Chandler Juvenile Monitoring Facility allows the comparison of survival between OCT and NIT smolts from release in the upper Yakima to smolts at Chandler, as well as estimates of survival from egg to smolt for natural and hatchery fish. The juvenile monitoring facility at Roza may also prove valuable although its operation and utility are not comparable to Chandler at this time. The comparison of morphometrics, behavior, and survival of OCT, NIT and naturally produced smolts that survive to Chandler may help to refine the product specifications for improving the NIT. The estimation of survival from smolt to returning adults can also be made as returning adults are monitored at the fish ladders on Chandler and Roza dams.

Another opportunity to compare performance of natural and hatchery fish occurs when the adults return to Roza. Representative subsamples of hatchery and natural-origin fish can be marked and tracked allowing their spawning distribution, timing, and egg-deposition success to be compared.

Tables 9.2 and 9.3 outline the monitoring plans for the NIT vs. Natural fish hypothesis testing.

Patient-Template Analysis

An essential part of the YFP planning process is the so-called Patient-Template Analysis (PTA) where factors limiting production are identified. The PTA is a part of an iterative process by which assumptions about the relationships between life histories and habitat are updated as new information is obtained and analyzed. New information from PTA may result, for example, in a modification of the template for the NIT.

A preliminary PTA (RASP 1991) has been conducted and a draft report is in preparation for upper Yakima spring chinook. Additional analysis of existing data will provide a better understanding about the factors limiting spring chinook production in the Yakima Basin.

The Natural Production Objectives analysis and subsequent risk assessment have pointed out the critical nature of assumptions concerning intra-specific ecological interactions during the smolt outmigration. The feasibility of developing experiments to test hypotheses regarding the effects of hatchery fish on smolt-to- smolt survival of natural fish should be investigated. These uncertainties are reflected in the risk-containment monitoring plan.

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(7) No ecological response variables are identified to compare interaction effects of NIT and OCT fish. Ecological interactions are subject to research under the PTA topic.

Table 9.2. Response Variables to Test Hypotheses

Population Response Categories	NIT vs OCT Response Variables for Hypothesis Testing	Hatchery vs Natural Response Variables for Hypothesis Testing
Post-Release Survival	Survival from Smolt at release to smolt at Chandler	Survival from smolt at Chandler to returning adult at Chandler and Roza
	Survival from smolt at Chandler to Adults at Chandler and Roza	
Reproductive Success	Returning Adults at Roza (by#,age,sex, and time)	Spawning (time, loc, eggs/carc.) from Tagged samples (Roza) of (OCT,NIT) vs Natural adults. Returns/Spawner[a] Smolts/Spawner
	Straying rate into Naches & American Rivers	
	Spawning (time, loc, eggs/carc.) from Tagged samples (Roza) of OCT vs NIT adults.	
Long-Term Fitness	Straying Rate into Naches & American Rivers	To be specified in GMP
Ecological Interactions	To be specified	To be specified

(a) This is a highly variable statistic that in nature varies with density as well as with environmental conditions throughout their life-history, consequently the statistical power of tests based on this response variable is expected to be very poor. However because of the unusual opportunity to intercept and account for all adults returning to Roza, it can be measured and would provide a record of outcomes by brood year.

Risk Containment

Analysis of results from all monitoring levels contribute to decisions about the future of the project. The purpose of risk containment is to identify monitoring needs and to organize information required to make rational decisions based on projected benefits and risks. This is where we test the hypothesis that supplementation in fact works.

The statement of objectives in quantitative and qualitative terms defines project success. When these objectives are met or exceeded, the project' s continuation is justified. Conversely, failure to meet objectives suggests that the project should be significantly modified or perhaps ended. Our ability to distinguish success from failure depends upon the quality of the risk-containment monitoring

program. Conclusions about project success (i.e., achievement of objectives) are manifested in decisions to continue or to reshape the project. These decisions are never final; they are reexamined on an iterative basis according to the policy of adaptive management. At each such iteration, an assessment is made regarding benefits and risks of the project, and the conclusions are affected by the results of new information. The question whether or not supplementation "works" is thus constantly reexamined ,and the conclusion is always conditioned upon available information. The decision to continue to supplement is synonymous to a conclusion that supplementation works (i.e., the benefits exceed the risks) at that point in time.

The determination of both risks and benefits requires a synthesis of all available information. This monitoring section should specify information needed to perform this synthesis, beyond what is needed to address the other four monitoring levels. The identification of the risk-containment monitoring needs is performed in a systematic way as described in Chapter 7, Risk Analysis.

The risk analysis defines risk in terms of failure to meet objectives in four categories: genetics, experimentation, ecological interaction/ natural production, and harvest. The monitoring needs for all four categories have been integrated in Table 9.3. The risk analysis provides the rationale for the entries in the table (see Chapter 7).

The entries in the second column of Table 9.3 are defined as follows:

ADLT MARK interr = sampling of adult fish; identifying whether or not they are marked; if they are marked ,the mark is decoded and the experimental treatment and replicate group of the fish are determined; a set of observations are recorded for each sampled fish including, time, location, size, sex, and other benign measurements; subsamples may also be subjected to tissue sampling as needed.

ADLT ENUM = enumeration of fish by externally observable categories (e.g., marked vs .unmarked).

REDDS = observations on the spawning grounds, such as no. fry/redd, and also biosampling of carcasses.

GroupMARK = application of unique marks to juveniles of each replicate group, that can be decoded on returning adults (without harming the fish).

ADULT TAGGING = application of individually unique marks to adults that are passed upstream at Roza or natural spawning. Representative subsamples of NIT, OCT, LNIT, and unmarked fish are selected and marked. These fish are subsequently tracked and observed on the spawning grounds, where time and location of spawning are recorded; redds and carcasses may also be examined.

The scope of the monitoring program may change as more information about needs and feasibility become available. The elements listed in Table 9.3 represent the high-priority monitoring needs that are also judged feasible based upon current technology.

Density and distribution(time, space and habitat type) by life stage are identified as high-priority monitoring needs in the risk analysis for natural production and ecological interactions. Sampling plans to address this need will be addressed following completion of the Patient Template Analysis.

Stock Status Monitoring

Monitoring of stock status (run size and spawning escapement) provides information essential to track long-term performance and fitness of the population. Monitoring needs for in-season run size assessment are included under risk containment monitoring (see Chapter 7 and Table 9.3). Stock status information includes abundance and distribution (by time, location, and habitat type) as well as other demographics. Target and key non-target species would be monitored.

Table 9.3. Summary of Observations needed to Compute Response Variables

MONITORING LOCATIONS (Where)	MEASUREMENT (What)	MONITORING PURPOSE(8) (Why)			
		Product Specs	Research/Hyp	Risk Containm.	Stock Status
		1) Fish health 2) Morphology 3) Behavior 4) Survival	1) NIT vs OCT 2) Natural vs NIT 3)PTA	1. Genetics 2. Ecological 3. Experimental 4. Harvest	1. Run Size 2. Escapement
CE Hatch	ADLT ENUM GroupMARK attrib/surv histories	 1,2,3,4 1,2,3,4	 1,2,3	1,2,4	1,2 1,2
Accl Pnds	NBR(time,size) Rand Biosample IND MARK subs	2,3,4 1 4			
Roza JV	attr of Hat fish? MARK interrog att of NAT fish	1,2,3 4 1,2,3	3 1, 2 3		
Chandler JV	attr of HAT fish attr of NAT fish MARK interrog	1,2,3 1,2,3 4	3 3 1,2		
Test Fishery	ADLT MARK interr		1,2	4	1
Prosser AD	ADLT MARK interr ADLT ENUM		1, 2	1,3,4 1,4	1 1
Fishery	ADLT MARK interr ADLT ENUM		1	1,3,4	1 1
Roza AD	ADLT MARK interr ADLT ENUM ADULT TAGGING		1 2 2	1,3,4 3	1 1
UY Spwg	ADLT MARK interr ADLT ENUM		1,2	1,4	2 2
Na Spwg	ADLT MARK interr ADLT ENUM		1,2	1,4	2 2
Am Spwg	ADLT MARK interr ADLT ENUM		1,2	1,4	2 2

(8) Quality Control Monitoring is not included.

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11.0 Amendments

The following lists document annual amendments to the Planning Status Report. Amendments may be submitted by interested parties at any time. Amendments will be reviewed by the Scientific and Technical Advisory Committee and forwarded to the Policy Group. Accepted amendments will be incorporated into the Project Planning Status Report (PSR). An updated PSR will be printed and distributed on approximately an annual basis. Project Planning Status Reports have been updated in February, 1993; May, 1994; and May, 1995.

Amendments

1993 Amendment	Location	Justification	Petitioner
65-93	Vol. 3, Summary Table S.1, page vi	Achieve consistency among stocks	PAG reviewers
66-93	Vol. 3, Summary Table S.1, page vi	Achieve consistency among stocks	PAG reviewers
67-93	Vol. 3, Summary Table S.1, page vi	Achieve consistency among stocks	PAG reviewers
68-93	Vol. 3, Summary Table S.1, page vii	Achieve consistency among stocks	PAG reviewers
69-93	Vol. 3, Summary Table S.1, page vii	Achieve consistency among stocks	PAG reviewers
70-93	Vol. 3, Summary Table S.1, page vii	Achieve consistency among stocks	PAG reviewers
71-93	Vol. 3, Summary Table S.1, page vii	Achieve consistency among stocks	PAG reviewers
72-93	Vol. 3, Sect. 4, page 4.1	Achieve consistency among stocks	PAG reviewers
73-93	Vol. 3, Sect. 4, page 4.2	Achieve consistency among stocks	PAG reviewers
74-93	Vol. 3, Sect. 5, Table 5.1, page 5.3	Achieve consistency among stocks	PAG reviewers
75-93	Vol. 3, Sect. 5, Table 5.1, page 5.3	Achieve consistency among stocks	PAG reviewers
76-93	Vol. 3, Sect. 5, Table 5.1, page 5.3	Achieve consistency among stocks	PAG reviewers
77-93	Vol. 3, Sect. 5, Table 5.1, page 5.3	Achieve consistency among stocks	PAG reviewers
78-93	Vol. 3, Sect. 5, Table 5.1, page 5.3	Achieve consistency among stocks	PAG reviewers
79-93	Vol. 3, Sect. 5, Table 5.1, page 5.3	Achieve consistency among stocks	PAG reviewers
80-93	Vol. 3, Sect. 5, Tables 5.2 and 5.3, page 5.4	Achieve consistency among stocks	PAG reviewers
81-93	Vol. 3, Sect. 5, Tables 5.2 and 5.3, page 5.4	Achieve consistency among stocks	PAG reviewers
82-93	Vol. 3, Sect. 5, Tables 5.2 and 5.3, page 5.4	Achieve consistency among stocks	PAG reviewers
83-93	Vol. 3, Sect. 5, Tables 5.2 and 5.3, page 5.4	Achieve consistency among stocks	PAG reviewers
84-93	Vol. 3, Sect. 5, Tables 5.3, page 5.5	Achieve consistency among stocks	PAG reviewers
85-93	Vol. 3, Sect. 5, Tables 5.3, page 5.5	Achieve consistency among stocks	PAG reviewers
86-93	Vol. 3, Sect. 5, Tables 5.3, page 5.5	Achieve consistency among stocks	PAG reviewers
87-93	Vol. 3, Sect. 5, Tables 5.3, page 5.5	Platts and Henry (1988) as cited in R. Wiley peer review of 1992 PSR	R. Wiley
88-93	Vol. 3, Sect. 5, Tables 5.3, page 5.6	Achieve consistency among stocks	PAG reviewers
89-93	Vol. 3, Sect. 5, Tables 5.3, page 5.6	Achieve consistency among stocks	PAG reviewers
90-93	Vol. 3, Sect. 5, Tables 5.3, page 5.6	Achieve consistency among stocks	PAG reviewers

91-93	Vol. 3, Sect. 5, Tables 5.3, page 5.6	Achieve consistency among stocks	PAG reviewers
92-93	Vol. 3, Sect. 5, Tables 5.3, page 5.7	Achieve consistency among stocks	PAG reviewers
93-93	Vol. 3, Sect. 5, Tables 5.3, page 5.7	Achieve consistency among stocks	PAG reviewers
94-93	Vol. 3, Sect. 5, Tables 5.4, page 5.8	Achieve consistency among stocks	PAG reviewers
95-93	Vol. 3, Sect. 5, Tables 5.4, page 5.8	Achieve consistency among stocks	PAG reviewers
96-93	Vol. 3, Sect. 6, page 6.1	Statement clarification	D. Neeley
97-93	Vol. 3, Sect. 6, page 6.3	Statement clarification	D. Neeley
98-93	Vol. 3, Sect. 6, page 6.3	Statement clarification	D. Neeley

1994 Amendment	Location	Justification	Petitioner
4-94	Vol. 3, Table 5.3, page 5.7	Add resolvable uncertainty #325	PAG
5-94	Vol. 3, Summary Table S.1, page v Vol. 3, Sect. 3, page 3.1	Add new natural production objectives #3 and #4	PAG - PG
	Vol. 3, Sect. 4, page 4.1 Vol. 3, Sect. 4, page 4.2	Add new natural production strategy #3 Delete old natural production strategy #3	PAG - PG
	Vol. 3, Sect. 5, Table 5.3, page 5.6	Delete resolvable uncertainty #195	PAG
	Vol. 3, Sect. 5, Table 5.3, page 5.6	Delete resolvable uncertainty #198	PAG
	Vol. 3, Sect. 5, Table 5.1, page 5.3	Add accepted assumption #326	PAG
	Vol. 3, Sect. 5, Table 5.1, page 5.3	Add accepted assumption #329	PAG
	Vol. 3, Sect. 5, Table 5.1, page 5.4	Add accepted assumption #331	PAG
	Vol. 3, Sect. 5, Table 5.1, page 5.4	Add accepted assumption #332	PAG
	Vol. 3, Sect. 5, Table 5.1, page 5.4	Add accepted assumption #338	PAG
	Vol. 3, Sect. 5, Table 5.4, page 5.9	Add resolvable uncertainty #327	PAG - PG
	Vol. 3, Sect. 5, Table 5.4, page 5.9	Add resolvable uncertainty #328	PAG - PG

	Vol. 3, Sect. 5, Table 5.4, page 5.9	Add resolvable uncertainty #333	PAG - PG
	Vol. 3, Sect. 5, Table 5.4, page 5.9	Add resolvable uncertainty #334	PAG - PG
	Vol. 3, Sect. 5, Table 5.4, page 5.9	Add resolvable uncertainty #335	PAG - PG
	Vol. 3, Sect. 5, Table 5.4, page 5.10	Add resolvable uncertainty #336	PAG - PG
	Vol. 3, Sect. 5, Table 5.4, page 5.10	Add resolvable uncertainty #337	PAG - PG
	Vol. 3, Sect. 5, Table 5.4, page 5.10	Add resolvable uncertainty *#new*	PG
6-94	Vol. 3, Section 7.0	Update	PAG
	Vol. 3, Sect. 7, page 7.1	Clarification	PG
	Vol. 3, Sect. 7, page 7.1	Clarification	PG
7-94	Vol. 3, Section 9.0	Update	PAG

1995 Amendments	Location	Justification	Petitioner
1-95	Vol. 3, Preface, page ii	change PSR date	STAC/PG
	Vol. 3, Summary, par. 1, page iii	update supplementation scope	STAC/PG
	Vol. 3, Summary, par. 3, page iii	revision to experimental design	STAC/PG
	Vol. 3, Table S.1, page iv	update genetic strategy	STAC/PG
	Vol. 3, Table S.1, page v	update nat. prod. objective	STAC/PG
	Vol. 3, Table S.1, page v	revision to nat. prod. strategy numbers	STAC/PG
	Vol. 3, Table S.1, page vi	revision to experimentation strategy numbers	STAC/PG
	Vol. 3, Sect. 3, page 3.1	update Nat Prod Obj #3	STAC/PG
	Vol. 3, Sect. 4, page 4.1	add Genetic Strategy #7	STAC/PG
	Vol. 3, Sect. 4, page 4.1	update Nat Prod Strategy #3	STAC/PG
	Vol. 3, Sect. 4, page 4.2	update Experimental Strat. #7	STAC/PG
	Vol. 3, Sect. 5, page 5.8	update uncertainty #335	STAC/PG
	Vol. 3, Sect. 6, all	chapter redrafted to present updated experimental designs	STAC/PG

	Vol. 3, Sect. 7, page 7.1	change date of PSR	STAC/PG
	Vol. 3, Sect. 8, page 8.1	restate LNIT treatment	STAC/PG
	Vol. 3, Sect. 8, page 8.2	restate LNIT treatment	STAC/PG
	Vol. 3, Sect. 8, page 8.5	restate LNIT treatment	STAC/PG
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	Vol. 3, Sect. 8, page 8.1	revision to number and pounds of smolts	STAC/PG
	Vol. 3, Sect. 8, page 8.5	revision to number and pounds of smolts	STAC/PG
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	Vol. 3, Sect. 8, page 8.24	revision to number and pounds of smolts	STAC/PG
	Vol. 3, Sect. 8, Table 8.2, page 8.6	revision to number and pounds of smolts	STAC/PG
	Vol. 3, Sect. 8, Table 8.3, page 8.9	revision to number and pounds of smolts	STAC/PG
	Vol. 3, Sect. 8, page 8.8	revision to number of adults	STAC/PG
	Vol. 3, Sect. 8, Table 8.3, page 8.6	revision to number of adults	STAC/PG
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	Vol. 3, Sect. 9, par. 5, page 9.1	clarification	STAC/PG

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	Vol. 3, Sect. 9, par. 1, page 9.2	deleted footnote	STAC/PG
	Vol. 3, Sect. 9, page 9.2	clarify LNIT description	STAC/PG
	Vol. 3, Sect. 9, par. 2, page 9.2	reorder for consistency	STAC/PG
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	Vol. 3, Sect. 9, Table 9.1, page 9.2	add fish health record	STAC/PG
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	Vol. 3, Sect. 10	revision to content	STAC/PG

Yakima/Klickitat Fisheries Project Planning Status Report 1995

Volume 5: Yakima Coho Salmon

December 1995

Prepared for
Bonneville Power Administration
Portland, Oregon

Preface

This is Volume 5 of eight volumes of the 1995 Planning Status Report[a] for the Yakima/Klickitat Fisheries Project. It contains an introduction detailing background information, project philosophy, and document organization, followed by specific information on Yakima coho salmon. A general summary of project planning for all species may be found in Volume 1. Detailed information for species other than Yakima coho salmon may be found in the following volumes:

- Volume 2: Yakima Fall Chinook Salmon
- Volume 3: Yakima Spring Chinook Salmon
- Volume 4: Yakima Summer Chinook Salmon
- Volume 6: Yakima Summer Steelhead
- Volume 7: Klickitat Spring Chinook Salmon
- Volume 8: Klickitat Summer Steelhead.

(a) NOTE: Not all volumes have been updated for 1995.

Summary

The immediate YKFP goal for Yakima coho salmon is to determine the feasibility of reestablishing a naturally spawning coho population and a significant fall fishery for coho, while keeping adverse ecological impacts within acceptable limits.

The indigenous stock of coho is believed to be extinct. Naturally spawning coho salmon occurring in the Yakima River Basin are considered the result of hatchery outplantings. In 1996, coho salmon will not be released under the auspices of YKFP in the Yakima River Basin upstream from Wapato Dam. The YKFP does not currently release of coho salmon into the Yakima River. Annual releases of 700,000 coho smolt have been conducted in the past as part of the Columbia River Fish Management Plan. Coho have been released under the auspices of that program since 1983. In earlier years, smolt were released directly into the Yakima River, without acclimation or additional rearing. Since 1994, however, these fish have been released from acclimation facilities downstream from Wapato Dam. While the acclimation and release program are *not* funded by BPA under YKFP, fish being acclimated and released under the CRFMP program would be used by YKFP in the proposed studies. Releases might also be sponsored under Mitchell Act reprogramming initiatives.

The essential elements of the Yakima coho salmon program are captured in the objectives and strategies (Table S.1). Coho smolt survival will be monitored at the Chandler Juvenile Evaluation Facility and at selected sites in the river to determine food habits of the smolt. This study is designed to evaluate the potential risk of coho smolt predation on juvenile fall chinook primarily, with consideration also for other species of concern (e.g. rainbow/steelhead trout). Returning adults will be enumerated at Prosser Dam fish ladders and in the various fisheries to determine smolt-to-adult survival rates.

Coho strategies are based on 10 assumptions, 9 of which are considered resolvable. Many of these will likely be reclassified as unresolvable once the feasibility of resolution has been reviewed further. Risks associated with unresolvable uncertainties are managed through risk containment monitoring. Uncertainty resolution is an iterative process that is managed through the application of adaptive management.

To date, coho salmon experimentation using the YKFP facilities has received limited consideration. The coho salmon experimental program has been only a small-scale experiment designed to determine possible interactions with juvenile fall chinook salmon. Experimental design is now being developed for this stock. Experimentation for addressing the resolution of coho salmon releases and reintroduction will provide information to facilitate future planning for Yakima coho salmon.

Studying Yakima coho salmon requires permanent and temporary facilities/structures to implement the program that is currently considered. Acclimation facilities have been incorporated under CRFMP. Other facilities currently in place or being planned for other

stocks (Yakima spring and fall chinook salmon have application to the Yakima coho salmon program.

Monitoring for the project generally encompasses five levels: quality control, performance standards (attributes of smolts who best survive to reproduce), hypothesis testing, comprehensive analysis, and stock status (attributes of adults who survive). Some of these may not be appropriate for the coho feasibility studies.

Table S.1. Yakima Coho Salmon Objectives and Associated Strategies

Objectives	Strategies
Experimentation	
Determine the feasibility of returning natural production of coho salmon to the Yakima River Basin.	Evaluate the survival, escapement, and natural reproduction of introduced coho salmon in the Yakima River Basin. Monitor release of 700,000 acclimated coho smolt into Lower Yakima River.
Determine the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin.	Evaluate the survival, escapement, and natural reproduction of introduced coho salmon in the Yakima River Basin Calculate potential harvest benefits. Monitor release of 700,000 acclimated coho smolt into Lower Yakima River. Monitor and evaluate tribal and non-tribal salmon fisheries in Lower Yakima River.
Determine the predation impacts of releasing 700,000 acclimated coho smolts on non-target species of concern in the Yakima River.	Conduct food habit analyses of coho salmon released into the Yakima River Basin to determine the impact on juvenile rainbow\steelhead and fall chinook populations. Monitor release of 700,000 acclimated coho smolt into Lower Yakima River.

Glossary

This glossary contains a list of abbreviations and acronyms, technical terms, and species' common and scientific names used in Volume 5 of the YKFP Planning Status Report. Words that would be defined in a desk-size dictionary (for example, the College Edition of the American Heritage Dictionary) are not included. Technical terms are defined as they are used in this report and may differ from uses in other fields.

Abbreviations and Acronyms

BKD	bacterial kidney disease
BPA	Bonneville Power Administration
Council	Pacific Northwest Electric Power and Conservation Planning Council
DOE	U.S. Department of Energy
EIS	environmental impact statement
GHGs	Genetic Hatchery Guidelines
IHN	infectious hematopoietic necrosis
NEPA	National Environmental Policy Act
PAR	Project Annual Review
PSR	Planning Status Report
RASP	Regional Assessment of Supplementation Project
RM	river mile
URP	Uncertainty Resolution Plan
USBR	U.S. Bureau of Reclamation
WDFW	Washington Department of Fish and Wildlife
YIN	Confederated Tribes and Bands of the Yakama Indian Nation
YKFP	Yakima/Klickitat Fisheries Project

Technical Terms

acclimation—stage in rearing, proceeding release, intended to condition fish to the ambient environment

ancestral drainages—subbasin where parents spawned

electrophoretic data—genetic data derived through a process called electrophoresis

fry—early juvenile stage in salmonids

genetic risk—risk of affecting the genetic characteristics in such a way as to decrease the long-term productivity of a population. It encompasses four types:

- *extinction*—the risk of losing a population altogether. Once a population has gone extinct, all its genetic material is irretrievably lost.

- *loss of within-population variability*—reduction in genetic variability within a population as a result of low, effective population size, which can lead to inbreeding depression and genetic drift.

- *loss of between-population variability*—reduction in gene differences between populations as a result of excessive gene flow, which can lead to outbreeding depression.

- *domestication selection*—nonrandom change in genetic composition of a population as a result of anthropogenic selective forces, intended or not. The two main sources of domestication selection imposed by hatcheries are nonrandom selection of broodstock and the selective force of the hatchery.

jacks—male fish that are sexually mature at an early age, 1 year earlier than the earliest maturing females

juvenile—fish that are not sexually mature

Limited New Innovative Treatment (LNIT)--a treatment applied to spring chinook salmon that uses the OCT during the incubation to rearing phase and uses the NIT during other portions of the acclimation to release phase.

locally adapted stock—a stock or population of fish that, although perhaps not native to the stream, is capable of sustaining some level of natural or artificial production

natural production--spawning and rearing of wild or non-first-generation hatchery fish in the environment outside the hatchery.

New Innovative Treatment (NIT)—a treatment that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrate, in-water structure) to produce fish with attributes similar to naturally-produced spring chinook salmon.

nontarget species—species not intended for supplementation

Optimal Conventional Treatment (OCT)—A treatment that incubates, rears, and acclimates salmonids using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin.

presmolt—fish that have not begun the physiological process of readying themselves for salt water entry

preterminal harvest—fish that are caught along their migration route before reaching their subbasin of origin, as opposed to terminal harvests, which occur in that subbasin

race—a subspecific designation indicating the season when adult salmonids return to the subbasin (e.g., spring, summer, fall chinook salmon)

raceways—vessels designed to rear fish

redd—a number of adjacent nests (depressions in the streambed) where salmon eggs are deposited by one female

run(s)—used interchangeably with race in this report

salmonids—trout, salmon and other fish of the family Salmonidae

smolt—anadromous salmonid that is physiologically fit for salt water entry and is migrating seaward

smolt:adult survival—the ability of a fish to survive from the time it leaves the subbasin as a smolt until the time it returns to the subbasin as an adult

smolt:smolt survival—the ability of a fish to survive from the time it becomes a smolt until the time it leaves the subbasin

smoltification—the process by which an anadromous fish becomes physiologically fit for salt water entry

"status-index harvest"—harvest policy that determines the rate of harvest on the basis of the strength of all run components

steelhead—sea-run rainbow trout

stock—a population of salmonids managed as a unit for supplementation purposes

supplementation—artificial propagation in an attempt to maintain or increase natural production while maintaining long-term fitness of the target population and while keeping ecological and genetic impacts on nontarget species within specified limits

target species—a species intended for supplementation or production; refers to Yakima coho salmon in this volume

Wild fish-indigenous fish that have never been in a hatchery system

Common and Scientific Names

coho salmon—*Oncorhynchus kisutch*
chinook salmon—*Oncorhynchus tshawytscha*
rainbow trout/steelhead—*Oncorhynchus mykiss*

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5.3 Resolvable Uncertainties Related to Management of Yakima Coho Salmon That Can Be Studied in the Near Term 5.4

1.0 Introduction

The Yakima/Klickitat Fisheries Project (YKFP) is a supplementation project designed to use artificial propagation in an attempt to maintain or increase natural production while maintaining the long-term fitness of the target population, and while keeping ecological and genetic impacts on nontarget species within specified limits. The project is also designed to provide harvest opportunities. The planning, implementation, and evaluation of this project are guided by the framework developed by the Regional Assessment of Supplementation Project (RASP 1992a, 1992b, 1992c). The purpose of the YKFP is to:

- mitigate existing stocks of anadromous fish in the Yakima and Klickitat river basins while maintaining genetic resources
- reintroduce stocks formerly present in the basins
- increase abundance of naturally reproducing salmonid stocks in order to increase harvest opportunities for Yakama tribal members and other fishers.
- apply the knowledge gained through supplementation throughout the Columbia River Basin, all consistent with the Pacific Northwest Electric Power and Conservation Planning Council's fish and wildlife program (BPA 1994).

Essentially, the YKFP is an experiment to resolve uncertainties (through uncertainty-resolution taskwork) associated with supplementation at the same time that it accomplishes construction and implementation milestones.. As a "laboratory," the YKFP would help determine the role of supplementation in increasing natural production of anadromous salmonids.

Since coho salmon are considered to be extinct in the Yakima basin, current objectives for the coho program pertain to investigastions of feasibility questions regarding key uncertainties needed for long-range YKFP planning. It is important to note that the essential elements of the current coho program are captured in listed objectives and strategies. These should be expected to evolve consistent with the overall purpose of the YKFP as new information becomes avialble.

Adaptive Management Process

The YKFP endorses an adaptive management policy, which expects objectives and strategies to change as new information becomes available (as explained by Walters 1986). The cyclic adaptive management process is shown in Figure 1.1. The adaptive management process revolves around three annual milestones:

- completion of an updated long-range plan, the Planning Status Report (PSR), by February 1 of each year
- completion of an updated long-range plan to resolve uncertainties, the Uncertainty Resolution Plan (URP), by April 1 of each year
- the Project Annual Review (PAR), which is held during November of each year and may include a peer review of work completed and in progress.

The PSR is intended to contain a complete description of the YKFP long-range plan. It is intended to identify objectives, strategies, and assumptions with justifications documented and changes and modifications recorded. Objectives and strategies are changed through an amendment process, typically in response to new information about the validity of assumptions.

Each annual PSR document provides an integral part of the YKFP adaptive management process. It is important to nnote that the present document for coho salmon reflects the status of planning completed in 1995, provid9ing direction for project activities in 1996. It would be expected to evolve in subsequent annual planning cycles.

Underlying assumptions form the rationale for the choice of strategies. The PSR identifies those assumptions that are accepted on the basis of their validity and applicability as established in the scientific literature or through peer-reviewed studies within the YKFP or elsewhere. Assumptions that are uncertain (those that lack documented justification) are classified as either resolvable or unresolvable. Those that are resolvable are scheduled for resolution through the URP.

The description of objectives and strategies is iterative in the sense that, as the project moves forward and as different phases of the project approach implementation, more detail is added. Strategies intended for implementation during the coming year are described in more detail than those planned for later implementation. Future strategies, however, are of detail sufficient to provide clear and focused direction for project planning and uncertainty resolution. Consequently, the level of detail varies throughout the PSR.

Results of uncertainty-resolution work are reported in memoranda and annual project progress and completion reports, all of which are summarized in the PAR. All underlying assumptions in the PSR are then reviewed and reclassified, and new assumptions added. Implications of these revisions on the strategies and objectives are assessed, along with risks and benefits, and amendment proposals submitted for policy review.

While justification for objective and strategy modifications may include technical judgment and policy preference, all changes in uncertainty levels of assumptions must be based on scientific evidence, hence the importance of peer review. Conclusions from the

PAR about the progress of ongoing work and the revised uncertainties from the PSR are then used to amend the URP, and thus the adaptive management cycle continues (Figure 1.1).

In planning for the following year, strategies (implementation or experimental) are considered on the basis of the validity of their underlying assumptions (i.e., likelihood of meeting the stated objectives). Strategies are implemented only when the risk of failure is within acceptable limits. This risk is managed and reduced over time through implementation of the URP (i.e., the prior removal of uncertainties) and the Monitoring Plan (Chapter 9). In other words, risk of strategy failure (i.e., where objectives cannot be met and/or strategies cannot be implemented correctly) can be reduced through (1) pre-implementation research or (2) risk-containment monitoring during implementation. The "Risk Analysis" (Chapter 7) is intended to aid in the selection of strategies for implementation.

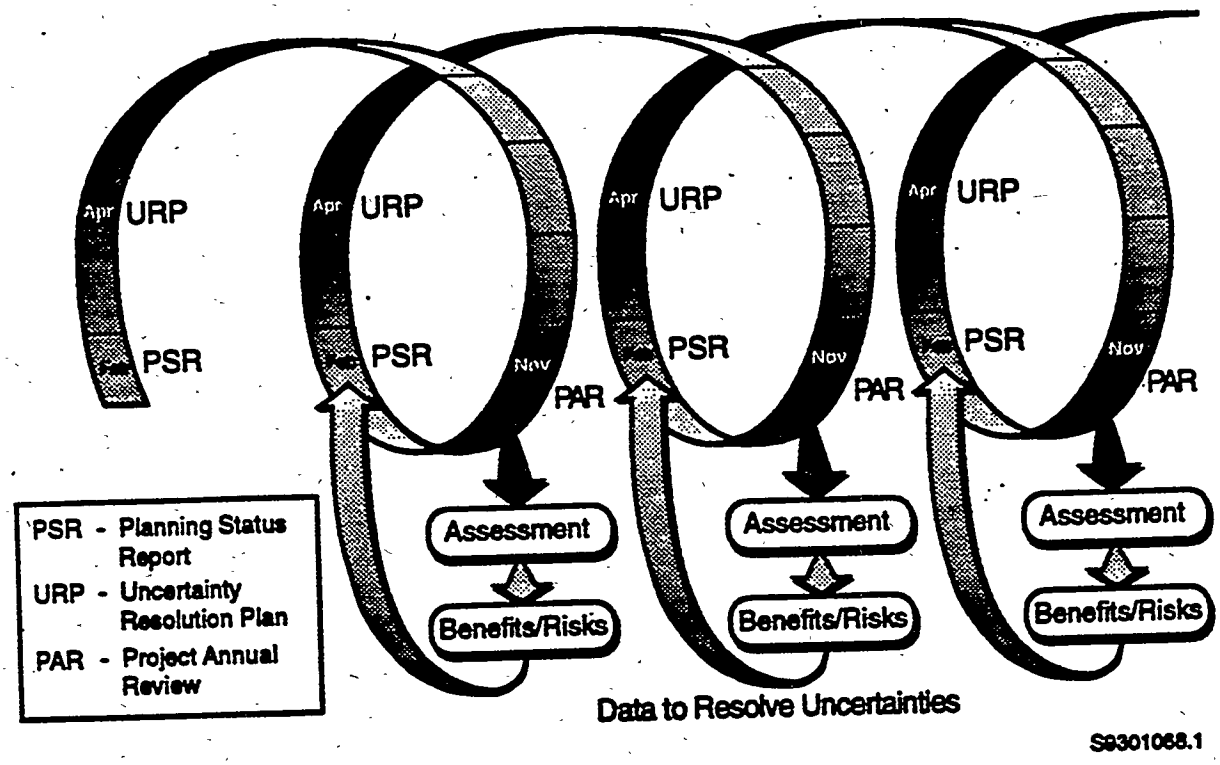


Figure 1.1. Planning Cycle for the Yakima/Klickitat Fisheries Project

Document Overview

In this volume, the PSR discusses the status of project planning for Yakima coho salmon. The specific plans:

- present background information
- describe objectives, i.e statements of what is to be accomplished in the genetics, natural production, experimentation, and harvest components
- state strategies that should accomplish these objectives and the assumptions on which these strategies are based
- outline how the uncertainties inherent in each assumption will be managed
- explain the experiments designed to test supplementation
- present the risk analysis conducted to describe management implications
- describe, as appropriate, the facilities for broodstock collection, hatcheries, rearing, and acclimation
- discuss the monitoring needs
- present citations for references used to document or support statements.

2.0 Background

Major historical production areas (Figure 2.1) for Yakima coho salmon occurred throughout much of the basin. Virtually all major upper Yakima River tributaries (Teanaway River and Taneum, Manastash, Swauk, Big, and Umtanum creeks) supported coho salmon. The Naches River and tributaries upstream from the Tieton River also produced substantial numbers of coho salmon. Less production also occurred in the upper Tieton River (upstream from Rimrock Lake), the upper Cle Elum River and its tributaries (upstream from Cle Elum Dam), and Ahtanum and Logy creeks (Anonymous 1967; Bryant and Parkhurst 1950; Mongillo and Falconer 1980; Smoker 1956).

Mullan (1983) estimates that coho salmon comprised 19% of the runs upstream from Roza Dam from 1949 through 1967. This run of coho salmon may have numbered 114,000 fish.

There is no historical data on age composition, size at age, or stock structure of Yakima River coho salmon.

Causes for Decline

The inbasin causes for decline include construction of unladdered dams, entrainment of juveniles in unscreened diversion canals, log driving on sudden releases of water, indiscriminate and intensive local fishing, diking and channelization, and loss of natural water storage and rearing habitat. Factors outside the basin included the advent of the major dams on the mainstem Columbia and the steady increase in fishing effort in the ocean and lower mainstem Columbia.

Present Stock Status

The indigenous natural coho salmon no longer occur in the Yakima River Basin. The only natural production now occurring is thought to be the result of hatchery fish outplantings in the basin.

In recent years, 700,000 coho salmon have been released into the Yakima River Basin as part of the *U.S. versus Oregon* Columbia River Fish Management Plan. These releases were intended to promote and diversify local fishing opportunities for the Yakama Indian Nation. The program uses early-run fish from lower Columbia River hatcheries (mainly Cascade Hatchery). Fisheries in the basin on returning hatchery fish have been negligible to date. Only a very low effort tribal subsistence fishery has occurred, and no sport fisheries have been allowed.

Coho salmon spawn in late October/November. Columbia River coho salmon typically spend 1 year in freshwater before outmigrating as yearling smolts in the spring (April/May). After outmigrating, coho salmon spend approximately 18 months at sea before returning to spawn. Sexually precocious males (jacks) return to spawn after 6 months at sea.

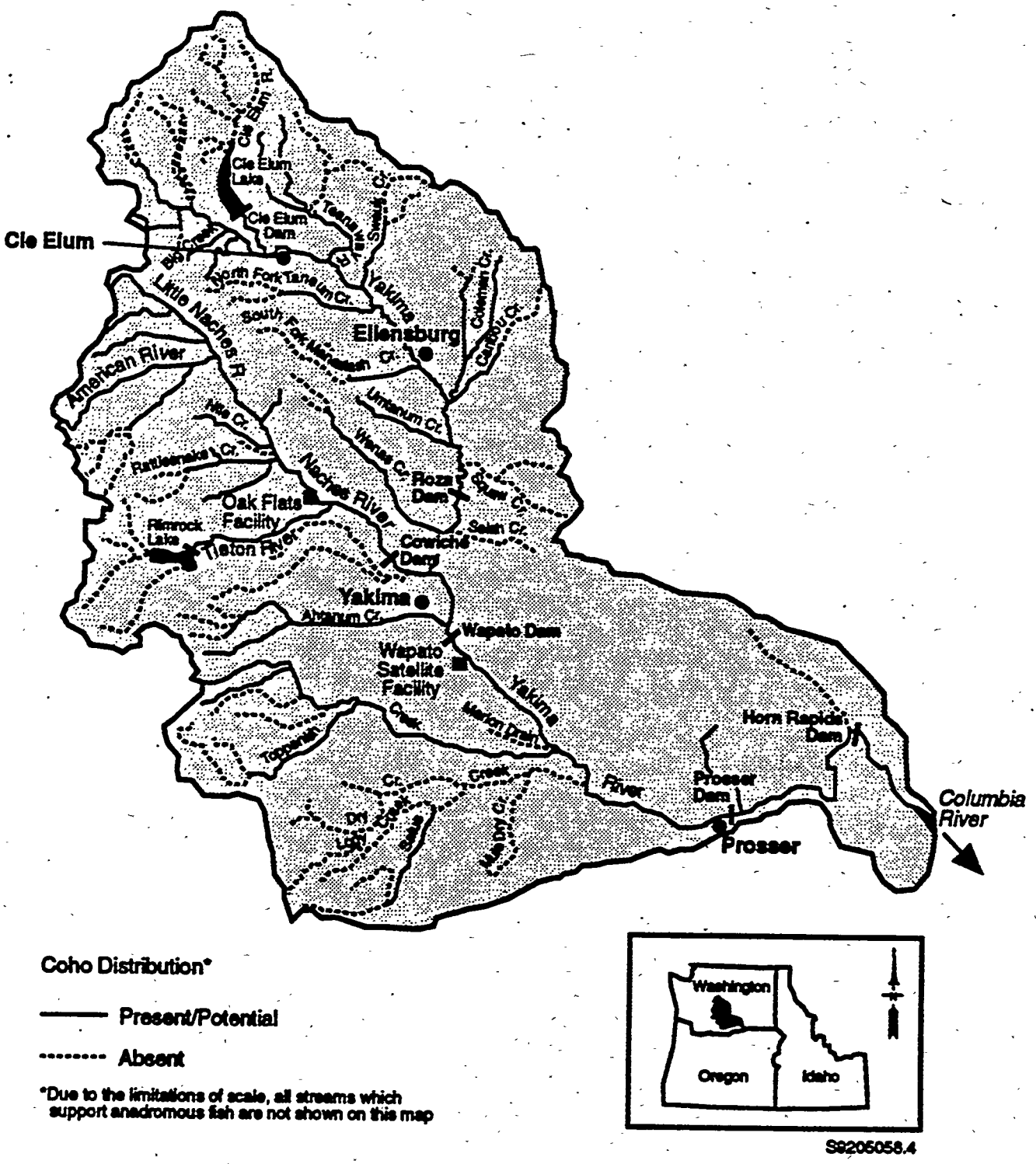


Figure 2.1. Historical Distribution of Yakima Coho Salmon

Constraints to Action

Factors limiting successful implementation of coho salmon enhancement in the basin are lower mainstem Columbia River and ocean harvest rates and smolt mortality within the mainstem Columbia and Yakima River. An issue that affects the enhancement strategy for coho salmon is habitat and water limitations imposed by existing uses. There are concerns about managing potentially adverse predatory effects by coho salmon on other fish species, particularly juvenile chinook salmon, and potential competition between naturally produced coho salmon and other fish.

During development of the YKFP, releases of coho salmon into the basin will be coordinated among the responsible managers. The project will strive to enhance feasibility studies in coordination with any coho releases.

3.0 Project Objectives

The project's objectives are statements of planned accomplishments. Accomplishments relate to genetics, natural production, experimentation, and harvest. Objectives for the coho salmon feasibility study are limited to experimentation objectives only. Natural production and harvest management objectives will be developed as appropriate pending the outcome of feasibility studies. Genetic objectives are not expressed because no native stocks are present. Genetic objectives could be developed if natural spawning populations are established.

Experimentation Objectives

The experimentation objectives are:

1. Determine the feasibility of returning natural production of coho salmon to the Yakima River Basin.

2. Determine the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin.

3. Determine the predation impacts of releasing 700,000 acclimated coho smolts on juvenile fall chinook and steelhead/resident trout populations in the Yakima River Basin.

4.0 Strategies

The project strategies are statements of action(s) to achieve specific objectives. These strategies have been developed based on current knowledge; they are provided with sufficient detail to allow planning of facilities, operations, and experimentation to proceed in a focused manner. Planned actions currently relate only to experimentation. Each strategy relates to at least one project objective.

Strategies to Meet Experimentation Objectives

The experimentation strategy is:

1. Evaluate the survival, escapement, and natural reproduction of introduced coho salmon in the Yakima River Basin. This strategy relates to Experimentation Objective 1.

2. Monitor release of 700,000 acclimated coho smolt into Lower Yakima River. This strategy relates to Experimentation Objective 1, 2, and 3.

3. Calculate the potential harvest benefits. This strategy relates to Experimentation Objective 2.

4. Monitor and evaluate tribal and non-tribal salmon fisheries in Lower Yakima River. This strategy relates to Experimentation Objective 2.

5. Conduct food habit analyses of coho salmon released into the Yakima River Basin to determine the impact primarily on fall chinook populations with consideration also for rainbow/steelhead trout and other non-target species of concern.

5.0 Management of Assumptions and Uncertainties

The project assumptions are suppositions or statements of conditions or perceptions under which the stated strategies will achieve the specified objectives. Assumptions are related to genetics, natural production, experimentation, and harvest. These lists are intended to be a complete list of significant assumptions that affect the choice of strategies to meet objectives. Each assumption relates to at least one strategy.

The statement of an assumption includes some degree of uncertainty. The strategy may not be definitely achievable at a planned time, or for a given quantity or occurrence. To successfully implement the strategies stated in the previous section, the uncertainties must be resolved or the associated risk must be monitored. Within the context of the YKFP, uncertainty resolution is managed through the application of adaptive management (Walters 1986). Planning, implementation, and evaluation are steps in an iterative process that over time reduced uncertainties and risk.

The implication of errors in these assumptions is important. The wrong strategy could result in serious damage to a species/stock in the basin or the expenditure of monies without realizing benefits. The uncertainty associated with an assumption must be resolved or the risk associated with the error must be contained. The manner in which uncertainties are resolved depends on their organization (Figure 5.1).

The two major issues that have been identified as uncertainties are:

1. Effect of predation of coho on other target and non-target species in the Yakima system,

2. Effect of acclimation on increasing smolt to adult survival to determine the feasibility of the future coho program (i.e. to reintroduce natural production of coho into the Yakima River Basin and to provide significant fisheries for Tribal and other fishers.)

The proposed monitoring program will assist in resolution of these uncertainties.

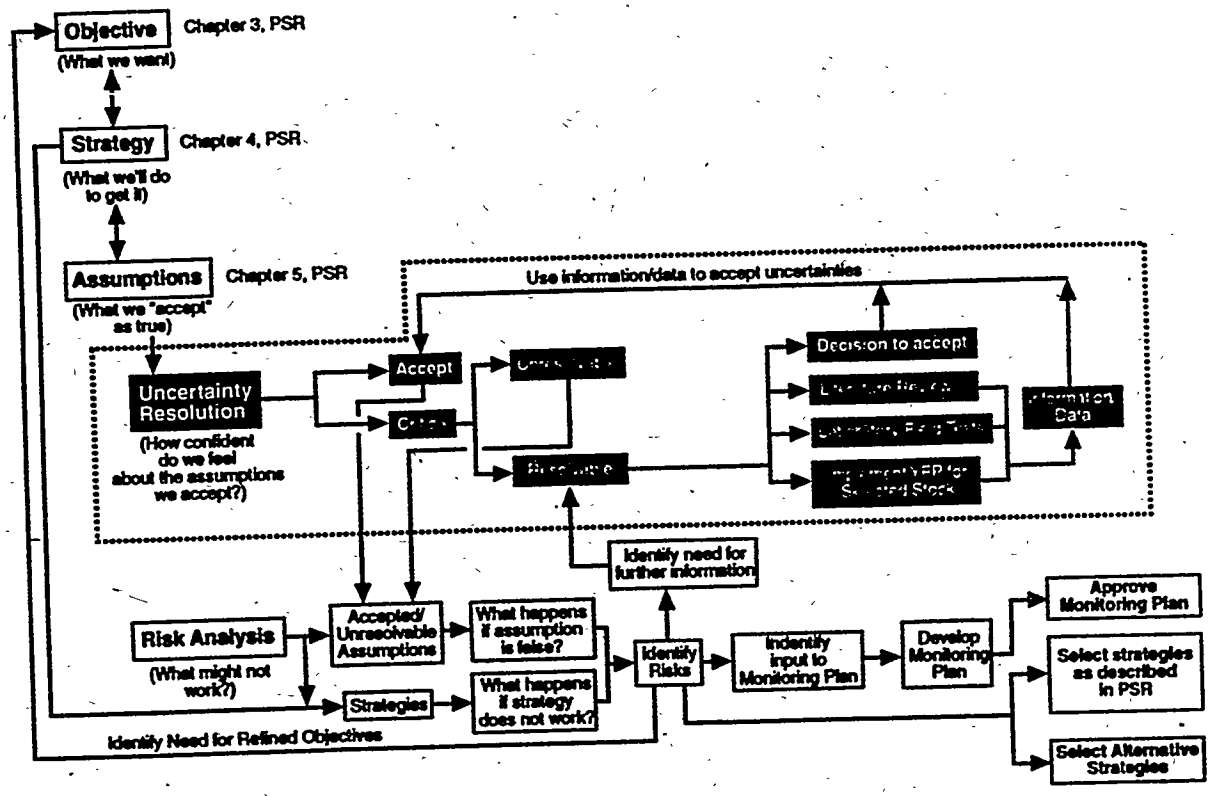


Figure 5.1. Resolution of Uncertainties Within the Yakima/Klickitat Fisheries Project

Management of Accepted Assumptions

Some assumptions related to the management of coho salmon are accepted on the basis of existing knowledge and information, pending documentation (Table 5.1). Each of these is deemed unlikely to be wrong and/or to have a minor impact on the success of the selected strategies in meeting the stated objectives. The accumulated risk associated with potential errors in these assumptions is managed through monitoring. New information will gradually allow resolvable uncertainties to be moved into this accepted category.

Table 5.1. Accepted Assumptions Related to Management of Yakima Coho Salmon

Assumption	Strategy Relationship
215 Habitat either is available or can be made available in the Yakima River Basin that can be effectively utilized by expanded populations of coho salmon.	Experimentation Strategy 1
216 Smolt:adult mortality related to mainstem passage, preterminal harvest, and ocean conditions will be less than or equal to those at present, and are understood well enough to refine strategies.	Experimentation Strategy 1
217 In 1996, no coho salmon will be released upstream from Wapato Dam under the auspices of YKFP.	Experimentation Strategy 1 and 5
218 In 1996, species interaction studies will be conducted using 700,000 smolts released downstream from Wapato Dam.	Experimentation Strategy 2 and 5
219 Additional YKFP monitoring will be designed to evaluate interactions with other species of concern, particularly rainbow/steelhead trout.	Experimentation Strategy 1 and 5
220 All harvesting of Yakima coho salmon can be monitored through catch sampling and reporting.	Experimentation Strategy 1, 3, and 4
221 Fisheries in the basin can be managed and regulated, and laws enforced to ensure implementation of an agreed upon harvest strategy.	Experimentation Strategy 1, 3, and 4
325 Hatchery rearing and acclimation facilities can be sited in the basin to increase coho salmon smolt production.	Experimentation Strategy 1

Table 5.1. Accepted Assumptions Related to Management of Yakima Coho Salmon (continued)

Management of Unresolvable Uncertainty

Some critical uncertainties are not expected to be resolved as part of the YKFP supplementation experiment or other research efforts (Table 5.2). Most of them are not feasible to resolve, and all are beyond the scope of the YKFP. The risk that any of these assumptions are wrong is managed through monitoring (Figure 5.1). While the uncertainties cannot be resolved, the health and condition of the population can be monitored, for example, for signs of unexpected change. On the basis of new information and other evidence, strategies can be reevaluated.

Table 5.2. Unresolvable Uncertainties Related to Management of Yakima Coho Salmon

Assumption	Strategy Relationship
224 The impact of sports fishery on coho salmon smolts will not effect the experimental evaluation by stock and/or release group, or the introduction of a donor stock as a naturally producing stock.	Experimentation Strategy 1 **126**

Management of Resolvable Uncertainties

Four methods can be used to manage the critical uncertainties that can be resolved: 1) reviewing the scientific literature to determine how others have resolved or managed them; 2) conducting small-scale studies (i.e., short-term experiments in the field or laboratory), feasibility studies, and baseline studies; 3) learning from studies or experiments conducted outside of the YKFP; and 4) operating a coho salmon production facility in the Yakima River Basin.

Uncertainties that may be resolved (Table 5.3) are a high priority in the near term, because they affect the ability to implement the operations. Because the design and operation of a facility for coho salmon production is not complete, the assumptions that need to resolved via or during the operation of a conventional hatchery have not been stated. Plans for literature studies, small studies, and studies outside the Yakima River Basin are the subject of the Uncertainty Resolution Plan.

The YKFP offers a unique opportunity to test hypotheses intractable to small-scale studies. While the outcomes of small-scale studies can modify details of the large-scale experiments (e.g., incubation facilities, rearing container design, acclimation pond design, feeding methods, and fish marketing methods), the results are not expected to fundamentally

change the experiment, but rather help ensure its success. The purpose of small-scale studies and facility planning is to "set up" the large-scale experiments. Consequently, it is important to define the experimental design for coho salmon in sufficient detail to make the planning focused and efficient.

Table 5.1. Accepted Assumptions Related to Management of Yakima Coho Salmon (continued)

Table 5.3. Resolvable Uncertainties Related to Management of Yakima Coho Salmon That Can Be Studied in the Near Term.

Assumption	Strategy Relationship
90 Non-target species and their ecological relationship to coho salmon can be effectively identified and described.	Experimentation Strategies 1 and 5
87 The natural production potential of the Yakima River Basin is known for coho salmon.	Experimentation Strategy 1
91 A natural production monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	Experimentation Strategy 1
Methods for evaluating risks and benefits are available.	Experimentation Strategy 1, 3, and 5 **133**
88 Production can be managed to avoid unintended ecological effects.	Experimentation Strategy 5
89 Acclimation pond sites can be identified.	Experimentation Strategy 2
92 A production program can be designed to produce adults for harvest.	Experimentation Strategy 4
93 Prosser Dam is an appropriate site for broodstock collection.	Experimentation Strategy 2 **136**
95 An experimentation monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	All Experimentation Strategies **143**
97 A harvest monitoring program can be designed and implemented that will have sufficient power to detect specified levels of impact.	Harvest Strategy 4 **145**

6.0 Experimental Design

The coho salmon program is designed to be an experiment designed to determine possible interactions between juvenile coho and juvenile fall chinook salmon and rainbow/steelhead trout. No experimental design regarding supplementation has been developed for coho. The key population variable is terminal harvest contributions.

This monitoring program has been developed for the purpose of prioritizing the information needs for consideration of future options for a YKFP coho program. This first phase of the coho program incorporates monitoring the outmigration survival, smolt to adult survival, and predation on fall chinook juveniles and steelhead/rainbow trout or other non-target species of concern from the 700,000 smolts currently being acclimated and released in the Yakima River Basin as mandated by the US v. Oregon agreement. This phase of the coho program is reduced from the full scale program originally described for the YKFP. One of the purposes of this reduction was to allow further research that would provide information on uncertainties that have been raised regarding the coho program.

The proposed monitoring program will provide useful information on the uncertainties of the coho effort. First, the study is designed to address the issue of predation of coho smolts on other fish stocks in the Yakima basin. Of major initial concern here is the predation of coho on fall chinook juveniles, with consideration also for rainbow/steelhead trout and other non-target species. Additional research may be needed to address ecological interaction risks of coho with non-target species of concern.

Secondly, the design addresses the survival of coho smolt releases to returning adults. This uncertainty is addressed by acclimating all of the imported smolts. The proposed monitoring program will help determine if acclimation of presmolts before release into the Yakima River will improve the survival rate of smolts migrating out of the Yakima and to the returning adult stage. The survival of outmigrating smolts will be monitored at Chandler Juvenile Evaluation Facility at Prosser. The survival rates of acclimated smolts will be compared to the survival rates of previous years releases when the fish were not acclimated. The returning adults will be monitored at Prosser dam fish ladders to determine smolt to adult survival rates. If it is determined later that actual experiments need to be conducted to address this uncertainty, these survival experiments could be conducted when monitoring facilities have been developed for adult monitoring of coho and other species.

The information collected from this monitoring program would be used to determine how to proceed with further research and planning regarding options for a future YFKP coho program. If the survival rates of the acclimated smolts are sufficient to return adequate numbers of adults, and if ecological risks of coho smolts are determined to be at or below acceptable levels, YFKP program options would be explored.

MONITORING FOR COHO PREDATION ON FALL CHINOOK

Within this monitoring program, all 700,000 coho smolts would continue to be acclimated under the current Yakama Tribal program. The smolts would continue to be imported under the U.S. v Oregon Columbia River Fish Management Plan. The monitoring program will address only the uncertainty of acclimated coho smolts preying on other target and non-target fish stocks of concern to the YKFP. The main species of concern is juvenile fall chinook.

A preliminary food habits study was conducted on released coho smolts in 1992 by Dr. Paul James of Central Washington University. The results of this preliminary study, conducted at Prosser smolt trap, suggested that fish did not appear to be a major food source for coho smolts collected in the facility. In fact, no fish were identified in the stomach contents of the coho sampled. The main problem with the study design was that most of the food in the smolts collected was too digested to be identified. This problem was the result of the coho being collected from the holding tank at the Chandler smolt trapping facility. The smolts were held in the tank from the time they entered the facility until the days catch was worked up -a period of time that could be as long as twenty-four hours. This allowed for ample time for the digestion of prey items to occur. In the present monitoring plan a wider spectrum of the coho population (both actively migrating and non-migrating) will be sampled by expanding effort into the river system itself and better methods will be used to preserve gut content samples immediately after capture.

It is suggested that a two year monitoring program be undertaken to determine the level of predation of coho smolts on juvenile fall chinook. The objective of the first year of the program will be to determine if coho predation on fall chinook is prevalent and under what conditions predation occurs. It will also provide information on predation on other non-target species of concern. If the results of the first year of the program indicate that coho are predators on fall chinook juveniles, the objective of the second year of the program would be to determine how many fall chinook are consumed by coho smolts.

With this information in mind the following coho smolt monitoring program is proposed:

YEAR ONE (1996)

OBJECTIVE - Determine if coho predation on fall chinook or other species of concern is prevalent and determine conditions under which predation occurs.

The following questions need to be answered to complete the objective of year one of the program: Is coho predation on fall chinook or other species of concern common? At what times do coho eat these species? What environmental conditions correspond to high predation rates? At what size do coho prey on fall chinook and other species of concern?

1. This program will utilize the ongoing Yakama Tribal acclimation and release program of 700,000 hatchery coho smolts into the Yakima River below Wapato Dam.

2. The 700,000 presmolts will be transported to the low tech acclimation and release facilities operated by the Yakama Indian Nation Fisheries Program. These facilities are located below Wapato dam (Granger Pond, Roza Wasteway #3 near Wapato, and the Wapato Canal net ponds).

3. The 700,000 fish will be reared in the acclimation facilities until they smoltify and volitionally leave the facilities. Automatic fish counters at the exit of each acclimation pond will monitor the number of fish outmigrating each day.

4. Sampling Strata and Effort: Spatial and Temporal

The Yakima River will be divided into two major spatial strata: Marion Drain to Prosser and Prosser to Horn Rapids. Using aerial photographs of the river each major stratum will be divided into 1 km sampling stations. Total sampling effort will be allocated based on the shifting distribution of coho above and below Prosser. Sampling effort will initially be targeted above Prosser until movement of coho out of the acclimation ponds and past Chandler indicates that effort should begin to shift to the lower river stratum. Effort will continue shifting to lower river stations based on estimates of coho movement past Prosser.

Each day will be divided into four 6-hour strata and sampling will occur in two of these strata each day. Daily sampling stations will be randomly selected and 10 stations will be sampled per week. The catch per unit effort will be used to assess the relative density of coho within each sampling station.

Some sampling effort will be directed at areas where fall chinook may be disoriented or densely populated (irrigation dam bypass outlets).

The study will occur over a six week period beginning at the time coho begin volitionally exiting the acclimation ponds. Automatic smolt counters installed on each acclimation pond will allow monitoring of smolt movement patterns and accurate enumeration of the total number of fish released. An initial "shake down" sampling period of 2 days will occur prior to smolt movement so that gear, operational logistics and sampling procedures can be refined.

5. Coho Sampling Methods and Protocols

Fish will be collected using a boat equipped with an electroshocking unit. One supervisor, one boat operator and one technician will be required for operation. Coho weight, stomach weight and length measurements will be collected and stomachs will be removed and placed into 10% formalin immediately upon capture. This will reduce the amount of digestion that will occur in the organisms.

6. Coho Stomach Content Analysis

Published reports of gastric evacuation rates for coho will be used to determine length of time prey items could be expected to remain in coho stomachs. Based on the percentage of coho stomach that contain fall chinook (% coho stomachs) and the catch per unit effort (CPUE) of coho an index of predation intensity (PI) will be calculated for each sampling location.

PI = % coho stomachs * CPUE

Sampling locations with high PI values indicate high predation intensity.

7. Ancillary Information Collection

Each day during daylight hours information on water temperature, flow, and turbidity will be collected at or near that day's sampling stations. CPUE of fall chinook will be measured, and habitat type and habitat structure will be described for each sampling period and location. A stepwise regression will be used to determine the variables that explain the greatest variation in the percent of coho that consumed fall chinook and other species of concern.

Lengths and weights of coho that consumed fall chinook will be compared to those that did not consume fall chinook in order to determine if there is a minimum size threshold at which predation occurs.

YEAR TWO (1997)

OBJECTIVE - Determine how many fall chinook are consumed by coho.

The specific details of when, where, and how to sample coho will be based on results and experience from year one of this monitoring program.

1. Collect coho smolts.

2. Determine number of fall chinook and other species of concern in the stomachs of coho.

3. Determine abundance of coho at times and places where predation occurs.

4. Determine gastric evacuation rates specific for fall chinook in coho stomachs.

5. Determine how many fall chinook are consumed by coho using an equation that incorporates factors discussed above.

MONITORING FOR SURVIVAL RATES

The second objective of the monitoring program is to determine the survival rates of coho smolts as they migrate out of the Yakima basin, and the rate of survival from outmigrating smolt to returning adult.

Smolt Monitoring Program

The outmigrating smolts will be monitored at the Chandler Juvenile Evaluation Facility. Coho smolts from the acclimation pond releases would be sampled on a daily basis in conjunction with the daily operation of the sampling facility. The standard sampling and handling protocol will be followed for the smolt sampling facility. Expansion of sample catches collected in the bypass sampling facility (or subsample catches when subsampling occurs) to estimate the total passage of smolts (through the bypass and in the river flow over the dam) from the basin will also follow established protocol utilizing expansion equations developed over numerous years of sampling throughout a wide range of river flows. Survival from smolt at release to smolt at Prosser will be calculated from estimated passage at Prosser and total number of smolts counted out of the acclimation ponds.

Adult Monitoring Program

The returning adults will also be monitored at the Prosser Dam. The three ladders at Prosser are equipped with windows that have video monitoring equipment that has been developed to record adult fish passage back into the Yakima basin. Returning adult hatchery coho will be identified as part of the ongoing video monitoring program that the Yakama Indian Nation is conducting. The survival rate from smolt to adult can be calculated as a ratio of the number of returning adults to the estimated number of outmigrating smolts.

7.0 Risk Analysis

In adaptive management, decisions are made in the face of uncertainty. Risks associated with the uncertainty are contained (managed) by designing strategies (actions) as experiments, evaluating the outcome, and modifying the strategy responsively. This trial-and-error approach requires a set of potential strategies, which can be evaluated to find the "best one." The nature of these strategy alternatives, along with an assessment of the specific risks associated with the initial strategies, may effect management decisions. These affects are management implications.

The expected overall impacts of the YKFP are discussed in the final environmental impact statement for the project, which was issued in December 1995.

The YKFP has an annual process of evaluating strategies for implementation in the following year. This process will address four sets of questions:

1. Are the strategies sufficiently well defined and are they feasible? If not, why not? What is missing? Are assumptions related to feasibility of facilities and operations (including monitoring) accepted? (If they are accepted, the Planning Status Report for the previous year would contain references to reports and studies that address the specifics, including the existence of an approved design.)

2. What are the risks[a] associated with uncertainties? What is the likelihood that some of the accepted assumptions are wrong? What are the implications to genetic, natural production, experimentation, and harvest objectives if these assumptions are wrong? Have all types of risks been weighed for this analysis?

3. What alternative strategies are feasible (including taking no action) and what are their implications?[b] Are there alternative strategies for meeting the objectives for which the risks and implications are less severe? What are the implications of delaying implementation of the strategy? Can some of the critically uncertain assumptions be effectively resolved through literature review or near-term studies? If so, should they be referred to the Uncertainty Resolution Plan?

In adaptive management, strategies may be implemented, even though they pose risk of uncertain outcomes, providing this risk is contained through monitoring.

4. Are provisions in place for the five-level monitoring project (outlines in the section titled "Monitoring" in this report)?

(a) Risk here refers to the likelihood of failing to meet genetic, natural production, experimentation, and/or harvest objectives.
(b) Implications refer to the risks, costs, and other impacts of alternative strategies.

The managers of the Yakima Fisheries Project have determined that the preferred alternative for the first phase of the project will include supplementation of the upper Yakima spring chinook and a monitoring and evaluation of the currently ongoing importation, acclimation, and release of 700,000 coho smolts. Key to understanding the risk of the YKFP coho program is understanding exactly what the coho program is and what it is not. The YKFP coho program is a monitoring effort to be conducted on an existing program that releases 700,000 acclimated coho smolts annually into the Yakima basin. The coho program itself does not release fish or involve any modifications in the way they are released. Therefore the coho program involves absolutely no increased risk to the fish resources of the Yakima basin. The only risks that need to be discussed then are risks to the objectives of the program.

The YKFP spring chinook program is a complex blend of genetic conservation, supplementation, experimentation, and harvest. Project objectives for it were therefore formulated in four categories: genetics, natural production, harvest, and experimentation. Accordingly, the spring chinook risk assessment document discussed in detail the risks of not meeting objectives in all four categories. The coho program is much simpler. Being only a monitoring effort, its objectives can be most concisely summarized in one category: research. Specifically, these research objectives are to determine:

1) the feasibility of returning natural production of coho salmon to the Yakima River Basin,

2) the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin, and

3) the predation impacts of releasing 700,000 acclimated coho smolts on fall chinook and other non-target populations of concern in the Yakima River Basin.

The purpose of this document, then is to evaluate and discuss the risk of the coho program not being able to achieve these objectives.

Strategies to meet the first two objectives are based on the detection and counting of returning adults from the annual smolt release of 700,000. Obviously, the survival rates of these fish is essential to meeting these objectives, so understanding the overall survival picture is a key element of risk assessment. Coho are currently considered extinct in the Yakima basin, but approximately 700,000 yearling coho have been released there since 1982 (except in 1984), as part of the U.S. vs. Oregon Columbia River Fish Management Plan. Before 1994, these released coho were not acclimated, and survival from smolt to returning adult has been about 0.04% (Watson 1993)- about 280 fish from the release of 700,000.

Several factors potentially affecting survival have changed since the 1993 estimates, which may lead to increased survival in the future. First, beginning in 1994, the coho were acclimated before release. This acclimation definitely resulted in an increase in the survival of the smolts from release to the smolt monitoring facility at Prosser dam. A recent three

year study comparing survival of acclimated and nonacclimated early stock coho in the Umatilla River demonstrated that acclimation increased survival 50% higher survival of acclimated coho (Technical Advisory Committee, January 1995). Second, the ocean and river harvest of coho was greatly reduced in 1994 due to the poor returns of adult fish throughout the Columbia. Third, the National Marine Fisheries Service is reviewing a petition to list coho as an endangered specie coastwide. If this occurs there could be substantial reduction in the ocean and river harvest quotas in the future.

On the other hand, there is considerable uncertainty in predicting survival rates to adulthood of any fish in the Columbia basin. Major factors influencing survival include survival through outmigration in both the Yakima and Columbia Rivers, ocean survival, future harvest levels on both sport and commercial fisheries, and upstream migration survival of adults returning to the Yakima basin. All these factors are obviously outside the control of the project.

Risks to Research Objective 1. Determining the feasibility of returning natural production of coho salmon to the Yakima River Basin.

The risk of most immediate concern is that the survival rate to adulthood will be so low as to preclude sufficiently precise estimation of survival rates. Imprecise estimates are likely to give an unduly pessimistic view of survival to be expected from a potential future expansion of the coho program.

The second major risk to this objective would be the inability to evaluate reproductive success of the returning adults. This is a very real risk in that the coho smolts are currently being acclimated in areas that would not support natural production of coho due to the low flows and high temperatures in summer. If coho adults return to spawn near their acclimation release site the resulting progeny would either migrate out of the Yakima basin or die during the summer rearing period. Precision of estimates of natural production from returning adults would obviously be better by releasing fish in areas that are determined to be good coho spawning and rearing habitat, but this is not possible under the current release program.

Both these risks could be reduced substantially by release of large numbers of smolts, but at this time the potential increased risk to other species due to interactions seems too great to permit these larger releases.

Risks to Research Objective 2. Determining the potential harvest benefits from reintroduction of coho salmon in the Yakima River Basin.

Estimation of potential harvest benefits from releasing coho depends entirely on the return rates to local fisheries, so the risks to this project are identical with the first risk listed for objective 1. If accurate information on the number and rate of returning adult coho salmon cannot be determined, the ability to make an informed decision on future expansion of coho releases would be impaired. Managers might expand the program when it might not

be successful, or to restrict the program when survival of coho returns could have produced a population of naturally reproducing coho. An incorrect decision has obvious consequences for a long-term objective of increasing coho salmon harvest opportunities for all fishers.

> Risk to Research Objective 3. Determining the predation impacts of releasing 700,000 acclimated coho smolts on fall chinook and other populations of concern in the Yakima River Basin.

Coho releases have been approached cautiously because of the possibility that coho smolts may prey upon juvenile fall chinook as the coho migrate through fall chinook production areas in the lower reaches of the Yakima basin. Research objective 3 relates to a monitoring program designed to resolve this question of predation. Since the research will be carried out entirely on the released smolts before they leave the basin, survival to adulthood, which dominated the risk picture for the other objectives, is not a factor here. Risks to objective three all relate to the possibility that the predation aspect of the monitoring plan will not give a sufficiently precise understanding of the predation impact to be expected from coho releases. The consequences of not understanding predation are clear. For example, there could be a decision to expand the coho program when expansion would depress fall chinook production, or to not expand and thus to forego production and harvest opportunities when expansion is warranted.

Development of a sufficiently extensive and powerful research program to obtain the information the project needs on coho predation on fall chinook is a difficult task. Therefore the study will occur in stages. The first stage will essentially be a feasibility study conducted during the first year of the program. During this stage preliminary data will be collected that will be used to design a more sophisticated study that will yield the desired information needed in consideration of future coho program options for YKFP. This more sophisticated study will be the second stage of the YKFP coho program. Even with the benefit of the preliminary information, there could still be a risk of not gaining the information needed to precisely determine the predation impact of coho on the fall chinook population. However, this risk cannot be evaluated until the first stage work is completed. It is important to understand that the staging of the research is a risk reduction strategy. The first stage work exists to reduce the risk of the full study. Any information it will yield is valuable. We view the risk of it being of no use as remote.

8.0 Facilities and Operations

Facilities needed for the YKFP currently include those for acclimation, release, and monitoring. Acclimation facilities developed under the CRFMP will continue to be used for this program. Facilities are designed primarily for production of smolts to provide adults for harvest. Ultimate coho salmon production numbers will be determined after species interaction studies have been conducted. During February, approximately 700,000 yearling presmolts would be transferred from Columbia River hatchery facilities to acclimation ponds described previously where they would be reared and released to migrate volitionally from late April through early June.

Monitoring facilities and operations plans will be identified through the development and implementation of the URP. They will meet the needs of the five levels of monitoring needed for the project.

9.0 Monitoring

Monitoring has been planned to track project progress toward meeting objectives. Related to monitoring is the management and dissemination of information so that project results are available in a timely manner and a usable form. Not all elements of the monitoring plan described below currently apply to the Yakima coho program.

The plan is organized into five sections according to monitoring: Quality Control, Product Specifications, Research, Risk Containment, and Stock Status. These groupings are not absolutely distinct; they simply provide a systematic way to present monitoring needs for each purpose. Monitoring activities to address all five purpose categories are then integrated into a single non-duplicative monitoring plan. This plan identifies measurements to be taken monitor experimental response variables and to contain risks associated with uncertainty. Future iterations of this plan will include more details on sampling methods and frequencies and a detailed quality-control program. The level of detail here is deemed sufficient to proceed with NEPA documentation.

Quality-Control Monitoring

The purpose of quality-control (QC) monitoring is to (1) assure that fish culture and monitoring activities are conducted as intended, (2) reduce to a minimum the variation from manageable sources other than experimental treatments, (3) assure the validity of the data collected, (4) assure proper record keeping and access to information, and (5) provide information needed for cost-effective operation. Quality control monitors performance of the facilities and their operators. Quality standards will be established for all fish-culture and data-collection activities. Quality-control monitoring procedures will be included in the operations manuals for all facilities and field activities.

Development of quality-control standards and monitoring protocols is a part of the certification tasks described in the URP. No further details about QC monitoring are covered in this section at this time. As the certification process proceeds, this portion of the monitoring plan will be expanded.

Feedback from QC monitoring affects management and supervision of operational activities. It does not affect the treatment prescriptions. When QC standards are met, it is assumed that various treatments are being applied according to stated protocols .

QC monitoring protocols are modified in response to changes in the treatment prescription, i.e. when the "Treatment Definitions and Descriptions" section of Chapter 8 is altered (e.g., through the results of product-specification monitoring).

Product Specification[a]

Product specification monitoring is an extension of quality control, where the "product of the artificial environment" is monitored and compared with a defined template.

Product specification monitoring collects information about the fish. Feedback affects the Treatment Definitions and Descriptions (Chapter 8). When specifications are met, the treatments are assumed appropriate and the supplementation strategies and experimental protocols are planned and implemented. When observations suggest that the fish do not meet the specification, a determination of the needed changes must be made.

The Product Specifications are modified based on results of research and risk-containment monitoring or new policy direction affecting objectives and strategies.

Research

There are critical uncertainties regarding both the artificial and natural environments within which the YKFP supplementation project operates. Success of the YKFP also depends upon a progressively better understanding of the ecological interactions among and within species in the Yakima Basin. There are critical uncertainties about both intra- and inter-specific effects of supplementation. Research pertaining to the dynamics of the ecosystem is described under the heading of PTA (Patient Template Analysis) below.

Patient-Template Analysis

An essential part of the YKFP planning process is the so-called Patient-Template Analysis (PTA) where factors limiting production are identified. The PTA is a part of an iterative process by which assumptions about the relationships between life histories and habitat are updated as new information is obtained and analyzed.

The Experimental Objectives analysis and subsequent risk assessment have pointed out the critical nature of assumptions concerning intra-specific ecological interactions during the smolt outmigration. The feasibility of developing experiments to test hypotheses regarding the effects of hatchery fish on smolt-to- smolt survival of natural fish should be investigated. These uncertainties are reflected in the risk-containment monitoring plan.

Risk Containment

((a)) The term "Performance" which was used in Chapter 9 of the PSR comes from the FWP framework terminology where e.g. "performance" of a flow strategy is measured as changes in travel time. We use "Product Specification" here to avoid confusion, since elsewhere we use the term "performance" to indicate survival, fitness etc.

Analysis of results from all monitoring levels contribute to decisions about the future of the project. The purpose of risk containment is to identify monitoring needs and to organize information required to make rational decisions based on projected benefits and risks. This is where we test the hypothesis that supplementation in fact works.

The statement of objectives in quantitative and qualitative terms defines project success. When these objectives are met or exceeded, the project's continuation is justified. Conversely, failure to meet objectives suggests that the project should be significantly modified or perhaps ended. Our ability to distinguish success from failure depends upon the quality of the risk-containment monitoring program. Conclusions about project success (i.e., achievement of objectives) are manifested in decisions to continue or to reshape the project. These decisions are never final; they are reexamined on an iterative basis according to the policy of adaptive management. At each such iteration, an assessment is made regarding benefits and risks of the project, and the conclusions are affected by the results of new information. The question whether or not supplementation "works" is thus constantly reexamined, and the conclusion is always conditioned upon available information. The decision to continue to supplement is synonymous to a conclusion that supplementation works (i.e., the benefits exceed the risks) at that point in time.

The determination of both risks and benefits requires a synthesis of all available information. This monitoring section should specify information needed to perform this synthesis, beyond what is needed to address the other four monitoring levels. The identification of the risk-containment monitoring needs is performed in a systematic way as described in Chapter 7, Risk Analysis.

The risk analysis defines risk in terms of failure to meet objectives in four categories: genetics, experimentation, ecological interaction/natural production, and harvest.

The scope of the monitoring program may change as more information about needs and feasibility become available. The elements listed in Table 9.3 represent the high-priority monitoring needs that are also judged feasible based upon current technology.

Stock Status Monitoring

Monitoring of stock status (run size and spawning escapement) provides information essential to track long-term performance and fitness of the population. Monitoring needs for in-season run size assessment are included under risk containment monitoring (see Chapter 7). Stock status information includes abundance and distribution (by time, location, and habitat type) as well as other demographics. Target and key non-target species would be monitored.

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Appendix C: Glossary of Species' Scientific Names

APPENDIX C

GLOSSARY OF SPECIES SCIENTIFIC NAMES

Adder's tongue (*Ophioglossum vulgatum*)
Aquatic earthworms (Oligochaeta)

Bald eagle (*Haliaeetus leucocephalus*)
Bear grass (*Xerophyllum tenax*)
Beaver (*Castor canadensis*)
Bedstraw (*Galium aparine*)
Belted kingfisher (*Ceryle alcyon*)
Bighorn sheep (*Ovis canadensis*)
Bitter cherry (*Prunus emarginata*)
Bitterbrush (*Purshia tridentata*)
Black cottonwood (*Populus trichocarpa*)
Black flies (Simuliidae)
Black hawthorn (*Crataegus douglasii*)
Black-capped chickadee (*Parus atricapillus*)
Blackberry (*Rubus* spp.)
Blue elderberry (*Sambucus cerulea*)
Bracken fern (*Pteridium aquilinum*)
Bridgelip suckers (*Catostomus columbianus*)
Brook trout (*Salvelinus fontinalis*)
Brown trout (*Salmo trutta*)
Bull thistle (*Cirsium vulgare*)
Bull trout (*Salvelinus confluentus*)
Bulrush (*Sciripus* spp.)
Bursage (*Ambrosia acanhicarpa*)

Caddisflies (Trichoptera/Hydropsychidae)
Caddisfly larvae (Trichoptera/Hydropsychidae)
Carey's balsamroot (*Balsamorhiza careyana*)
Carp (*Cyprinus carpio*)
Cascades frog (*Rana cascadae*)
Cattail (*Typha latifolia*)
Channel catfish (*Ictalurus punctatus*)
Cheatgrass (*Bromus tectorum*)
Chinook salmon (spring, summer, fall) (*Oncorhynchus tshawytscha*)
Chiselmouth (*Acrocheilus alutaceus*)
Choke cherry (*Prunus virginiana*)
Clover (*Medicago* spp.)
Coho salmon (*Oncorhynchus kisutch*)
Coltsfoot (*Petasites frigidus*)
Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*)

Common snipe (*Gallinago gallinago*)
Cutthroat trout (*Oncorhynchus clarki*)

Deer (*Odocoileus* spp.)
Dock (*Rumex* spp.)
Douglas fir (*Pseudotsuga menziesii*)
Douglas squirrel (*Tamiasciurus douglasi*)

Elk (*Cervus elaphus*)

Ferruginous hawk (*Buteo regalis*)
Fireweed (*Epilobium angustifollium*)
Fleabane (*Erigeron* spp.)

Western garter snake (*Thamnophis elegans*)
Golden-crowned kinglet (*Regulus satrapa*)
Goldenrod (*Solidago* spp.)
Grand fir (*Abies grandis*)
Gray wolf (*Canis lupus*)
Green-fruited sedge (*Carex interrupta*)
Grizzly bear (*Ursus arctos = U. a. horribilis*)
Gull (*Larus* spp.)

Hairy woodpecker (*Picoides villosus*)
Harlequin duck (*Histrionicus histrionicus*)
Hawthorn (*Crataegus* spp.)
Hoover's tauschia (*Tauschia hooveri*)
Huckleberry (*Vaccinium* spp.)

Killdeer (*Charadrius vociferus*)
Kinnickinnick (*Arctostaphylos uva-ursi*)
Knapweed (*Centaurea* spp.)
Kokanee (*Onchorhynchus nerka*)

Lake trout (*Salvelinus namaycush*)
Largemouth bass (*Micropterus salmoides*)
Largescale sucker (*Catostomus macrocheilus*)
Leopard dace (*Rhinichthys falcatus*)
Lodgepole pine (*Pinus contorta*)
Loggerhead shrike (*Lanius ludovicianus*)
Longnose dace (*Rhinichthys cataractae*)
Lupine (*Lupinus* spp.).

Marbled murrelet (*Brachyramphus marmoratus*)
Mayflies (Ephemeroptera)
Mock orange (*Philadalphus lewisii*)
Mountain whitefish (*Prosopium williamsoni*)
Mullein (*Verbascum thapsus*)

Northern flicker (*Colaptes auratus*)
Northern goshawk (*Accipiter gentilis*)
Northern red-legged frog (*Rana aurora aurora*)
Northern spotted owl (*Strix occidentalis caurina*)
Northern squawfish (*Ptychocheilus oregonensis*)

Oak (*Quercus* spp.)
Oceanspray (*Holodiscus discolor*)
Oregon grape (*Berberis nervosa*)
Osprey (*Pandion haliaetus*)

Pacific fisher (*Martes pennanti pacifica*)
Pacific lamprey (*Lampetra tridentata*)
Pacific yew (*Taxus brevifolia*)
Pearly everlasting (*Anapahlis margaritacea*)
Peregrine falcon (*Falco peregrinus*)
Pine broomrape (*Orobanche pinorum*)
Ponderosa pine (*Pinus ponderosa*)
Purple aster (*Machaeranthera canescens*)

Rainbow trout (*Oncorhynchus mykiss*)
Raven (*Corvus corax*)
Red Alder (*Alnus rubra*)
Red osier dogwood (*Cornus stolonifera*)
Red-breasted nuthatch (*Sitta canadensis*)
Redside shiner (*Richardsonius balteatus*)
Reed canary grass (*Phalaris arundinacea*)
Rose (*Rosa* spp.)
Rubber boa (*Charina bottae*)
Rush (*Juncus* spp.)
Russian knapweed (*Centaurea repens*)

Sandberg's bluegrass (*Poa sandbergii*)
Sculpin (*Cottus* spp.)
Sedge (*Carex* spp.)
Sharp-tailed snake (*Contia tenuis*)
Smallmouth bass (*Micropterus dolomieui*)
Snowberry (*Symphoricarpos albus*)
Sockeye salmon (*Onchorhynchus nerka*)

Southern alligator lizard (*Elgaria multicarinata*)
Speckled dace (*Rhinichthys oscuslus*)
Spotted frog (*Rana pretiosa*)
Spring vetch (*Vicia sativa*)
Squirrel tail (*Sitanion histrix*)
Stoneflies (Plecoptera)
Strawberry (*Fragaria* spp.)
Sucker (*Catostomus* spp.)
Summer steelhead (*Onchorhynchus mykiss*)
Swamp saxifrage (*Saxifraga integrifolia* var *apetala*)

Thimbleberry (*Rubus parviflorus*)
Torrent sculpin (*Cottus rhotheus*)
True flies (Diptera)
Tumblemustard (*Sisymbrium altissimum*)

Varied thrush (*Ixoreus naevius*)
Victorin grape-fern (*Botrychium minganense*)
Vine maple (*Acer circinatum*)

Western fence lizards (*Sceloporus occidentalis*)
Western hemlock (*Tsuga heterophylla*)
Western red cedar (*Thuja plicata*)
Western sage grouse (*Centrocercus urophasianus phaios*)
Western white pine (*Pinus monticola*)
Westslope cutthroat trout (*Onchorhynchus clarki lewisi*)
Wheatgrass (*Agropyron* spp.)
Willow (*Salix* spp.)
Yarrow (*Achillea millifolium*).
Yellow perch (*Perca flavescens*)
Yellow salsify (*Tragopogon dubius*)

Appendix D: Biological Assessments and Endangered Species Consultation

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

DEC 19 1995

Mr. William Stelle, Jr., Regional Director
National Marine Fisheries Service
7600 Sand Point Way, NE
Bin C15700, Building 1
Seattle, WA 98115

Dear Mr. Stelle:

In fulfillment of the requirements for consultation under Section 7 of the Endangered Species Act of 1973 as amended, we are enclosing a Biological Assessment (BA) of 1997-2001 hatchery operations of the proposed Cle Elum Hatchery.

Bonneville Power Administration (BPA), in cooperation with the Yakama Indian Nation and the Washington Department of Fish and Wildlife, proposes to fund the construction and operation of an upper Yakima River spring chinook salmon hatchery and satellite acclimation facilities near Cle Elum, Washington. This action responds to measure 7.4K.1 of the 1994 Columbia River Basin Fish and Wildlife Program. Contingent upon a favorable BPA Record of Decision and completion of consultation with the National Marine Fisheries Service (NMFS), construction of the hatchery would begin in May 1996 and be completed in 1997. Broodstock collection would begin in 1997, and the first annual release of a maximum of 810,000 spring chinook salmon smolts would occur in 1999. The enclosed BA addresses potential effects of Cle Elum Hatchery operation on listed Snake River salmon.

Based on the analysis in the BA, BPA has determined that the proposed operation of the Cle Elum Hatchery would not adversely affect listed Snake River sockeye salmon, spring/summer chinook salmon, or fall chinook salmon. We request your concurrence. Because we are awaiting completion of Section 7 consultation with NMFS before beginning construction of the Cle Elum Hatchery, we would appreciate your response at the earliest possible date.

Sincerely,

Maryann Armbrust

Maryann Armbrust
Environmental Policy, Strategy, and Analysis

Enclosure

cc:
Mr. Mel Sampson, Yakama Indian Nation
Mr. Steve Leider, Washington Department of Fish and Wildlife

Biological Assessment

1997-2001 Hatchery Operations of the Proposed Cle Elum Hatchery

Submitted to the National Marine Fisheries Service

by

Bonneville Power Administration

December 1995

I. BACKGROUND

The Bonneville Power Administration (BPA), in cooperation with the Yakama Indian Nation (YIN) and the Washington Department of Fish and Wildlife (WDFW), proposes to fund the construction and operation of an upper Yakima River spring chinook salmon hatchery and satellite acclimation facilities near Cle Elum, Washington, hereafter referred to as the Cle Elum Hatchery. This action responds to measure 7.4K.1 of the Northwest Power Planning Council's (NPPC) Columbia River Basin Fish and Wildlife Program (NPPC 1994), which calls for BPA to "Fund design, construction, operation and maintenance of a hatchery to enhance the fishery for the Yakama Indian Nation as well as other harvesters."

In accordance with Section 7 of the Endangered Species Act of 1973, as amended, BPA is submitting this Biological Assessment, which assesses the effects of proposed Cle Elum Hatchery operations on listed anadromous fish, to the National Marine Fisheries Service (NMFS). The proposed action represents an addition to BPA's Artificial Propagation Program as previously described in the *Biological Assessment of 1995-1999 Umatilla Hatchery Operations* (BPA 1994) and the NMFS *Biological Opinion for 1995 to 1998 Hatchery Operations in the Columbia River Basin* (NMFS 1995a).

The Cle Elum Hatchery project would consist of a central outplanting facility near Cle Elum, Washington, and three satellite acclimation facilities: two on the Yakima River (at Easton and at Clark Flat) and one on the North Fork Teanaway River (Figure 1). Several alternative locations are currently being considered for the Easton and North Fork Teanaway River acclimation facilities (BPA 1995).

The project is currently in the design and planning stage. The final design of the facilities is nearly 100% complete. BPA has completed a Revised Draft Environmental Impact Statement for the project (BPA 1995) and is currently completing the Final Environmental Impact Statement. BPA's Record of Decision (ROD) for the project is expected in mid-February 1996. If the ROD and NMFS Biological Opinion are favorable, construction of the Cle Elum Hatchery would begin in May 1996 and be completed in 1997. Juvenile rearing would begin in 1998, and annual releases of a maximum of 810,000 spring chinook smolts are expected to begin in 1999. Spring chinook salmon broodstock collection would begin in 1997 at Roza Dam on the Yakima River. The Roza collection facility is owned by the Bureau of Reclamation (BOR) and would be operated cooperatively by the BOR and YIN (with BPA funding of the YIN personnel who would operate the facility).

II. LISTED ANADROMOUS SPECIES AND CRITICAL HABITAT

No Snake River sockeye salmon, Snake River spring/summer chinook salmon, or Snake River fall chinook salmon are present in the project area. The Cle Elum Hatchery and acclimation facilities are not located in the critical habitat for these listed species. However, spring chinook smolts produced by the Cle Elum facility would outmigrate through the critical habitat of these listed species in the mainstem Columbia River. Adult hatchery-produced upper Yakima spring chinook

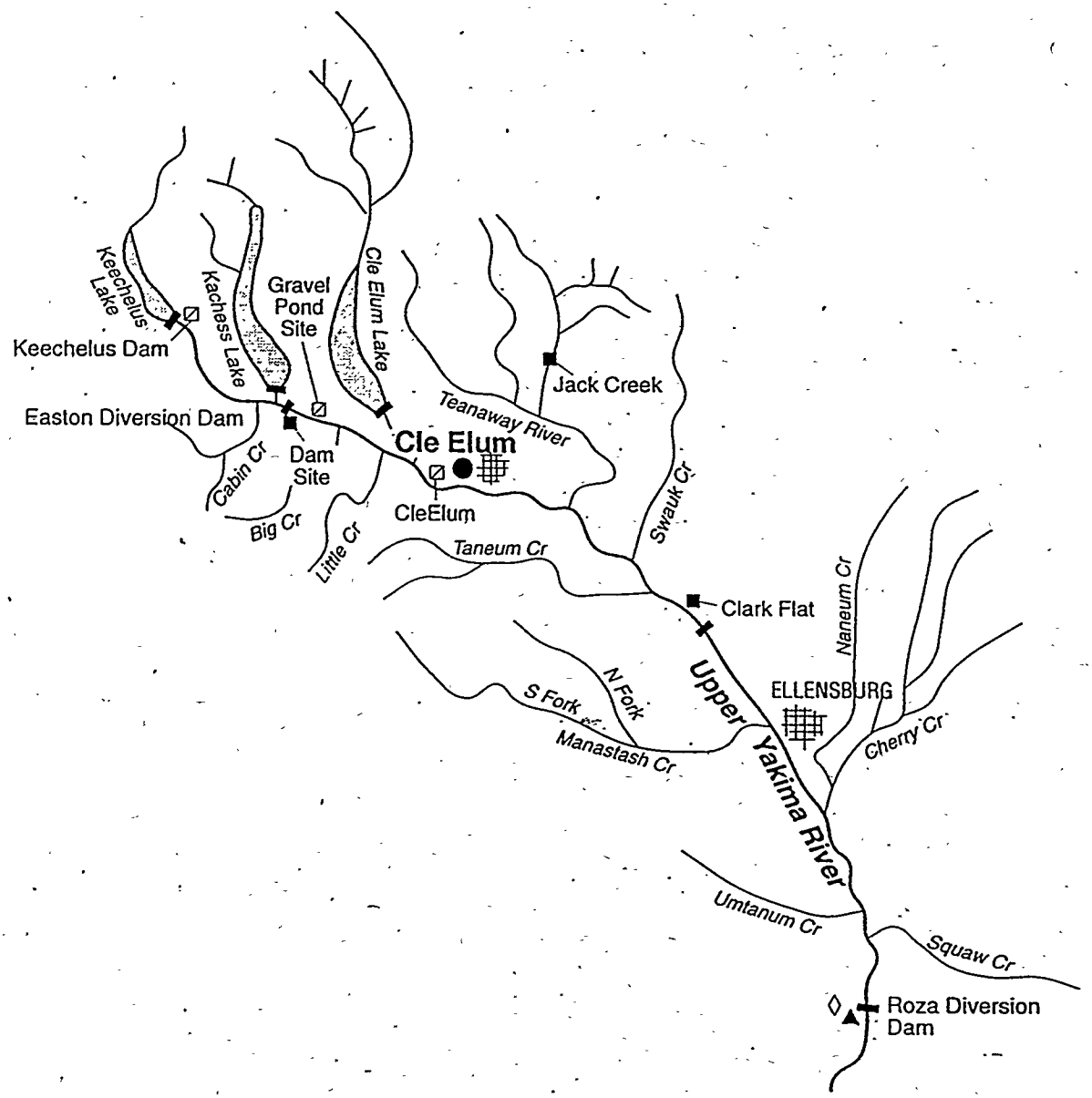


Figure 1. Map of Upper Yakima River Basin showing location of project facilities.

would pass through the critical habitat in the mainstem Columbia River as they migrate upstream to the Yakima River.

III. PROPOSED PROPAGATION PROGRAM

BPA proposes to fund the Cle Elum Hatchery to undertake fishery research and mitigation activities in the Yakima River Basin. WDFW and YIN, the project managers, would jointly direct the project. Research activities designed to increase knowledge of supplementation techniques would be conducted at the propagation facilities. These supplementation techniques would be applied to rebuild naturally spawning anadromous fish stocks historically present in the Yakima River Basin and, ultimately, to rebuild those throughout the Columbia River Basin. The uncertainties about the techniques, as well as the importance of supplementation to existing and potential future enhancement plans, make it imperative that supplementation be thoroughly evaluated using a systematic, experimental program. The Cle Elum Hatchery project would be designed to meet both the need for rigorous research and for responsiveness to changes as the project proceeds (BPA 1995).

1. Adult Collection

Broodstock of upper Yakima River spring chinook salmon would be trapped at Roza Dam from late May through September, beginning in 1997. Adult collection facilities are currently in place at Roza Dam and would be operated cooperatively by the YIN and Bureau of Reclamation. The Roza collection facility is located on the Yakima River at river kilometer (RK) 211 (river mile (RM) 131). The adult trapping facility (as described by STAC 1995) incorporates proven design features and is located on the left bank of the Yakima River (Roza pool) approximately 92 m (300 ft) upstream of Roza Dam. It is hydraulically connected to the existing fishway by a flow control structure and a light-ported aluminum pipe which serves a lake-level fish transport channel (following Cowlitz Hatchery design). An intake provides a gravity source for the transport channel and a river water source, via pumps, for the trapping facilities. The head end of the transport channel is a collection area consisting of a "V" trap entrance, crowder, and a Bonneville Hatchery-style fish lock and lift. From the top of the fish lock, a fish sorting flume (Prosser Dam design) descends past four holding tanks and exits as a river return line. Access to each holding tank is provided by remotely or automatically controlled quick-acting power gates. Holding tanks are provided with a crowder channel access port and individual crowders. The common crowder channel is provided with a crowder that is used to separate/crowd fish retained for hatchery transfer or for crowding to a fish-handling "scalloped" brail. A water-to-water fish transfer brail is used for lifting fish from the crowder channel and for fish transport truck holding.

Fish would ascend the Roza fishway and enter the trap via the transportation pipe. Trapped fish would be crowded into the fish lock that would subsequently be closed and flooded to the elevation of the fish sorting structure. A false floor (lift) would be raised to crowd the fish upward within the lock. Fish sorting would be managed by an operator controlling the lock and lift operation. Fish would have the opportunity to exit the lock volitionally over the weir as flow is increased or would be otherwise encouraged to exit by raising the false floor which serves as a

brail. The individual controlling the fish lock would also be responsible for either sorting fish (by species) into holding tanks, or directing fish to pass through and exit into the Roza pool.

A maximum of 1,100 upper Yakima River spring chinook salmon adults would be collected annually and transported to Cle Elum Hatchery. Only naturally produced (non-marked) fish would be selected for hatchery use and no more than 50% of the available non-hatchery adults would be used for broodstock.

2. Juvenile Rearing and Release

Spring chinook spawning, egg incubation, and fry and juvenile rearing would be conducted at the Cle Elum Hatchery. The initial year of spawning would be 1997. The mating scheme would follow hatchery genetic guidelines developed for the Yakima/Klickitat Fisheries Project (Kapuscinski and Miller 1993), and samples of heart, eye, liver, and muscle tissues from spawned adults would be collected for electrophoretic and other genetic analysis. Fry would be ponded and reared in raceways at the Cle Elum facility. Prior to the end of their rearing cycle (approximately one year after swim-up), all juveniles would be transferred to satellite rearing facilities for acclimation and release. Satellite acclimation ponds would be located at two sites on the Yakima River (at Easton (RK 325 (RM 202)) and Clark Flat (RK 272 (RM 169)) and at one site near RK 314 (RM 195) on the North Fork Teanaway River, a tributary to the Teanaway River, which flows into the upper Yakima River (Figure 1). Smolts would be allowed to outmigrate volitionally from the acclimation ponds from mid-April to mid-May, following five months of acclimation and imprinting. The annual spring chinook salmon production goal of the Cle Elum Hatchery is a release of 810,000 spring chinook smolts at 15 per pound and an average length of 151 mm (6 inches) and a range of 136 mm to 166 mm (5.4 to 6.6 inches). The initial smolt release is planned for spring 1999.

Supplementation research with spring chinook salmon in Cle Elum Hatchery would initially compare two experimental treatments:

- Treatment A is an Optimal Conventional Treatment (OCT) that incubates, rears, and acclimates spring chinook salmon using optimal conventional fish-culture methods derived from artificial propagation experiences within the Columbia River Basin. One-half of the juveniles reared at Cle Elum Hatchery would be reared using this treatment.

- Treatment B is a New Innovative Treatment (NIT) that incubates, rears, and acclimates spring chinook salmon using natural-like environments (e.g., natural cover, substrates, in-water structures in rearing containers) to produce fish that display attributes of naturally-produced spring chinook salmon. One-half of the juveniles reared at Cle Elum Hatchery would be reared using this treatment.

The production figure of 810,000 smolts is based on the number of released smolts required to produce enough returning adults to detect a relative between-treatment difference in adult survival of 50% (with a significance level of 0.1 and a 90% certainty, or power) (STAC 1995).

Research monitoring would include measurements of performance in four main areas:

- post-release survival (survival from time of release until the fish return to spawn);
- reproductive success (number of offspring produced per spawner);
- long-term fitness (genetic diversity and long-term stock productivity); and
- ecological interactions with con-specifics and non-target species (population abundance and distribution, growth rates, carrying capacity, survival rates, transfer of disease, and gene flow).

The following product specification attributes would also be monitored at the Cle Elum facility, the acclimation ponds, and the juvenile monitoring facilities to determine whether the fish produced by the project meet certain goals:

- fish health;
- morphology;
- behavior; and
- survival.

This production-scale comparison of the OCT and NIT would provide results relevant to Recovery Tasks 4.4.c. (developing methods of achieving high quality fish) and 4.4.d. (developing new natural rearing systems) of the NMFS Proposed Recovery Plan (NMFS 1995b). The complete upper Yakima River spring chinook experimental design is contained in the *Yakima/Klickitat Fisheries Project Spring Chinook Planning Status Report* (STAC 1995).

The Cle Elum Hatchery is the type of hatchery envisioned by the National Research Council (NRC), which recommended that the goal of hatchery planning, management, and operations should be to assist recovery of wild populations and to increase knowledge about salmon (NRC 1995). The NRC (1995) concluded that hatcheries should be thought of as laboratories that can provide improved environments for studying juvenile fish and for testing treatments to improve our understanding of what happens to juveniles after they leave the spawning areas. Seen in that light, the NRC indicated hatcheries can be a powerful tool for learning about salmon.

All phases of artificial propagation, fish transfers, and supplementation procedures for the Cle Elum Hatchery project would follow the fish health policy documented in the Integrated Hatchery Operations Team's (IHOT) *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1994). Rigorous sanitation and the use of disinfection procedures combined with optimum husbandry, isolation and quarantine practices, and a strong diagnostic and therapeutic program would minimize fish health concerns and reduce the potential for adverse impacts from disease on wild and hatchery-reared fish during operation of the Cle Elum Hatchery (BPA 1995).

3. Adult returns

Wild upper Yakima River spring chinook spawners are predominantly 4-year-old fish, with a small percentage of 3- and 5- year-old fish (Fast et al. 1991). Hatchery-produced adults would be expected to follow the same general maturation pattern. Therefore, 2000 would be the first year when any brood-year 1997 Cle Elum Hatchery adults would be expected to return to the upper Yakima River (as age 2+ fish), with the majority of the brood-year 1997 fish expected to return in 2001 at age 3+ (Table 1). Adult spring chinook salmon begin migrating upstream past Prosser Dam on the lower Yakima River in late April and have completed passage by late July (BPA 1995).

Table 1. Proposed schedule of Cle Elum Hatchery propagation activities

YEAR	PROPAGATION ACTIVITY			MAXIMUM SPRING CHINOOK SMOLT RELEASE
1997	Begin annual broodstock collection at Roza Dam			
1998	Broodstock collection at Roza Dam	Rearing of brood-year 1997 fry		
1999	Broodstock collection at Roza Dam	Begin annual juvenile releases into Yakima River/North Fork Teanaway River. Rearing of brood-year 1998 fry.		810,000
2000	Broodstock collection at Roza Dam	Juvenile releases into Yakima River/North Fork Teanaway River. Rearing of brood-year 1999 fry.	First year of hatchery adult returns (age 2+ fish)	810,000
2001	Broodstock collection at Roza Dam	Juvenile releases into Yakima River/North Fork Teanaway River. Rearing of brood-year 2000 fry.	Hatchery adult returns continue. (age 2+ and 3+ fish)	810,000

IV. ASSESSMENT OF IMPACTS

A. Effects to Juveniles

1. Migration Corridor Impacts

When juveniles released from a hatchery commingle with listed juveniles in the Columbia River migration corridor, there may be possible adverse effects due to transmission of disease, predation, and competition for food and space. We agree with NMFS (1995a and 1995b) that considerable speculation, but little scientific information, is available concerning the overall effects to listed Snake River salmon from the combined number of hatchery fish in the Columbia River migration corridor and that quantitative information on the level of impact to listed fish from hatchery actions is not available. Consequently, NMFS used qualitative analysis to assess effects of hatchery releases on listed stocks in the *Biological Opinion for 1995 to 1998 Hatchery Operations in the Columbia River Basin* (NMFS 1995a). We have also used a qualitative approach in this Biological Assessment.

a. Snake River Sockeye Salmon

Disease impacts would be minimal. All phases of artificial propagation, fish transfers, and supplementation procedures for the Cle Elum Hatchery project would follow the fish health policy documented in the Integrated Hatchery Operations Team's (IHOT) *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1994). Rigorous sanitation and the use of disinfection procedures combined with optimum husbandry, isolation and quarantine practices, and a strong diagnostic and therapeutic program should result in healthy smolts and reduce the potential for adverse impacts from disease transmission from Cle Elum Hatchery smolts to listed Snake River sockeye salmon smolts in the Columbia River migration corridor.

Cle Elum Hatchery spring chinook (at an expected average release size of 151 mm (6 inches)) would probably not be large enough to prey on Snake River sockeye. Sockeye salmon migrating out of Redfish Lake range in size from 60 mm (2.4 inches) to 117 mm (4.7 inches) (IDFG 1993 as cited in NMFS 1995a).

There is only a slight overlap between the migration period of Cle Elum Hatchery spring chinook smolts, which would be released between mid-April to mid-May (STAC 1995), and the outmigration period of Snake River sockeye, which migrate past Lower Granite Dam between mid-May and early July (Fish Passage Center 1992 as cited in NMFS 1995a). Most of the Cle Elum spring chinook smolts would probably migrate through the Columbia River migration corridor prior to the sockeye outmigration, thus minimizing any potential adverse effects from competition or disease transmission. Most importantly, the 810,000 spring chinook smolts proposed for annual release from the Cle Elum Hatchery acclimation facilities is only 0.4% of the 197.4 million anadromous hatchery fish released into the Columbia Basin in 1994. The addition of this relatively small number of hatchery spring chinook smolts into the Columbia River migration corridor would not significantly increase the current level of interaction between hatchery and listed salmonids. Furthermore, the number of smolts proposed for release from Cle

Elum Hatchery is certainly far below the historical number of smolts produced by the estimated 200,000 adult spring chinook that returned each year to the Yakima Basin prior to 1900 (BPA).

b. Snake River Spring/Summer Chinook Salmon

Disease impacts would be minimal. All phases of artificial propagation, fish transfers, and supplementation procedures for the Cle Elum Hatchery project would follow the fish health policy documented in the Integrated Hatchery Operations Team's (IHOT) *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1994). Rigorous sanitation and the use of disinfection procedures combined with optimum husbandry, isolation and quarantine practices, and a strong diagnostic and therapeutic program should result in healthy smolts and would reduce the potential for adverse impacts from disease transmission from Cle Elum Hatchery smolts to listed Snake River spring/summer chinook smolts in the Columbia River migration corridor.

Predation is not a concern, since Cle Elum Hatchery spring chinook smolts would be expected to be in the same general size range as listed spring/summer chinook salmon smolts.

The release period for Cle Elum Hatchery spring chinook smolts (mid-April to mid-May) overlaps the migration period (early April through June) for listed spring/summer chinook at Lower Granite Dam. Data is not available to allow a quantitative analysis of any competitive interactions between Cle Elum spring chinook and Snake River spring/summer chinook. However, the 810,000 spring chinook smolts proposed for annual release from the Cle Elum Hatchery acclimation facilities is only 0.4% of the 197.4 million anadromous hatchery fish released into the Columbia Basin in 1994. The addition of this relatively small number of hatchery spring chinook smolts into the Columbia River migration corridor would not significantly increase the current level of interaction between hatchery and listed salmonids. Also, the number of smolts proposed for release from Cle Elum Hatchery is certainly far below the historical number of smolts produced by the estimated 200,000 adult spring chinook that returned each year to the Yakima Basin prior to 1900 (BPA 1995).

c. Snake River Fall Chinook Salmon

Disease impacts would likely be minimal. All phases of artificial propagation, fish transfers, and supplementation procedures for the Cle Elum Hatchery project would follow the fish health policy documented in the Integrated Hatchery Operations Team's (IHOT) *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1994). Rigorous sanitation and the use of disinfection procedures combined with optimum husbandry, isolation and quarantine practices, and a strong diagnostic and therapeutic program would reduce the potential for adverse impacts from disease transmission from Cle Elum Hatchery smolts to Snake River fall chinook salmon smolts in the Columbia River migration corridor.

We considered the possibility that the Cle Elum spring chinook smolts might have an adverse predation impact on age-0 Snake River fall chinook outmigrants due to size differences. It has been suggested that predators prey on food items less than or equal to one-third of their length

(Parkinson et al. 1989 as cited in Witty et al. 1995). Cle Elum spring chinook are expected to have an average size of 151 mm (6 inches) and range from 136 mm to 166 mm (5.4 inches to 6.6 inches), while Snake River fall chinook, in 1991, ranged in size from 40 mm (1.6 inches) on May 2 to 104 mm (4.2 inches) on July 14 (Fish Passage Center 1992 as cited in NMFS 1995a). Thus, the average Cle Elum spring chinook smolt would be more than three times the size of the subyearling, 40 mm fall chinook smolts.

In a recent draft review of the potential impacts of hatchery fish on naturally-produced salmonids in the migration corridor of the Snake and Columbia rivers (Witty et al. 1995), the reviewers examined hatchery steelhead predation on subyearling natural chinook salmon because this interaction had the greatest potential adverse impact due to size differences. The reviewers indicated that most salmon and steelhead smolts released from Columbia Basin hatcheries are smaller than 250 mm (10 inches), with residual steelhead exceeding 250 mm in the migration corridor. The reviewers concluded that, since it is unlikely than hatchery steelhead prey on chinook salmon during the year in which the steelhead are released from the hatchery and few residual steelhead survive, the potential impact of hatchery salmonid predation on natural salmonids in the mainstem migration corridor is not a significant factor. Based on this review, we conclude that Cle Elum Hatchery spring chinook smolts, which would be smaller than the typical steelhead smolt, would not be a significant predator on subyearling fall chinook smolts in the migration corridor. NMFS (1995a) also indicated that predation by hatchery fish on listed salmon smolts is believed to be low.

Most Snake River fall chinook pass Lower Granite Dam from mid-June through July (NMFS 1995a), while Cle Elum Hatchery spring chinook smolts will be released from mid-April to mid-May. Therefore, most, if not all, of the Cle Elum spring chinook smolts would probably migrate through the lower Columbia River before Snake River fall chinook smolts would enter this migration corridor, minimizing the opportunity for potential competition and disease transmission. Most importantly, the 810,000 spring chinook smolts proposed for annual release from the Cle Elum Hatchery acclimation facilities is only 0.4% of the 197.4 million anadromous hatchery fish released into the Columbia Basin in 1994. The addition of this relatively small number of hatchery spring chinook smolts into the Columbia River migration corridor would not significantly increase the current overall level of interaction between hatchery and listed salmonids. Also, the number of smolts proposed for release from Cle Elum Hatchery is certainly far below the historical number of smolts produced by the estimated 200,000 adult spring chinook that returned each year to the Yakima Basin prior to 1900 (BPA 1995).

B. Effects to Adults

1. Broodstock Collection

If listed Snake River adults stray outside their normal migration route they may be incidentally captured at hatchery broodstock collection facilities and delayed or prevented from reaching their natural spawning area. The potential for Snake River salmon to stray into the Roza Dam broodstock collection facility is examined as follows:

a. Snake River Sockeye Salmon

No adult sockeye salmon would be collected for broodstock at Roza Dam. There is overlap between the proposed spring chinook collection period at Roza Dam (late May through September) and the migration period of adult Snake River sockeye salmon at Ice Harbor Dam (mid-June through early September) (Dauble and Mueller 1993). However, Roza Dam is located at Yakima RK 211 (RM 131), and the distance between the Snake/Columbia River confluence and the Yakima/Columbia River confluence is 18 RK (11 RM). Thus, a Snake River sockeye salmon would have to stray 229 RK (142 RM) from its normal migration route to reach Roza Dam. We believe straying this far off the migration route to be a highly unlikely event. Furthermore, in the extremely remote event of a Snake River sockeye salmon straying 229 RK and entering the Roza trap, it would be passed back to the Yakima River, because no sockeye would be collected for broodstock. The Roza collection facility is state-of-the-art, allowing sorting of fish and return to the river without removal from the water, and no adverse effects would be anticipated due to handling during the fish sorting process. Accordingly, we have concluded that the opportunity for the operators of the adult collection facilities at Roza Dam to encounter a Snake River sockeye salmon or cause them to modify their migration behavior is unlikely.

b. Snake River Spring/Summer Chinook Salmon

Adult upper Yakima River spring chinook salmon would be collected at Roza Dam from late May through September. This collection period generally coincides with the migration period of Snake River spring/summer chinook. However, it is unlikely that any adult Snake River spring/summer chinook salmon would stray 229 RK from their normal migration route and be incidentally collected at the Roza facility. Furthermore, spring chinook salmon in general have a low potential for straying (Chapman et al. 1991). Accordingly, we have concluded that the opportunity for the operators of the adult collection facilities at Roza Dam to encounter a Snake River spring/summer chinook salmon or cause them to modify their migration behavior is unlikely.

c. Snake River Fall Chinook Salmon.

Fall chinook are not targeted for broodstock collection at the Roza facility. Run timing for fall chinook at Ice Harbor Dam extends from mid-August to the end of October (Dauble and Mueller 1993). There is some overlap of the spring chinook collection period at Roza Dam (late May through September) with the migration period of Snake River fall chinook salmon at Ice Harbor Dam. However, it is unlikely that any Snake River fall chinook salmon would stray 229 RK from their normal migration route and be incidentally collected for broodstock at the Roza adult trap. Thus, we have concluded that the opportunity for the operators of the adult collection facilities at Roza Dam to encounter a Snake River fall chinook salmon or cause them to modify their migration behavior is unlikely.

2. Genetic Introgression

Straying of hatchery-produced adult salmon into the Snake River system and spawning with listed Snake River salmon may lead to outbreeding depression and reductions in the fitness of natural Snake River populations. Furthermore, straying can lead to breakdown in population structure if the strays make permanent genetic contributions. Given these concerns, it is prudent to limit the genetic introgression by non-native hatchery fish into natural populations (NMFS 1995a). Potential straying of Cle Elum Hatchery adults into the Snake River system is assessed as follows:

a. Snake River Sockeye Salmon

No sockeye salmon would be reared at the Cle Elum Hatchery.

b. Snake Spring/Summer Chinook Salmon

We believe the likelihood of Cle Elum Hatchery spring chinook straying into the Snake River system and spawning with Snake River spring/summer chinook is very low. This assessment is based on a several planned propagation measures that would enhance the homing ability of the hatchery-produced spring chinook:

- Pre-release acclimation of hatchery juveniles at upper Yakima River acclimation sites above RK 272 (RM 169).
- The use of locally-adapted upper Yakima River spring chinook stock as broodstock.

All hatchery-reared juveniles would be marked prior to release into the upper Yakima River, allowing identification of any stray Cle Elum Hatchery fish arriving at Snake River hatcheries, and an estimate of the straying rate for Cle Elum Hatchery fish.

c. Snake River Fall Chinook Salmon

No fall chinook salmon would be reared at the Cle Elum Hatchery.

V. SUMMARY AND CONCLUSIONS

Based on our qualitative analysis, BPA has concluded that the operation of the Cle Elum Hatchery and the Roza Dam broodstock collection facilities from 1997 through 2001 would not adversely affect the existence or recovery of Snake River sockeye salmon, spring/summer chinook salmon, or fall chinook salmon.

- Adverse impacts from Cle Elum spring chinook smolts on listed Snake River salmon smolts in the Columbia River migration corridor are unlikely. Application of state-of-the-art fish health and fish husbandry practices at the Cle Elum Hatchery would promote production of high-quality, healthy smolts, thereby minimizing the risk of disease transmission to listed salmon

juveniles in the migration corridor. Predation on listed smolts would not be significant. The number of Cle Elum Hatchery smolts proposed for annual release (810,000) is extremely small compared to total Basin-wide hatchery releases in 1994 (197.4 million anadromous juveniles), and represents only 0.4% of this total. The addition of this relatively small number of hatchery spring chinook smolts into the Columbia River migration corridor would not significantly increase the current overall level of interaction between hatchery and listed anadromous salmonids.

- The opportunity for the operators of the adult collection facilities at Roza Dam to incidentally capture a Snake River sockeye salmon, spring/summer chinook salmon, or fall chinook salmon or cause them to modify their migration behavior is highly unlikely due to the location of the collection facility 229 RK (142 RM) upstream from the Snake/Columbia River confluence.

- The upstream location of the Cle Elum Hatchery acclimation and release sites and the use of locally-adapted upper Yakima River spring chinook stock for broodstock, early pre-smolt transfer to acclimation facilities, and volitional release would encourage strong imprinting in smolts and would be expected to greatly reduce, if not eliminate, straying of Cle Elum Hatchery adults from the Yakima Basin.

As a reasonable and prudent alternative in the *Biological Opinion for 1995 to 1998 Hatchery Operations in the Columbia River Basin*, NMFS decided to limit anadromous hatchery releases to the 1994 level of 197.4 million fish. We assume that a similar Basin-wide production cap will be in effect in 1999 when the initial Cle Elum Hatchery smolt release is proposed. Since the qualitative analysis in this Biological Assessment shows no adverse effects to listed Snake River salmon, we suggest that, in 1999, production could be reduced at other hatcheries to accommodate the small amount of new annual production from the Cle Elum Hatchery under the Basin-wide production cap. An alternative approach would be to raise the production cap in 1999 by an increment of 810,000 fish to accommodate the new Cle Elum Hatchery production.

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Department of Energy
Bonneville Power Administration
P.O. Box 3621
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December 18, 1995

Mr. David Frederick
U.S. Fish and Wildlife Service
3704 Griffin Lane S.E., Suite 102
Olympia, WA 98501

Dear Mr. Frederick:

In complying with its responsibilities under the Endangered Species Act of 1973, Bonneville Power Administration (BPA) submits the enclosed Biological Assessment of the threatened and endangered species listed in your letter (1-3-96-SP-58) of November 29, 1995.

Biological Assessment - Conclusion: It is BPA's opinion that the construction and operation of proposed facilities within the Yakima Fisheries Project fall under the categories of either "no effect" or "may affect, not likely to adversely affect."

We would appreciate a written response for our files indicating your concurrence with our conclusions. Please contact me at (503) 230-7349 if you have any questions.

Sincerely,

Patricia Smith
Environmental Specialist

Enclosure

BIOLOGICAL ASSESSMENT OF POTENTIAL IMPACTS ON THE BALD EAGLE, GRAY WOLF, GRIZZLY BEAR, PEREGRINE FALCON, MARBLED MURRELET, AND NORTHERN SPOTTED OWL RESULTING FROM CONSTRUCTION AND OPERATION OF HATCHERY FACILITIES AND ACCLIMATION PONDS FOR THE YAKIMA FISHERIES PROJECT

Introduction

The Bonneville Power Administration (BPA) proposes to construct and operate fisheries-related facilities in the upper Yakima River Basin to test the principles of supplementation, with the eventual goal of applying the results throughout the Columbia River Basin. Supplementation is a strategy for rebuilding fish spawning runs by releasing artificially propagated fish into natural streams to increase natural production. The proposed facilities and activities, collectively called the Yakima Fisheries Project (YFP), will be jointly managed by the BPA, the State of Washington, and the Yakima Indian Nation (YIN).

In support of the environmental impact statement (EIS) being prepared for the YFP, the Pacific Northwest National Laboratory (PNNL) has initiated consultation with state and federal resource management agencies regarding the potential occurrence of threatened and endangered species in the vicinity of the proposed hatchery and acclimation pond sites (Attachment 1).

In compliance with Section 7(c) of the Endangered Species Act (ESA), this Biological Assessment (BA) addresses potential impacts on those species (other than anadromous salmonids) listed as endangered or threatened under the ESA that may occur in the vicinity of the project sites. Listed species that may be present include the following: bald eagle (*Haliaeetus leucocephalus*), gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), peregrine falcon (*Falco peregrinus*), marbled murrelet (*Brachyramphus marmoratus marmoratus*), and northern spotted owl (*Strix occidentalis caurina*).

Background

BPA proposes to construct a central hatchery facility for spring Chinook salmon at Cle Elum, and three acclimation ponds within upper Yakima River basin, one near Thorp (Clark Flat), one near Easton (Easton Ponds), and one within the drainage of the North Fork Teanaway River (Jack Creek). The general locations of these proposed facilities are provided in Table 1.

Table 1. Locations of Proposed Yakima Fisheries Project Facilities

Site	Township	Range	Section
Cle Elum Hatchery	20N	15E	33
Easton Ponds Acclimation Pond	20N	13E	12 (SW/4)
Clark Flat Acclimation Pond	19N	17E	28 (SW/4)
Jack Creek Acclimation Pond	21N	16E	8 (E/2,E/2)

Earlier drafts of the YFP EIS included a number of additional sites that have since been eliminated from consideration in the Final YFP EIS. The original environmental assessment (EA) prepared for the siting and construction of proposed facilities (BPA 1990) found no significant impact on environmental resources. However, it was determined that additional information regarding the operation of fish production facilities and the potential impacts of the construction of the acclimation ponds was necessary. A draft EIS, and subsequently a Revised Draft EIS (BPA 1995), were prepared to address these issues. This BA has been prepared to support the Final EIS for the YFP, and is intended to fulfill requirements of the ESA, the National Environmental Policy Act (NEPA), and the State Environmental Policy Act (SEPA) regarding the consideration and protection of threatened and endangered species.

Project Description

An overall description of the Yakima Fisheries Project is provided in the FEIS. General locations of the proposed facilities within the upper Yakima River Basin, and specific site locations and layout diagrams for each of the proposed facilities, are provided in Attachment 2. Development of each site will include some clearing and earthwork, construction of the facilities, the laying of pipes for water intake and discharge, construction and/or improvement of access roads, and installation of fences around the site. Construction of the approximate 6-hectare (ha) (15-acre (ac.)) Cle Elum Hatchery facility is expected to begin in Spring 1996, and construction of the acclimation sites in Spring 1997. The acclimation sites will each be less than 0.8 ha (2 ac.). The Cle Elum hatchery will be staffed full-time, year round, and will include several on-site staff residences. The acclimation facilities will be operated primarily from January through May. Operation of the acclimation sites will require daily visits by 1 to 2 people for up to 8 hours per site.

Description of Affected Environment

The proposed facility sites are all along the Yakima River and the North Fork of the Teanaway River. The sites are all in Kittitas County, in naturally forested and non-forested areas. The forested areas are characterized by conifers, some of which have been logged. The non-forested areas are characterized by desert shrubs and grasses; much of it has been grazed by domestic livestock. A narrow band of broad-leaved, deciduous trees forms an essentially continuous riparian corridor along the banks of the Yakima River and its major tributaries. The existing environments in the vicinity of each of the proposed facility sites are described in the original EA (BPA 1990) and are briefly summarized in the following paragraphs.

Cle Elum Hatchery Site. The proposed site is located on an approximately 200-ha (500-ac.)parcel that consists of an old oxbow or river channel cut off from the Yakima River by the Burlington Northern Railroad. The land is currently owned by Burlington Northern Railroad and Plum Creek Timber. The site includes wetlands, riparian forest, upland forest, and several large ponds. The proposed site for the hatchery supports second growth ponderosa pine/Douglas fir upland forest. Black cottonwood is also abundant in the area. The understory vegetation is sparse. Wildlife observed in the area include osprey, common snipe, killdeer, belted kingfisher, hairy woodpecker, northern flicker, red-breasted nuthatch, raven, black-capped chickadee, golden-crowned kinglet, varied thrush, and Douglas squirrel. One beaver dam was noted.

The riparian area along the Cle Elum River below Cle Elum Lake and the Yakima River in the vicinity of this site is used by wintering bald eagles and cavity-nesting waterfowl. However, large ponderosa pines and cottonwoods along the river that provide perches for bald eagles are limited on the hatchery site. Osprey have nested in two large snags on the northeast end of the site, about 610 meters (m) (2000 feet (ft.)) from the proposed development area. Cavity-nesting waterfowl nest along the John Wayne Trail, about 2 km (1.2 mi.) from the site.

The site is within an elk wintering area (WDFW 1995). About 100 animals use the area along the Cle Elum River, below Cle Elum Lake Dam. The elk range on either side of the river and occasionally wander into the southern portion of the site.

Large woody debris, abundant on the site, provide habitat for reptiles and amphibians including sharp-tailed snakes, alligator lizards, western fence lizards, garter snakes, and rubber boas (Renfrow 1994).

Easton Gravel Pond Acclimation Site. The proposed site is located next to the I-90 corridor and is currently owned by the Washington Department of Transportation and private parties. Much of the adjacent forest land has been logged. The ponds are surrounded by cottonwoods with scattered pines and Douglas fir. The understory includes vine maple, willow, alder, and snowberry. The proposed acclimation pond site is in a highly disturbed area that includes a large gravel pile. Vegetation is patchy and includes daisy, mullein, aster, goldenrod, and dock. Great blue herons, downy woodpeckers, other cavity-nesting species, and amphibians probably use the riparian corridor along the periphery of the site and the adjacent ponds.

Clark Flat Acclimation Site. This site is currently privately owned. The shoreline vegetation at the Clark Flat site consists of a narrow corridor of cottonwood and alder associated with shrub willows, wild rose, snowberry, red osier dogwood, choke cherry, and mock orange. There is some reed canary grass growing along an irrigation ditch. Common herbs include knapweed, Carey's balsam root, Sandberg's bluegrass, cheatgrass, and Russian thistle. The site is not in the coniferous zone, but a few scattered ponderosa pine trees and a single oak tree are in the general area. The adjacent slopes support bitterbrush and bluebunch wheatgrass. The site shows signs of overgrazing. The bitterbrush on the adjacent slopes may attract deer in the winter, and the tall trees along the Yakima River likely provide perch sites for wintering bald eagles. This site is near mule deer winter range (WDFW 1995).

Jack Creek Acclimation Site. The proposed site is currently owned by Boise Cascade Corp. and is located in an open field dominated by wheatgrass, knapweed, yellow salsify, and yarrow. The site is in open range and has been heavily grazed by cattle. The shoreline vegetation along the creeks consists of cottonwood and alder. The adjacent forest is dominated by Douglas fir and ponderosa pine, with some grand fir. Some of the larger trees may provide perch sites for wintering bald eagles. Common shrubs include snowberry, red osier dogwood, hawthorn, and vine maple. The area is a hunting unit and receives repeated recreational use by campers, hunters, and anglers. The site is located immediately south of the 29 Pines campground. The site is within an elk calving range (WDFW 1995).

Environmental Impacts

This assessment of potential effects on threatened and endangered species is based on field surveys conducted by PNNL and other workers, and on information provided by the Cle Elum Ranger District of the U.S. Forest Service (USFS), the US Fish and Wildlife Service (USFWS), and the Washington Department of Fish and Wildlife (WDFW).

Bald Eagle

A BA was prepared to assess potential impacts on bald eagles as part of the original YFP EA (BPA 1990). At that time the BPA determined that the project would have no adverse affect on nesting or wintering bald eagles, their habitat, or food supply.

PNNL conducted surveys during the winter of 1991/1992 at all of the proposed facility sites. The Yakima River and all its tributaries with proposed acclimation sites were surveyed. Primary concentrations of eagles were found on tributaries to the Yakima River. Most of the eagles were

observed perching in large trees, and no signs of nesting were observed. An aerial survey conducted by PNL in May 1993 covered the entire Yakima River mainstem from Stampede Pass to the Columbia River. No bald eagle nesting was observed. One pair of bald eagles is known to nest near Lake Cle Elum, and the USFS is attempting to encourage a second nest at Lake Kachess.

The Clark Flat site is within a portion of the Yakima River that has been identified by WDFW as a bald eagle wintering area. The floodplain and associated wetlands within the approximate 37-km (23-mi.) river section between Yakima Canyon and the confluence of Swauk Creek (including the Clark Flat site) are used by approximately 25 to 30 wintering eagles (WDFW 1995). These birds may also range throughout the surrounding area during the winter in search of carrion. The construction of the acclimation facility will be timed to avoid the period of use by wintering bald eagles (November through March). Therefore, construction of the facility is not likely to adversely affect the eagles. The extent of night-roosting use of the area near the Clark Flat site is not known. If necessary, periodic surveys of the area can be performed to determine whether the area is being used for night roosting. Operation of the facility would involve daily visits by one to two people from January through May. If night roosting eagles were detected, these visits could be scheduled, if necessary, for mid-day, when the presence of humans is unlikely to disturb night roosting eagles.

The Easton gravel ponds acclimation site and the Cle Elum hatchery site are within a stretch of the Yakima River (upstream from Swauk Creek) that is typically used by 10 to 15 bald eagles, especially in early spring (WDFW 1995). Eagles may occasionally perch on trees near the river at both sites. If they are observed in the vicinity, construction can be delayed until after the primary winter use period. Since both sites are located close to the interstate highway and other areas of intense human activity, the operation of the hatchery and acclimation sites are unlikely to affect eagles.

Bald eagles may use the North Fork Teanaway drainage for a period each fall (WDFW 1995). They are unlikely to spend the entire winter in that area because of greater snow cover and lower temperatures than those in areas closer to the Yakima River mainstem (Lee Stream pers. comm.). If the North Fork Teanaway were to freeze over during the winter, the amount of prey for bald eagles would be limited. Construction of the facility would be timed to avoid the period of use by bald eagles. The operation of the facility in the North Fork Teanaway drainage would not significantly increase the level of human activity in the area, since the area is used extensively for recreation, including hunting and snowmobiling.

It is concluded that the proposed activities are not likely to adversely affect bald eagles in the vicinity of the proposed YFP facilities. If the project is successful in increasing the numbers of anadromous fish in the Yakima Basin, wintering bald eagles may ultimately benefit because of an increased food base.

Grizzly Bear

Isolated incidences of grizzly bears have been reported for uninhabited areas (e.g. minimal human disturbance) on the eastern slopes of the Cascade Mountains in Washington. Several unconfirmed sightings are reported each year in the Cle Elum Ranger District. Surveys for grizzly bear habitat in the vicinity of proposed acclimation pond and hatchery facilities were conducted during the spring of 1992. No definitive sightings of grizzly bear have been reported near the Clark Flat or Easton Ponds sites. The Clark Flat site is not located within or near suitable grizzly bear habitat; the Easton Ponds site is within a relatively disturbed area, and is surrounded by an area of heavy human presence, including an interstate highway, residences, and a gravel pit. One grizzly bear was sighted in 1989 in the Teanaway Butte area approximately 16 km (10 mi.)north of Cle Elum (Almack 1990). If still present, the home range of that individual may overlap the Cle Elum hatchery site and the Jack Creek acclimation site.

The Cle Elum hatchery site does not contain many of the elements (isolation, space, denning, and safety) considered essential for grizzly bear habitat (Craighead et al. 1982). The proposed site is located in close proximity to man-made features (such as highways, railroads, and residences) that may reduce the attractiveness of the site to grizzly bear.

The Jack Creek site contains upland and riparian vegetation that could provide some forage for grizzly bear, but is not dominated by vegetation (i.e. huckleberries, kinnickinnick, or sedges) that constitute primary forage for this species (Servheen 1992). The Jack Creek site is located immediately adjacent to the 29 Pines Campground, which may reduce the attractiveness of the site to grizzly bears, at least during the summer months while the area receives considerable recreational use. However, grizzlies could use the area for spring forage, and may also be attracted to the area in the spring because of the potential presence of winter carrion. Since the Jack Creek site is located on private land that is not completely surrounded by federal land, this site is not within a designated recovery zone for grizzly bear.

The operation of an acclimation facility at Jack Creek is not expected to adversely affect grizzly bear because the activities associated with the operation of the facility will not significantly increase the level of human presence in the area. Also, because the facility will be fenced, the bears would not be directly affected by the presence of the facility.

Construction and operation of the proposed facilities at the Cle Elum, Clark Flat, and Easton sites are expected to have no effect on grizzly bear. The Clark Flat site is located several miles from suitable habitat, and the Easton and Cle Elum sites are located adjacent to or near the interstate highway in disturbed areas that do not contain suitable grizzly bear habitat.

Gray Wolf

Isolated sightings of gray wolf have been reported for uninhabited areas (e.g. minimal human disturbance) on the eastern slopes of the Cascade Mountains in Washington. Several unconfirmed sightings are reported each year in the Cle Elum Ranger District. Surveys for gray wolf habitat in the vicinity of the proposed facilities were conducted by PNNL during the Spring of 1992. Howling surveys were also conducted within the Cle Elum Ranger District, USFS, during 1989, 1990, and 1992. No gray wolf sightings have been reported in the vicinity of the proposed Clark Flat, Easton Ponds, or Cle Elum sites. Gray wolves were observed in the vicinity of Matthew's Creek, approximately 6.4 km (4 mi.) NW of the Jack Creek Site, during the 1989 and 1990 surveys. An unconfirmed sighting of a gray wolf was reported near the North Fork Teanaway River in 1992.

The construction of the proposed facilities will not remove or significantly alter any habitat areas that are regularly used by gray wolves, and will not affect denning or the wolf prey base. However, the North Fork Teanaway drainage might be used by gray wolves, especially during spring because of deer fawning, elk calving, and the potential presence of winter carrion.

The operation of an acclimation facility at the Jack Creek site is not expected to adversely affect the gray wolf because the activities associated with the operation of the facility will not significantly increase the level of human presence in the area. Also, because the facilities will be fenced, wolves would not be directly affected by the presence of the facility.

Construction and operation of the proposed facilities at Cle Elum, Clark Flat, and Easton are not expected to affect gray wolves. The Clark Flat site is located several miles from suitable habitat, and the Cle Elum and Easton sites are located near the interstate highway in disturbed areas that do not contain suitable gray wolf habitat.

Peregrine Falcon

Peregrine falcons require rocky cliffs or outcrops greater than 18 meters (m) (60 feet (ft.) in height for nesting. The WDFW inventoried portions of the Wenatchee National Forest and found no active nest sites within the Cle Elum Ranger District. There are no known outcrops or cliffs that would support peregrine falcon nesting in the vicinity of any of the proposed sites. Individuals are known to migrate through the region during spring and fall, and have been observed within the forests in the vicinity of the proposed facility sites.

Use of habitat by peregrine falcons can be affected by timber harvest, road construction and recreation. However, the construction and operation of the proposed hatchery and acclimation ponds is unlikely to alter the use of the area by peregrine falcons, will not decrease the prey base for this species, and will not disturb any potential nesting habitat. Because construction of the facilities will not result in the loss of significant amounts of riparian habitat, the use of the area by song birds is not likely to be affected. It is possible that smaller birds may be attracted to the acclimation ponds, which could expose those birds to predation by peregrines. However, this is not likely to have a detrimental effect on the peregrine falcons.

It is concluded that the proposed activities may affect, but are not likely to adversely affect, peregrine falcons in the vicinity of the proposed facility sites.

Marbled Murrelet

Marbled murrelets forage in salt water and nest in large conifers (greater than 81 centimeters (cm) or 32 inches (in.) diameter at breast height (dbh) within mature forest stands that are no more than approximately 80 km (50 mi) of the shore. A single marbled murrelet fly-over was reported in western Kittitas County in 1993 (Kim Flotlin pers. comm.). The region has not been extensively surveyed for murrelet habitat or nesting, so the extent of use by this species in the vicinity of the proposed facility sites is not known.

The Easton acclimation site is located approximately 80 air-kilometers (50 mi.) from Puget Sound, and therefore may be at the edge of the known nesting distribution of murrelets. However, there is no suitable murrelet nesting habitat in the near vicinity of the proposed Easton site.

Suitable nesting habitat does occur in the vicinity of the Jack Creek acclimation site. However, the proposed site is at least 100 km (64 mi.) from Puget Sound, and is therefore outside of the known nesting range for the species. The Cle Elum hatchery site and the Clark Flat acclimation site are both out of the known range for the species, and there is no suitable nesting habitat at either of these sites.

Construction of the proposed facilities will not remove any large trees suitable for marbled murrelet nesting, and all of the sites are either at the outer edge or well outside of the known nesting distribution for murrelets. None of the sites are near proposed critical habitat for marbled murrelets (50 FR 154). Therefore, it is concluded that the construction and operation of the proposed hatchery and acclimation facilities will have no effect on marbled murrelets.

Northern Spotted Owl

Surveys for northern spotted owls have been performed in the vicinities of the proposed YFP facilities. Additional information has been provided by the WDFW and the USFS. A summary of the status of each of the proposed facility sites in regard to spotted owls is provided in Table 2. None of the proposed sites are located in federal lands; therefore, none of the sites fall under the jurisdiction of the Northwest Forest Plan, and none have been designated as critical habitat.

Table 2. Status of Northern Spotted Owls at Proposed YFP Facility Sites

Site	Owl Habitat	Site within a 2.9-km (1.8 -mi.) management radius?	Conclusion
Cle Elum	Site inspections indicate no suitable habitat at or near the site.	No	No impact on spotted owls will result from project construction or operation.
Easton Ponds	Examination of aerial photos indicates that the site is not suitable spotted owl habitat.	No	No impact on spotted owls will result from project construction or operation.
Clark Flat	Examination of aerial photos indicates that the site is not suitable spotted owl habitat.	No	No impact on spotted owls will result from project construction or operation.
Jack Creek	Site itself is not suitable habitat, but suitable habitat is in vicinity.	Yes	Construction can be timed to minimize disturbance.

No suitable spotted owl habitat exists at the proposed Clark Flat acclimation facility site, or within several miles of the site. Construction and operation of an acclimation facility at this site will have no effect on spotted owls.

The proposed Easton Ponds acclimation site does not contain suitable spotted owl habitat, nor is there suitable habitat in the near vicinity. The proposed site is near the boundary of several 2.9-km (1.8-mi.) owl management circles. The proposed site is approximately 4 km (2.5 mi.) from both the Easton Ridge and Domerie Creek owl centers, and approximately 5 km (3 mi.) from the Big Creek-Lower owl center. The site is located adjacent to the I-90 corridor in an area that has been logged or otherwise disturbed. Construction of an acclimation facility at this site therefore will not remove any spotted owl habitat, nor will it alter the habitat suitability for spotted owls in the area. Operation of the proposed facility will not significantly increase the level of human presence in the area, and therefore will not affect spotted owls in the vicinity.

The Cle Elum Hatchery site does not contain suitable habitat for spotted owls, nor is there suitable habitat in the near vicinity of the site. The closet known owl centers are the Prospect Creek (approximately 5.6 km or 3.5 mi. north) and Orso Creek (approximately 8 km or 5 mi. northeast), and several in the Taneum Drainage approximately 8 km (5 mi.) south on the far side of South Cle Elum Ridge. The most recent sighting of the Prospect Creek owl was during 1995 (Stan Sovern pers. comm.). A single male owl was observed at the Orso Creek center in 1994, but a female has not been observed at that center since 1992. Since the Cle Elum Hatchery site does not contain suitable spotted owl habitat, and is not in proximity to suitable habitat, construction and operation of the Cle Elum hatchery site is expected to have no effect on spotted owls.

The Jack Creek site is proximal to suitable spotted owl habitat, although the site itself does not contain spotted owl habitat. A total of nine spotted owl centers have been identified in the general vicinity of the Jack Creek site; four of these centers were active in 1995 (Table 3). The proposed site is located within the 2.9-km (1.8-mi.) management radius for the Jungle Creek - Teanaway owl center, but this center has not been active since 1986, and it is unlikely to be used by spotted

owls in the near future. It is classified as a status 4 center. The proposed Jack Creek site is also within the 2.9-km (1.8-mi.) management radius for the Shirk Creek center; these owls were last observed in 1992. The proposed site is also on the edge of the 2.9-km (1.8-mi.) management radius for the Teanaway North Fork Owl center. This owl center has been active, and owls were confirmed as using the area during the 1995 nesting season.

Development of Jack Creek site will not require the removal of any trees suitable for spotted owl nesting, and the site is located in an essentially open meadow with a few scattered trees, all less than 20 cm (8 in.) dbh. This type of habitat is not selected for foraging by spotted owls (Stan Sovern pers. comm.). Therefore, development of this site will not reduce the acreage of usable nesting or foraging habitat within the home range of any owls in the vicinity.

The primary potential effect of construction would be disturbance of nesting owls from noise and increased human activity. Over the last several years, Boise Cascade has surveyed parts of the area surrounding the proposed site for spotted owl nesting sites and spotted owl habitat. They have determined that the proposed acclimation site is not within spotted owl habitat, and that no owls are known to nest within at least 0.8 km (0.5 mi.) of the proposed sites. The known owl centers in the area are also monitored yearly by the Pacific Northwest Research Station in Cle Elum; this monitoring was the primary source for the observation records listed in Table 3.

Table 3. Owl Centers in the Vicinity of the Proposed Jack Creek Acclimation Site

Owl Center Name	Most Recent Year Owls Observed	Distance from Jack Creek site to 2.9-km (1.8 mi.) administrative boundary
Indian Creek	1995	0.8 km (0.5 mi.)
Jack Creek	1995	2.9 km (1.8 mi.)
Jungle Creek North	1993	1.4 km (0.9 mi.)
Jungle Creek South	1991	1.0 km (0.6 mi.)
Jungle Creek - Teanaway	1986	within
Rye Creek	1993	1.4 km (0.9 mi.)
Shirk Creek	1992	within
Standup Creek	1995	2.6 km (1.6 mi.)
Teanaway North Fork	1995	within or <0.2 km (0.1 mi.)

If needed, additional surveys can be performed by BPA during the 1996 nesting season, and prior to construction in the 1997 nesting season, to determine whether any spotted owls are nesting in the vicinity of the Jack Creek site. If active nests are found within 0.8 km (0.5 mi.) of the site, formal consultation with the USFWS will be initiated. Once constructed, the operation of the acclimation facility is expected to have no effect on spotted owls in the region because the activities associated with the operation of the facility will not significantly increase the level of noise or human presence.

Federal Candidate Species and Other Species of Concern

Several additional species that may occur in the vicinity of the project sites are listed by the USFWS as candidate species or by the State of Washington as species of concern (Table 4). Surveys have not been specifically conducted for all of the species listed in Table 4, but some of them are known to occur at or near some of the proposed facility sites. The proposed actions are not anticipated to affect or jeopardize any of these species of concern.

Two federal candidate plant species of concern (Clustered lady's slipper and Seely's silene) were identified by the USFWS as occurring in the vicinity of the proposed facility sites. However, the Washington State Natural Heritage Program determined that there are no known populations of these or other federal- or state-listed plants that would be affected by the proposed activities (see Attachment 1).

Bull trout are known from a number of lakes, rivers, and creeks in the Upper Yakima River Basin, including the North Fork Teanaway River and the mainstem of the Yakima River near Cle Elum. It is possible that increased natural production of target species (spring chinook) due to the YFP may result in adverse competitive interactions with bull trout. However, the proposed acclimation facilities have been sited to minimize the potential for adverse interactions with other native species, while still achieving production objectives for the target species.

Westslope cutthroat trout are also present in portions of the Yakima Basin, mainly at elevations between 677 and 988 m (2220 and 3240 feet) above sea level (Pearsons et al. 1994), but a few adults have been observed at lower elevations within both tributaries and the Yakima mainstem. A YFP increase in the natural production of spring chinook could increase the level of interaction between these species. However, both competitive and predatory interactions would probably favor the cutthroat over the chinook within the mainstem of the Yakima River and its lower tributaries. The spawning areas used by the two species will probably not overlap, because the cutthroat normally uses higher elevation portions of the tributaries. The proposed acclimation facilities have been sited so as to minimize the potential for adverse interactions between the spring chinook and other native species.

The Pacific lamprey is occasionally observed in the upper Yakima River Basin, but very little information about its abundance and distribution is available, and no adults have been seen (Todd Pearsons pers. comm.). Construction and operation of the proposed facilities are not expected to have any direct impacts on this species, and competitive, predatory, and other interactions between the Pacific lamprey and either juvenile or returning adult spring chinook are expected to be minimal.

Six of the species listed in Table 4 are bats. Most of these require roost sites that include crevices in rocks or cliffs, caves, under the bark of trees, or in snags or cavities created by woodpeckers. They forage mainly in riparian areas. The proposed activities are not expected to have a significant effect on these species because no cliffs or large rocks will be disturbed and tree removal will be minimal at all sites. Riparian areas will not be significantly or permanently disturbed.

Western sage grouse require sagebrush steppe for nesting and foraging, and could be present in the vicinity of the Clark Flat acclimation site. Development of this site will not remove any sagebrush or other desert shrubs, and therefore will not disturb or remove sage grouse habitat. Known sharp-tailed grouse populations in Washington are currently restricted to Douglas and Okanogan counties. They were historically known to be in Kittitas county, but have not been observed in that area since the 1950's (Lisa Fitzner pers. comm.).

Table 4. Potential Federal Candidate and other Species of Concern near YFP sites

Common Name	Scientific Name	Status*
Bull trout	*Salvelinus confluentus*	FC1
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	FC2
Pacific lamprey	*Lamptra tridentata*	FC2
Spotted frog	*Rana pretiosa*	FC1
Cascades frog	*Rana cascadae*	FC2
Northern red-legged frog	*Rana aurora aurora*	FC2
Tailed frog	*Ascaphaus truei*	FC2
Columbia sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	FC2
Western sage grouse	*Centrocercus urophasianus phaios*	FC2
Harlequin duck	*Histrionicus histrionicus*	FC2
Northern goshawk	*Accipiter gentilis*	FC2
Ferruginous hawk	*Buteo regalis*	FC2
Loggerhead shrike	*Lanius ludovicianus*	FC2
Olive-sided flycatcher	*Contopus borealis*	FC2
Fringed myotis	*Myotis thysanodes*	FC2
Long-eared myotis	*Myotis evotis*	FC2
Long-legged myotis	*Myotis volans*	FC2
Small-footed myotis	*Myotis ciliolabrum*	FC2
Yuma myotis	*Myotis yumanensis*	FC2
Pale Townsend's big-eared bat	*Plecotis townsendii pallescens*	FC2
Pacific fisher	*Martes pennanti pacifica*	FC2
California wolverine	*Gulo gulo luteus*	FC2
Clustered Lady's-slipper	*Cypripedium fasiculatum*	FC2
Seely's silene	*Silene seelyi*	FC2
Golden eagle	*Aquila chrysaetos*	SC
Osprey	*Pandion haliaetus*	SM
	Cathartes aura	SM
Sharptail snake	*Contia tenuis*	SM

*FC1 = Federal Candidate category 1, FC2 = Federal Candidate category 2, SC = State Candidate, SM = State Monitor

The Cle Elum hatchery site is known to be an important herpetological site (W. Leonard pers. comm.). The site is inhabited by a number of reptiles, including the sharp-tailed snake, rubber boa, alligator lizard, Western fence lizard, three species of garter snake, and possibly spotted frogs. It has the furthest-east known population of the Northwest garter snake (Leonard and Darda 1995), and supports some of the largest known populations of both sharp-tailed snakes and rubber boas in the State of Washington. Sharp-tailed snakes hide in the organic matter on the forest floor, and prey primarily on slugs. These snakes have been found within some refuse piles in moist areas of the site. If necessary, impacts on sharp-tailed snakes and rubber boas can be minimized by avoiding, to the extent possible, prime habitat areas on site (especially along edges between grassy areas and conifer forests), minimizing disturbance to the slough and riparian areas, and selectively placing the replacement habitat features such as large-diameter conifer logs and slash piles. The presence of the proposed facility may ultimately serve to protect the populations in the area because undeveloped portions of the site can be dedicated to the maintenance and perpetuation of wildlife, including reptiles.

Harlequin ducks, northern goshawks, golden eagles, turkey vultures, and ospreys are known to be in the vicinity of the proposed facility sites, primarily along the mainstem of the Yakima River. Northern goshawks are also known to inhabit the North Fork Teanaway drainage. However, the proposed activities are not expected to remove or significantly alter the habitat or prey base used by these species.

The Cascades frog and northern red-legged frog will probably not be affected because they generally occur in areas either further west or at higher elevation than the proposed facility sites. The spotted frog could be in the vicinity of the Cle Elum hatchery site, but its presence there has not been confirmed.

The remaining species listed in Table 4 may also be present at some or all of the proposed facility sites, but the distribution of these species in regard to the proposed facility sites has not been determined. The proposed activities are not expected to significantly remove or alter the habitat or prey base for any of the species listed in Table 4.

Conclusions

The potential impacts on ESA-listed species from the construction and operation of proposed facilities within the Yakima Fisheries Project fall under the categories of either "no effect" or "may affect, not likely to adversely affect." The specific conclusions for each species and site are listed in Table 5, and summarized in the following paragraphs. If, before or during construction, additional field observations or other data regarding the status, abundance, or usage of the affected areas by these species suggest that potential impacts on these species would be greater or different than expected, plans to avoid, minimize, or otherwise mitigate those effects will be developed, or formal consultation with the USFWS will be initiated.

The construction and operation of the proposed hatchery facility at Cle Elum is expected to have no effect on grizzly bear, gray wolf, marbled murrelet, and northern spotted owl because of a lack of suitable habitat, proximity to on-going human activities, and a lack of indication that these species use the site. The construction of the facility may affect peregrine falcons if significant riparian habitat that could support a falcon prey base were lost. However, disturbance of the riparian zone is expected to be minimal. Construction and operation of the facility may affect bald eagles if roosting or perching trees were removed from the site. However, there are presently few suitable trees on site, and removal of any trees will be minimized to the extent possible. Bald eagles are not known to use the immediate area regularly for perching or roosting, so operation of the facility is not likely to adversely affect bald eagles. The area will be monitored for bald eagle usage and, if appropriate, additional mitigative efforts will be initiated.

Table 5. Summary of Conclusions Concerning Potential Impacts due to Construction and Operation of Yakima Fisheries Project Facilities

	SPECIES					
SITE	Bald Eagle	Grizzly Bear	Gray Wolf	Peregrine Falcon	Marbled Murrelet	Northern Spotted Owl
Cle Elum	May affect*	No effect	No effect	May affect*	No effect	No effect
Easton	May affect*	No effect	No effect	May affect*	No effect	May affect*
Clark Flat	May affect*	No effect	No effect	May affect*	No effect	No effect
Jack Creek	May affect*	May affect*	May affect*	May affect*	No effect	May affect*

* In all cases that the project "may affect," it is not likely to adversely affect the species.

Construction and operation of the Clark Flat acclimation facility may affect bald eagles that winter in the area, but they are not likely to adversely affect the eagles. The effects of construction can be minimized by timing the activities to avoid the period of bald eagle usage. Construction of the facility will not alter the habitat or reduce the prey base for bald eagles. Bald eagles may be affected during operation of the acclimation sites due to increased human presence. Such effects can be minimized by scheduling the daily visits during mid-day, when the eagles are not on their night roosts. The site will be monitored prior to construction to determine the extent of night roosting. Peregrine falcons may be in the vicinity of the Clark Flat site during spring and fall migrations. The construction and operation of the proposed acclimation facility is not expected to alter the falcon prey base, and would not remove nesting habitat. Therefore, the development of this site is not likely to adversely affect peregrine falcons. Construction and operation of the Clark Flat site is expected to have no effect on grizzly bear, gray wolf, marbled murrelet, or northern spotted owl because the site is not located in or near suitable habitat for these species.

Construction and operation of the proposed acclimation facility at Easton is expected to have no effect on Grizzly bear, Gray wolf, or Marbled murrelet because of the lack of suitable habitat and/or the close proximity of the site to high levels of human activities. Development of this facility may affect, but is not likely to adversely affect bald eagles, peregrine falcons, and northern spotted owls. Bald eagles are not known to use the site, but may be present in the general vicinity. Construction will not remove or significantly alter eagle habitat, and operation will not significantly increase the level of human presence in the area. Peregrine falcons could be affected if passerine bird habitat is removed, or if prey species are attracted to the facility itself (which could be beneficial to peregrines). Disruption of riparian habitat will be minimal, so any impacts are not expected to be adverse or permanent. Because the proposed site is within 3.2- to 4.8 - km (2 to 3 mi.) of known spotted owl centers, portions of the area in the vicinity of the acclimation site may be used by spotted owls. However, because the site is not in or adjacent to suitable owl habitat, is not within an area designated as critical habitat, and is not within 0.8 km (0.5 mi.) of a known owl nesting site, the proposed facility is not likely to adversely affect spotted owls.

The development of the Jack Creek Site may affect all of the species being considered except the marbled murrelet. In all cases, however, construction and operation of an acclimation facility in this area is not likely to adversely affect these listed species. The proposed site is located on non-federal land and is therefore outside the jurisdiction of the Northwest Forest plan, is not designated

as critical habitat for spotted owls, and is not within a designated recovery zone for grizzly bear. Construction of the facility at Jack Creek will not remove habitat for any of the listed species, nor will it remove habitat for any prey species or otherwise alter the prey base.

Most likely, the construction of the Jack Creek site will occur during the summer, and therefore will not significantly affect wintering bald eagles. Surveys for spotted owls will be conducted prior to construction, and if owls are found within 0.8 km (0.5 mi.), formal consultation with the USFWS will be initiated. The only known owl center within 0.8 km (0.5 mi.) of the Jack Creek site is currently a status 4 center where owls have not been observed for 11 years. Bald eagles may be in this area for at least part of the winter. If they are observed during operation of the facility, the daily visits will be scheduled to minimize disturbance to night roosting eagles.

Peregrine falcons would be adversely affected only if small bird habitat is lost. Alteration of the riparian zone, which would constitute much of the important passerine bird habitat, will be minimal. Therefore, the facility is not likely to have an adverse effect on peregrine falcons.

Gray wolves and grizzly bear are potentially present in the North Fork Teanaway Drainage, and could therefore be affected by the construction and operation of an acclimation facility at the Jack Creek site. However, construction will not remove any habitat regularly used by these species, nor will it decrease or alter the prey base for these species. In addition, the animals will not have access to the facility itself. Therefore, it is concluded that development of a facility in this drainage may affect, but is not likely to adversely affect, gray wolves or grizzly bears.

The proposed construction and operation of the Yakima Fisheries Project facilities is not expected to jeopardize or have a significant effect on any species listed as candidates for protection under the Endangered Species Act, or on any species considered a species of concern by the Washington State Department of Fish and Wildlife.

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WDFW (Washington Department of Fish and Wildlife) 1995. Washington Wildlife Priority Habitat System Database. Washington Department of Fish and Wildlife. Olympia, WA.

The following individuals were contacted by telephone or letter regarding the preparation of this biological assessment:

Tom Owens, WDFW, Olympia
Lori Adkins, WDFW, Olympia
Joe Buchannon, WDFW, Olympia
Lee Stream, WDFW, Yakima
Steve Leider, WDFW, Olympia
Todd Pearsons, WDFW, Ellensburg
Lisa Fitzner, WDFW
Sandy Norwood, WNHP, Olympia
John Gamon, WNHP, Olympia
Nancy Gloman, USFWS, Olympia
Chondra Madrona, USFWS, Olympia
Kim Flotlin, USFWS, Olympia
Bill Noble, USFWS, Wenatchee
Jo Ellen Richards, USFS, Cle Elum Ranger District
Stan Sovern, Pacific Northwest Research Station, Cle Elum
Tim Quinn, Boise Cascade Corp., Yakima
William Leonard, WDOE & WNHP, Olympia

ATTACHMENT 1

CORRESPONDENCE

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509)

November 6, 1995

Nancy Gloman
U.S. Fish and Wildlife Service
3704 Griffen Lane SE, Suite 102
Olympia, WA 98501

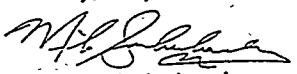
Dear Nancy:

On behalf of the Bonneville Power Administration, the Pacific Northwest National Laboratory (PNNL) would like to request updated information regarding the presence of endangered, threatened, and candidate species, and the occurrence of spotted owls in the vicinity of proposed hatchery and acclimation pond sites for the Yakima Fisheries Project. Specific locations that should aid you in processing this request are listed in the following table:

Site	Township	Range	Section
Cle Elum Hatchery	20N	15E	33
Easton Ponds Acclimation Pond	20N	13E	12 (SW/4)
Clark Flat Acclimation Pond	19N	17E	28 (SW/4)
Jack Creek Acclimation Pond Alternative	21N	16E	8 (E/2,E/2)
North Fork Teanaway Acclimation Pond Alternative	21N	16E	5 (E/2.E/2

Several of these sites have been reviewed previously by your office (Letter from David Frederick to Rosy Maizaika, 7 October 1994). Information recieved as a result of this request will remain confidential according to provisions of the Memorandum of Understanding, formalized by PNNL with the State of Washington on 7 July 1992. If any fees are to be charged for processing this request, please contact me as soon as possible. If you have any questions regarding this request please contact me on (509) 376-2554.

Sincerely,



Michael R. Sackschewsky
Research Scientist
Battelle, Pacific Northwest National Laboratory
P.O. Box 999 MSIN K6-84
Richland, WA 99352

cc: P. Smith, Bonneville Power Administration
N. Wientraub, Bonneville Power Administration
J. Gislason, Bonneville Power Administration

United States Department of the Interior

FISH AND WILDLIFE SERVICE
North Pacific Coast Ecoregion
Western Washington Office
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501-2192
(360) 753-9440 FAX: (360) 753-9008

November 29, 1995

Michael R. Sackschewsky
Battelle, Pacific Northwest National Laboratory
P.O. Box 999 MSIN K6-84
Richland, Washington 99352

FWS Reference: 1-3-96-SP-58 (X-Ref: 1-3-94 SP-698)

Dear Mr. Sackschewsky:

This is in response to your letter dated November 6, 1995, and received in this office on November 9. Enclosed is a list of proposed and listed threatened and endangered species, and candidate species (Attachment A) that may be present within the area of the proposed Yakima Fisheries Project acclimation pond sites in Kittitas County, Washington. The list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act of 1973, as amended (Act). We have also enclosed a copy of the requirements for Bonneville Power Administration (BPA) compliance under the Act (Attachment B).

Should the Biological Assessment determine that a listed species is likely to be affected (adversely or beneficially) by the project, the BPA should request section 7 consultation through this office. If the Biological Assessment determines that the proposed action is "not likely to adversely affect" a listed species, the BPA should request Service concurrence with that determination through the informal consultation process. Even if the Biological Assessment shows a "no effect" situation, we would appreciate receiving a copy for our information.

Candidate species are included simply as advance notice to federal agencies of species which may be proposed and listed in the future. However, protection provided to candidate species now may preclude possible listing in the future. If early evaluation of a project indicates that it is likely to adversely impact a candidate species, the BPA may wish to request technical assistance from this office.

In addition, please be advised that federal and state regulations may require permits in areas where wetlands are identified. You should contact the U.S. Army Corps of Engineers in Chatteroy, Washington, for federal permit requirements and the Washington State Department of Ecology for state permit requirements.

Your interest in endangered species is appreciated If you have additional questions regarding your responsibilities under the Act, please contact Chandra Madrona (360) 753-7762 or Jim Michaels of this office at the letterhead phone/address.

Sincerely,

David C. Frederick
Supervisor

cm/jkp
Enclosures
SE/BPA/1-3-96-SP-58/Kittitas
c: BPA
WDFW, Region 3
WNHP, Olympia

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES WHICH MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED YAKIMA FISHERIES PROJECT ACCLIMATION POND SITES IN KITTITAS COUNTY, WASHINGTON
(T20N R15E S33 / T20N R13E S12 / T19N R17E S28 / T21N R16E S08 / T21N R16E S05)

FWS REF: 1-3-96-SP-58

LISTED

Bald eagle *(Haliaeetus leucocephalus)* - wintering bald eagles may occur in the vicinity of the project from about October 31 through March 31.

Gray wolf (*Canis lupus*) - may occur in the vicinity of the project.

Grizzly bear *(Ursus arctos = U.a. horribilis)* - may occur in the vicinity of the project.

Marbled murrelet *(Brachyramphus marmoratus marmoratus)* - murrelets may occur in the vicinity of the project.

Northern spotted owl *(Strix occidentalis caurina)* - may occur in the vicinity of the project throughout the year.

Peregrine falcon *(Falco peregrinus)* - spring and fall migrant falcons may occur in the vicinity of the project.

Major concerns that should be addressed in your Biological Assessment of project impacts to listed species are:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas, in addition to roosting, nesting, and dispersal habitat for applicable species in all areas influenced by the project.

3. Impacts from project construction and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) which may result in disturbance to listed species and/or their avoidance of the project area.

PROPOSED

None

CANDIDATE

The following candidate species may occur in the vicinity of the project.

Bull trout *(Salvelinus confluentus)*
California wolverine *(Gulo gulo luteus)*
Cascades frog *(Rana cascadae)*
Columbian sharp-tailed grouse *(Tympanuchus phasianellus columbianus)*
Ferruginous hawk *(Buteo regalis)*
Fringed myotis (bat) (*Myotis thysanodes*)
Harlequin duck *(Histrionicus histrionicus)*
Loggerhead shrike *(Lanius ludovicianus)*
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk *(Accipiter gentilis)*
Northern red-legged frog *(Rana aurora aurora)*
Olive-sided flycatcher (*Contopus borealis*)
Pacific fisher *(Martes pennanti pacifica)*
Pale Townsend's (=western) big-eared bat *(Plecotus townsendii pallescens)*
Small-footed myotis (*Myotis ciliolabrum*)
Spotted frog *(Rana pretiosa)*
Tailed frog (*Ascaphaus truei*)
Western sage grouse *(Centrocercus urophasianus phaios)*
Yuma myotis (*Myotis yumanensis*)
Cypripedium fasciculatum (clustered lady's slipper)
Silene seelyi (Seely's silene)

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(C) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires: 1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 3704 Griffin Lane SE, Suite 102, Olympia, WA 98501-2192.

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* "Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal action such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P O Box 999
Richland, Washington 99352
Telephone 15051

November 6, 1995

Sandy Norwood
Washington Department of Natural Resources
Natural Heritage Database
P.O. Box 47047
Olympia, WA 98504-7047

Dear Sandy:

On behalf of the Bonneville Power Administration, the Pacific Northwest National Laboratory (PNNL) would like to request updated information regarding endangered, threatened, and sensitive species in the vicinity of proposed hatchery and acclimation pond sites for the Yakima Fisheries Project. Specific locations that should aid you in processing this request are the following:

Site	Township	Range	Section
Cle Elum Hatchery	20N	15E	33
Easton Ponds Acclimation Pond	20N	13E	12 (SW/4)
Clark Flat Acclimation Pond	19N	17E	28 (SW/4)
Jack Creek Acclimation Pond Alternative	21N	16E	8 (E/2,E/2)
North Fork Teanaway Acclimation Pond Alternative	21N	16E	5 (E/2,E/2

All of the listed sites, except the North Fork Teanaway site, were reviewed by your office previously (Letter Sandy Norwood to Rosy Maizaika, 18 July 1994). If any fees are to be charged for processing this request, please contact me as soon as possible. If you have any questions regarding this request please contact me on (509) 376-2554.

Sincerely,

Michael R. Sackschewsky
Research Scientist
Battelle, Pacific Northwest National Laboratory
P.O. Box 999 MSIN K6-84
Richland, WA 99352

cc: P. Smith, Bonneville Power Administration
N. Weintraub, Bonneville Power Administration
J. Gislason, Bonneville Power Administration

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands
KALEEN COTTINGHAM
Supervisor

November 17, 1995

Michael Sackschewsky
Battelle - PNL
PO Box 999
Richland WA 99352

SUBJECT: 5 Proposed Hatchery and Acclimation Pond Sites, Yakima Fisheries Project: Cle Elum Hatchery (T20N R15E S33); Easton Ponds Acclimation Pond (T20N R13E S12); Clark Flat Acclimation Pond (T19N R17E S28); Jack Creek Acclimation Pond Alternative (T21N R16E S08); and North Fork Teanaway Acclimation Pond Alternative (T21N R16E S05)

We've searched the Natural Heritage Information System for information on significant natural features in your study areas. Currently, we have no records for rare plants, high quality native wetlands or high quality native plant communities in the vicinity of your projects.

The Washington Natural Heritage Program is responsible for information on the state's endangered, threatened, and sensitive plants as well as high quality native plant communities and wetlands. The Department of Fish and Wildlife manages and interprets data on wildlife species of concern in the state. For information on animals of concern in the state, please contact the Priority Habitats and Species Program, Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501-1091, or by phone (360) 902-2543.

The Natural Heritage Information System is not a complete inventory of Washington's natural features. Many areas of the state have never been thoroughly surveyed. There may be significant natural features in your study area that we don't yet know about. This response should not be regarded as a final statement on the natural features of the areas being considered and doesn't eliminate the need or responsibility for detailed on-site surveys.

I hope you'll find this information helpful.

Sincerely,

Sandy Norwood

Sandy Norwood, Environmental Review Coordinator
Washington Natural Heritage Program
Division of Forest Resources
PO Box 47016
Olympia WA 98504-7016
(360) 902-1667, FAX (360) 902-1787

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P O Box 999
Richland, Washington 99352
Telephone (509)

November 6, 1995

Lori Adkins
Priority Habitats and Species Programs
Washington Department of Fish and Wildlife
600 N. Capitol Way
Olympia, WA 98504

Dear Lori:

On behalf of the Bonneville Power Administration, the Pacific Northwest National Laboratory (PNNL) would like to request updated information regarding the presence of endangered, threatened, and other species of concern, and the occurrence of spotted owls in the vicinity of proposed hatchery and acclimation pond sites for the Yakima Fisheries Project. Specific locations that should aid you in processing this request are listed in the following table:

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North Fork Teanaway Acclimation Pond Alternative	21N	16E	5 (E/2,E/2

All of the listed sites have been reviewed previously by your office. Information received as a result of this request will remain confidential according to provisions of the Memorandum of Understanding, formalized by PNNL with the State of Washington on 7 July 1992. If any fees are to be charged for processing this request, please contact me as soon as possible. If you have any questions regarding this request please contact me on (509) 376-2554.

Sincerely,

Michael R. Sackschewsky
Research Scientist
Battelle, Pacific Northwest National Laboratory
P.O. Box 999 MSIN K6-84
Richland, WA 99352

cc: P. Smith, Bonneville Power Administration
N. Weintraub, Bonneville Power Administration
J. Gislason, Bonneville Power Administration

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
Mailing Address: 600 Capitol Way N, Olympia, WA 98501-1091, (206) 902-2200; TDD (206) 902-2207
Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia, WA

November 15, 1995

Mike Sackschewsky
Pacific Northwest Labs
Battelle Boulevard
P.O. Box 999
Richland, WA 99352

Dear Mr. Sackschewsky:

This letter supersedes my letter to you dated November 14, 1995. This letter corrects project name errors noted by you and includes your additional requests.

Per your request I have queried the following project areas for possible involvement in spotted owl management concerns: Cle Elum Hatchery at T20N 15E S33, Jack Creek at T21N R16E S08, North Fork Teanaway at T21N R16E S05, Easton at T20N R13E S12 SW, and Clark Fork at T19N R17E S28. Both the Jack Creek and North Fork Teanaway sites are encompassed by the management circles of multiple spotted owl sites. The Teanaway site is potentially involved with the sites: 322, 328, 336, 660, and 700. The Jack Creek site is potentially involved with sites: 322,336, 660, 700, 729, and 817. The Easton site is involved with site 773. The Clark Fork and Cle Elum sites are not involved in spotted owl management circles at this time. I have enclosed a summary printout of your data request and its results.

I recommend that you contact Joe Buchanan at (360) 902-2697, for his assessment as to what Battelle needs to do next to complete its environmental review for these projects. I hope this information is useful to you. If you need further information, please call me at (360) 664-3750.

Sincerely,

Tom Owens, Manager
Wildlife Survey Data Management

Enclosure

c. Buchanan

Appendix E: Harvest Management

APPENDIX E

HARVEST MANAGEMENT

In the Yakima River Basin, salmon and summer steelhead harvest management is a cooperative venture between the Yakama Indian Nation (YIN) and the Washington Department of Fish and Wildlife (WDFW). A subbasin harvest management planning process currently exists for spring chinook salmon and summer steelhead.

Tribal subsistence fishing regulations for the Yakima River are adopted by the Yakama Nation Tribal Council. Technical staff prepare a set of options for fisheries that will provide for Tribal fishing opportunities while meeting conservation goals. The Council reviews each option and adopts the one that best balances the needs of Tribal anglers with the needs of the resource.

Fisheries management activities are outside the scope of the proposed project. However, during the review of the DEIS, numerous comments addressed this subject. Since changes in policies and planned efforts would influence enhancement efforts in the basin, a detailed discussion of the status of specific resource management activities in the Yakima River Basin is presented below.

Existing Harvest Management and Managers

The YFP is designed to operate within the constraints of existing harvest management regimes. Harvest management issues are outside the scope of this EIS since BPA has no harvest regulatory authority. The Tribal and state fishery managers recognize the need for adequate harvest management regulations and will regulate the fisheries to assure that the objectives of the Yakima Fisheries Project (YFP) are met.

In ocean waters off the U.S. coast, harvest is regulated by the coastal States out to 4.8 kilometers (km) or 3 miles (mi.) from shore. The Magnuson Fishery Conservation and Management Act of 1976 established the North Pacific Fishery Management Council and the Pacific Fishery Management Council to regulate harvest in the fishery conservation zone located from 4.8 to 322 km (3 to 200 mi.) of the coast. Public hearings are held by these management councils at various coastal locations. Public testimony is also accepted at their regulatory meetings. Final regulation proposals are adopted at their annual meetings and forwarded to the Secretary of Commerce for final approval and adoption.

The WDFW and the Oregon Department of Fish and Wildlife (ODFW) independently regulate non-Indian recreational salmon harvest in the Columbia River system. The WDFW also controls recreational salmon fisheries in the Washington tributaries of the Columbia. The WDFW and the ODFW regulate non-Indian recreational fishing for steelhead and other game species. Each of these agencies has an annual public hearing process for the consideration and adoption of regulations.

Recommendations for Indian and non-Indian commercial fisheries in the Columbia River are developed jointly by technical staff from Tribal, state, and federal co-managers. These recommendations, together with testimony by the public and Treaty Indian tribes, are heard by the Columbia River Compact, which is empowered to approve regulations for non-Indian commercial fisheries. The Compact is composed of representatives from the WDFW and the ODFW. Public hearings are held in the Portland vicinity before each fishing period.

The YIN and other Columbia Basin Treaty Indian Tribes (Nez Perce, Umatilla, Warm Springs) regulate Indian treaty fishing in Zone 6 (Bonneville to McNary dams) within the bounds set by the Columbia River compact. Tribal regulations generally are adopted also by the states into state law. Other Tribes in the Columbia Basin have treaty fishing rights.

The WDFW and the YIN are the entities with primary responsibility for management of resident fish harvest in the Yakima basin. Establishing or revising harvest regulations incorporates an extensive public involvement process. The WDFW assesses issues related to resource status and recreational use and makes harvest recommendations to the Washington Fish and Wildlife Commission, using available biological information and input from the public. The Washington Fish and Wildlife Commission, with members appointed by the governor, establishes regulations for resident fish species in State waters in an open public process.

Applicability to Other Stocks

The harvest management planning process and the subsequent annual harvest management plan for spring chinook salmon fisheries provides a management framework that could be applied to other species. In this plan, harvests are subordinate to escapement for the naturally spawning spring chinook salmon stock. The State and Tribal managers agree that in-basin harvest rates should not exceed 20 percent of the number of adults returning over Prosser Dam until such time as optimum spawner stock size can be estimated. At present, the Tribal subsistence fishery takes priority at run sizes below 5,000 adults at Prosser Dam. Above that number, a sport fishery may occur in a manner agreeable to the co-managers.

Goals of Harvest Management

Development of the annual harvest plan for Yakima River spring chinook salmon is part of a larger process that is intended to provide equitable harvests for treaty and non-treaty anglers in terminal fisheries above Bonneville Dam. The goal of this process is to allocate harvest opportunities between treaty and non-treaty anglers across terminal areas within the ceded area of the YIN in such a way as to be consistent with Federal court rulings on Indian treaty fishing rights. The State and Tribal co-managers have agreed that treaty/non-treaty harvest sharing need not be 50/50 in each terminal fishery, so long as the sum of projected harvests across all co-managed terminal fisheries is approximately 50/50 or is considered "equitable." This allows flexibility between the parties to prioritize harvest needs in terminal areas.

Harvest Planning Process

The annual subbasin harvest planning process, in which the Yakima River basin is included, begins with a technical assessment of expected run sizes to the subbasins within the YIN's ceded area. Harvestable numbers of fish are calculated for each terminal fishery, based on broodstock and natural spawning escapement needs. The co-managers next jointly develop harvest sharing goals, as described above, and propose time/area/gear regulations for their respective fisheries. The regulation packages are adopted by each party upon agreement. Catch-and-effort information is exchanged weekly between the co-managers during fishing seasons.

Steelhead fisheries in the Yakima River Basin do not currently require the close harvest monitoring that is necessary to manage the spring chinook salmon properly. Tribal fisheries harvest very few steelhead in current chinook fisheries, and the recreational fishery is closed at this time. Most wild steelhead that return to the Basin spawn naturally.

Relation between harvest Management and Supplementation

In the event that supplementation of chinook salmon and steelhead stocks does not occur, harvest management alone could not serve to rebuild stock status above current levels. Current harvest levels on wild and natural components of chinook salmon and steelhead runs are relatively minor. For example, harvests of Yakima River spring chinook salmon in the Pacific Ocean and mainstem Columbia River are required by the Columbia River Fish Management Plan (CRFMP) to remain below 12 percent when the aggregate upriver spring chinook salmon run does not reach the Bonneville Dam escapement goal of 128,000. This has been the case every year since 1977. The average terminal harvest rate in the Yakima River Tribal subsistence fishery has been 14 percent since 1980. Despite these low harvest rates, spring chinook salmon stock abundance in the Yakima River is not increasing.

Out-of-basin harvest impacts on Yakima River wild steelhead also are minimal. Wild steelhead cannot be retained in non-treaty fisheries and must be returned to the water unharmed. A small incidental catch of wild steelhead may occur in non-treaty fall season gillnet fisheries below Bonneville Dam, but these fisheries are heavily regulated to minimize steelhead handling and mortality. The Indian fall chinook gillnet fishery above Bonneville Dam is constrained by the CRFMP to harvest no more than 15 percent of wild Group A steelhead (of which the Yakima river stock is a component) crossing Bonneville Dam. Additional harvest impacts may occur during Zone 6 winter fishery, during any sockeye fishery, and during the spring/summer chinook subsistence fisheries. Management actions have reduced the actual harvest rates to around 12 percent or less in recent years as a result of constraints imposed by fall chinook management needs. These low harvest rates have not resulted in rebuilding of the wild steelhead stock in the Yakima River system.

The CRFMP limits further reductions in Columbia River fisheries. Existing harvest provisions in the plan are held at minimal levels to help rebuild upriver stocks. Upriver stocks of salmon and steelhead are managed under the Plan as aggregates of subbasin stocks because stock

components cannot be identified in preterminal fisheries. Alteration by the parties of existing provisions of the plan to manage for individual Yakima River stocks within an aggregate is doubtful. However, management in the terminal tributaries is in no way prejudiced by aggregate mainstem management. Furthermore, modifications to existing plan provisions could produce imbalances in treaty and non-treaty harvest-sharing arrangements or violate regional and international harvest agreements.

Harvest of a wide variety of species not targeted for supplementation is also managed within the Yakima subbasin. These include warmwater game fish species such as bass, perch, channel catfish, resident coldwater fishes (e.g. rainbow trout, bull trout), whitefish, and squawfish. These species must be managed concurrently to achieve a balance among objectives such as recreational opportunity, resource protection and maintenance, and impact on YFP supplementation activities or target stock rebuilding.